# Open Source Automation and Monitoring Make SAP Much More Manageable in the Cloud and On Premises

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## IDC OPINION

SAP is a formidable player in the software market, driving the digital transformation of tens of thousands of small, midsize, and large companies. The software that SAP has developed and continues to develop touches every aspect of running a modern business. There are hundreds of applications addressing every imaginable business process. But SAP is also a restless company. It continuously improves its products, sometimes quite radically, and SAP's customers find themselves constantly being pulled forward by the company. Move to SAP HANA, move to SAP S/4HANA, move to the cloud – SAP is always urging its customers to embrace the next big thing.

IDC rarely, if ever, hears customers complain about what their SAP landscapes do for them in terms of business innovation once they have them in place, but the journeys they need to make to get there can be complex. It was, nevertheless, a stroke of genius that SAP, at the time, decided to run SAP HANA on Linux only. With that decision, the company solidly put open source software development for SAP on par with its own software development, enabling the two Linux distributors that it certified for SAP HANA to develop a wealth of open source tools around SAP's own software and help integrate SAP software into the increasingly open source-driven infrastructure abstraction layers.

The actual migration process notwithstanding, which can be exceptionally complex, and the unavoidable learning curve with Linux for Windows-based businesses, these open source tools have ultimately made SAP much more configurable, easier to deploy, manageable, and available. They provide a wrapper around the often mission-critical SAP workloads that protects them and makes them easier to run, both on premises and in the cloud. Now, SAP has even started a long development process of containerizing many of its applications so that the company ultimately becomes as cloud-friendly as any cloud-native application. For SAP customers, the tools that the Linux distributions provide should be considered quintessential for managing and/or migrating their SAP landscapes, and this white paper therefore takes a deeper dive into the capabilities that businesses can achieve with SUSE Linux Enterprise Server (SLES) for SAP Applications.

## SAP Strategy for the Intelligent Enterprise

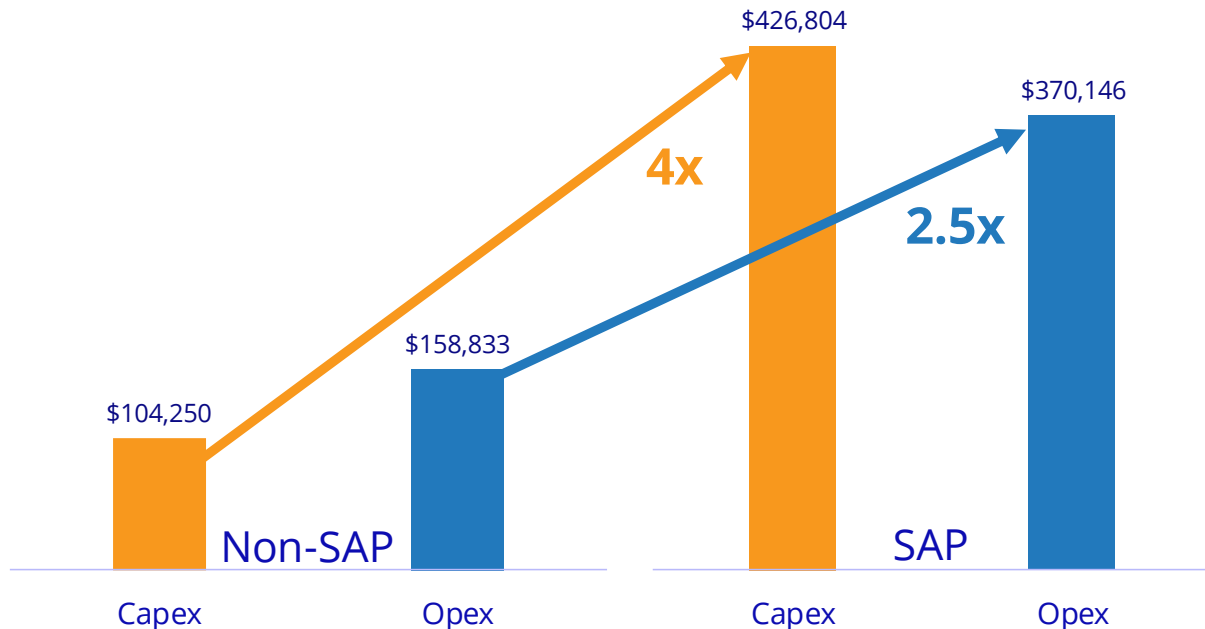### *SAP Urges Customers to Migrate to SAP S/4HANA*

SAP is urging its customers to migrate to S/4HANA. S/4HANA is SAP's enterprise resource planning (ERP) system that has various technologies built-in for artificial intelligence (AI) and advanced analytics. S/4HANA is intended to help businesses improve the way they run their business with a new data model and new business processes. It aims to provide better, more consistent access to data in real time and allows businesses to combine traditional data with customer sentiments to obtain a "360-degree view" of the business. S/4HANA is also designed to give businesses the ability to use data for anticipating need requirements in the market. This will enable them to deliver services and products faster, attract new customers, keep existing customers happy, and prevent customers from going to competitive solutions. And, finally, S/4HANA sets businesses up to start taking advantage of some of the newer data sources and fold these into their operational data, such as data from IoT devices, AI, machine learning (ML), and blockchain.

S/4HANA runs on the SAP HANA database, an in-memory database for real-time online transaction processing (OLTP) and online analytical processing (OLAP). Today, businesses can still run SAP's Business Suite with SAP NetWeaver on databases such as Microsoft SQL Server, IBM's DB2, or Oracle Database, but SAP is encouraging its customers to move to the SAP HANA database and to the integrated ERP on HANA solution, S/4HANA. The deadline for support with NetWeaver is in 2027; after that, businesses will have to pay for support with NetWeaver.

Furthermore, SAP S/4HANA is the company's flagship innovation platform, and SAP customers that want to take advantage of the integrated nature of ERP and SAP HANA in S/4HANA and that want to leverage the built-in intelligence will need to switch to S/4HANA. There is a reason why SAP needs to *urge* its customers to make this switch, though, which is that the migration of a complex SAP landscape from any of the other databases to SAP HANA is not a trivial exercise. The migration can be resource demanding, risk fraught, and expensive. Figure 1 shows the average increases in server capex and opex, for example, when switching from any database for SAP applications to SAP HANA. As one SAP customer described it to IDC: "On a scale of 1-10 for complexity, this is a solid 10+; must have a playbook or a road map." IDC research has found that 64% of SAP customers have not reached the POC stage yet with S/4HANA.

**FIGURE 1**

**Shift in Annual Server Capex and Opex When Migrating from Any Database to SAP HANA**



Source: IDC, 2020

## *SAP Also Urges Customers to Migrate to the Cloud*

SAP is also strongly urging its customers to migrate to the cloud. SAP has early on realized that businesses want to liberate themselves from capex-oriented on-premises infrastructure models as much as possible and move certain workloads to the cloud. Rather than get blindsided by this pervasive trend, SAP has decided to get ahead of it. Today, many of SAP's solutions are available in the cloud only, as a combination of cloud and on premises, or as a mixture of SAP hosting offerings as well as software-as-a-service (SaaS) solutions. There are various cloud scenarios that SAP customers can opt for: infrastructure as a service (IaaS) from an SAP HANA-certified public cloud service provider (SP), hosted infrastructure at a managed services provider, or SaaS, including SAP's own clouds.

But, again, there is an explanation why SAP needs to *urge* its customers to migrate to the cloud rather than merely stay ahead of them, and that is the fact that cloud migration of an SAP production landscape can be even more daunting than a database migration. Often, businesses decide to migrate their database to the cloud first, which is a complex and time-consuming undertaking, and then the applications. For example, IDC found that the average time to plan and implement migration of a S/4HANA production system to an IaaS destination is 11.7 months. The biggest impediments are complexity and cost, and only 7% of SAP customers say they do not face any hurdles. That said, once they have arrived at an IaaS destination for their SAP landscape, businesses cite multiple benefits, most notably better security, higher-performance infrastructure, and greater scalability.

# SAP Essentials: High Availability, Security, and Manageability

## *High Availability*

According to IDC research, on average, SAP users have to restart their SAP applications 3.4 times per year after unplanned outages that have an average duration of 25 minutes each; in other words, customers experience an average availability of about 99.9% for the entire landscape. Furthermore, SAP users say that 33% of their SAP landscapes require high availability (HA), which translates into 33% requiring at least 99.99% availability. The database and S/4HANA fall into this mission-critical portion of the SAP landscape, and for most organizations, high availability of these workloads is of paramount concern. After all, SAP's intelligent enterprise is often at the center of their digital transformation, which is first and foremost focused on the customer experience, and one of the quintessential customer experience requirements is uninterrupted availability.

## *Security*

IDC research has also found that businesses spend a large portion of their SAP budget on SAP security software (12.4%) more than on the actual database (9.9%). Security is a top priority and is implemented on multiple levels: hardware, operating system, software development life cycle (SDLC), database, and device. IDC has seen that businesses take the security capabilities of SAP vendors so seriously that they often conduct an onboarding security review with every vendor that wants to provide products or services for their SAP landscape. Similarly, security in the cloud for SAP is an essential factor in choosing cloud service providers. Some businesses will not migrate SAP to a cloud provider that does not offer multifactor authentication, for example.

## *Manageability*

Manageability is also a major concern, meaning configuring, provisioning, monitoring, patching, and ensuring compliance of the SAP environment. Here too, SAP customers are spending a larger percentage of their SAP budget on management software (10.4%) than on the database. This is especially relevant for rapidly expanding landscapes with a growing number of cloud, server, or virtual instances and with environments that ingest data from multiple data sources, for example, with SAP Data Intelligence. These landscapes need to be easily manageable despite their inherent complexity, and businesses expect high levels of automation for many of these management functions. Automation allows for new, innovative services to be delivered faster, which is another key aspect of a customer-focused business model.

# Open Source Tools for SAP

Even as SAP provides its own availability, security, and management software, there is a wealth of enterprise-class open source software available from the two SAP-certified Linux distributors, SUSE and Red Hat, that extends, augments, and deepens these functionalities, all integrated with the open source ecosystem that so relentlessly drives innovation across IT technologies these days. It is important to emphasize that these are not just Linux distributions; rather, their SAP solution stacks go well beyond the kernel and optimize SAP management, automation, orchestration, and availability. Both vendors have deep relationships with SAP and are working closely with SAP on continuous community-based innovations within their specific focus areas.

We will take a closer look at SUSE Linux Enterprise Server for SAP Applications in the sections that follow.

## SUSE LINUX ENTERPRISE SERVER FOR SAP APPLICATIONS

SUSE and SAP have collaborated for many years codeveloping solutions and best practices for SAP landscapes. SUSE is SAP's in-house implementation platform, and the first SAP HANA solution was built on SUSE Linux, which may serve as testimony of the companies' joint product development and innovation efforts. SUSE and SAP refer to each other as "co-innovation" partners, jointly developing and delivering solutions across their respective portfolios. SUSE offers SUSE Linux Enterprise Server for SAP Applications, a comprehensive platform for SAP software solutions.

### Key Areas Where SUSE Provides Value for SAP Offerings

Figure 2 shows the building blocks for SLES for SAP Applications with, in the center, the following four areas that make up the product:

- SUSE Linux Enterprise Server
- High Availability Extension, which provides the underlying infrastructure to operate SAP HANA and the NetWeaver service in the HA setup
- SAP-specific tools, including technical tools that smoothen operations from an administrative perspective such as implementing and tuning the system based on SAP recommendations (the so-called SAP Notes) to make it simpler
- Product support, allowing businesses to remain on a release or service pack for 4.5 years and get 24 x 7 priority support during that period (This period aligns better with today's on-premises hardware cycles and with refresh cycles in the cloud.)

### FIGURE 2

### SUSE Linux Enterprise Server for SAP Applications
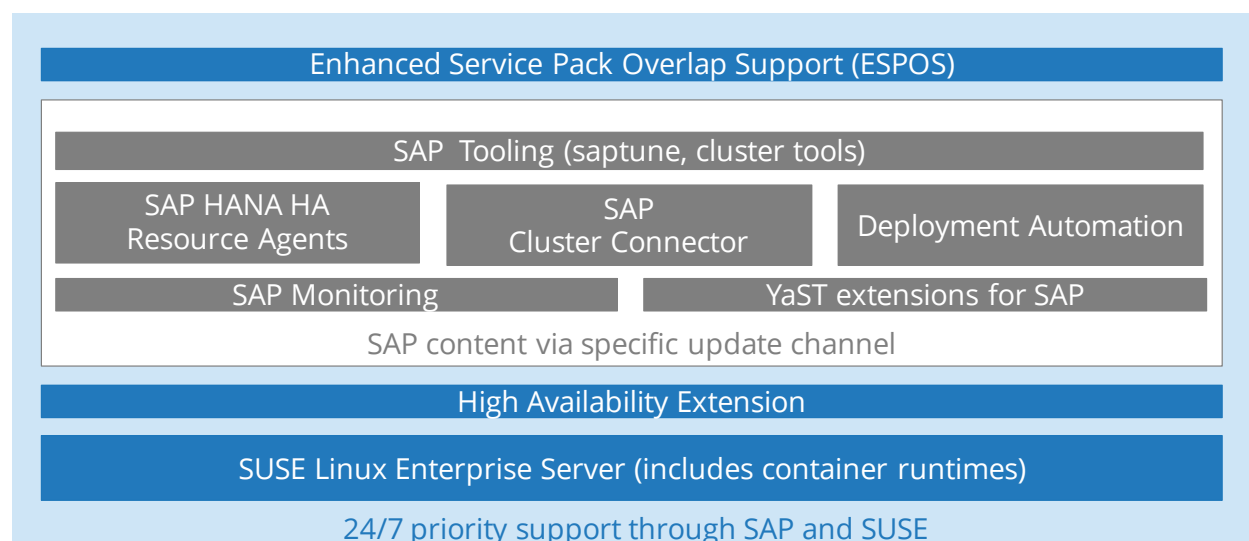


Source: SUSE, 2020

Furthermore, SUSE is now investigating to integrate SLES for SAP Applications with other parts of its portfolio as well, namely:

- SUSE Manager, which is a tool that connects to the deployment automation, measures compliance and automatically sets up systems and patches them. SUSE says that it has built the first set of bridges to the deployment automation. Furthermore, the company says that it is working on a more SAP-centric value proposition for SUSE Manager, one that provides additional automation and thereby eliminates human error even further. This will enable administrators to focus less on repetitive tasks and more on providing their expertise to keep the system stable and up and running. As the industry is moving to containerization, SAP is developing containerized versions of its applications and database. SUSE CaaS platform is providing the Kubernetes distribution for running SAP Data Intelligence. IDC expects that the Rancher Labs technology, which was recently acquired by SUSE, will become a part of this solution. SUSE (and Red Hat, for that matter) is working with SAP on various research projects for containerization of additional SAP products.

- SUSE Enterprise Storage is SUSE's solution for network-attached storage (NAS).

- SUSE Linux Enterprise Live Patching enables SUSE to apply patches to the Linux kernel *and beyond* the kernel against vulnerabilities without a reboot for up to one year. This capability has distinct advantages for SAP customers as with large SAP HANA instances, a reboot means that the SAP HANA database will need to be reloaded, which in some cases can take as long as 60 minutes. Even if an organization has an HA setup, for example, a server problem during a reboot could cause a full SAP application service outage.

## SUSE's Road Map — Focus on Cloud Deployment

### Basic Road Map Updates

As can be expected, SLES for SAP Applications will support the latest infrastructure technology, such as the latest processors from Intel and IBM. Intel's Cooper Lake, the third generation of Intel's Xeon Scalable processors targeting 4-socket and 8-socket segments of the server market, was released in June 2020. Cooper Lake supports Optane memory. IBM's POWER10 is expected in the second half of 2021 and will feature "memory inception," a technology that improves cloud capacity and economics for memory-intensive workloads like SAP.

SLES for SAP Applications supports both second-generation Intel Optane DC NVDIMMs and IBM Virtual PMEM DRAM-based persistent memory options, for which SAP HANA has been optimized. These persistent memory solutions for SAP HANA allow businesses to reduce reload times after a system restart as the database will reside on them rather than in storage, enabling a much faster reloading into memory of the in-memory database.

### Additional Road Map Components

SUSE is seeing its customers increasingly move bare metal and virtualized workloads into the public cloud. The company believes that future growth will be in the cloud not in the least because SAP is pushing its customers as quickly as possible to S/4HANA deployed in the cloud. Therefore, the company is now also focused on customer needs around cloud deployment, especially deployment automation and monitoring. SUSE is working on enabling businesses to set up their compute in just a few hours rather than days at a major cloud SP, with a completely automated SAP deployment regardless of the back end that the business is deploying. With SLES for SAP Applications 15 SP2, an initial version of such deployment automation is available for both cloud and on premises.

The various deployment options with SLES for SAP Applications are:

- **Bare metal —** Intel and IBM Power LPAR
- **Virtualized —** VMware, KVM, OpenStack, and SUSE Cloud Application Platform (CAP)
- **Public cloud —** Microsoft Azure, AWS, GCP, Alibaba, IBM Cloud, and others
- **Container based (this is mostly exploratory for SAP applications such as Data Intelligence, not SAP HANA) —** SUSE CaaS Platform, Kubernetes, and SAP Gardener, which is SAP's internal containerization project

In terms of monitoring, SAP systems are typically mission critical, and businesses need to have a more sophisticated ability to know when something goes wrong. This is especially true when there are different deployments that are not necessarily connected to an in-house monitoring solution. SLES for SAP Applications 15 SP2 features an initial version of a cross-deployment monitoring solution. In a future release, possibly before SP3, SUSE aims to expand data gathering on the systems with capabilities that trigger various actions and recommendations for system healing.

## Additional HA features

A typical ASCS high-availability three-node setup consists of both ASCS and ERS instances running on two nodes in active/active configuration and databases and dialog instances running on the third node. High-availability software such as Pacemaker, an open source project, is used to manage the two-node cluster and to provide high-availability capabilities. Such a setup limits the ERS instance to be always started in the node where ASCS is not running due to enqueue replication. This limitation can be overcome using a three-node or multinode high-availability cluster.

SUSE is supporting and simplifying a three-node high-availability cluster setup through satellite application services. SUSE also will support multiple system replication scenarios for SAP HANA deployments, including scale-up (performance optimized, cost optimized, and multitarget) and scale-out configurations (performance optimized).

## End-to-End Deployment Automation of SAP in the Cloud

With an increasing shift toward SAP deployment on public environments, SUSE is making end-to-end deployments of SAP deployments on public cloud simple, reliable, and consistent with on-premises implementations. Such consistency provides more flexibility to end users in running their SAP deployments in a hybrid setup (see Figure 3).

SUSE is enabling customizable, modular end-to-end automation using Salt as the automation framework. This framework automates in various phases of the end-to-end automation, such as single-node HANA installation, Pacemaker setup, and NetWeaver installation. These phases can be used separately using a "LEGO bricks" approach to suit the individual use case.

Public cloud environments employ different virtualization environments to power their compute instances. They also lack a standard sizing convention. This introduces additional complexity when SAP deployments are moved to public cloud environments. SUSE is providing Terraform scripts to create SAP environments on major public cloud service providers, including AWS, Azure, and GCP, to enable businesses to deploy SAP workloads via Salt automation. Through these scripts, end users can migrate their SAP workloads between SAP deployments on public cloud platforms. This Salt-based deployment automation capability can be used on bare metal and virtualized servers, providing a consistent deployment approach for both on-premises and cloud implementations.
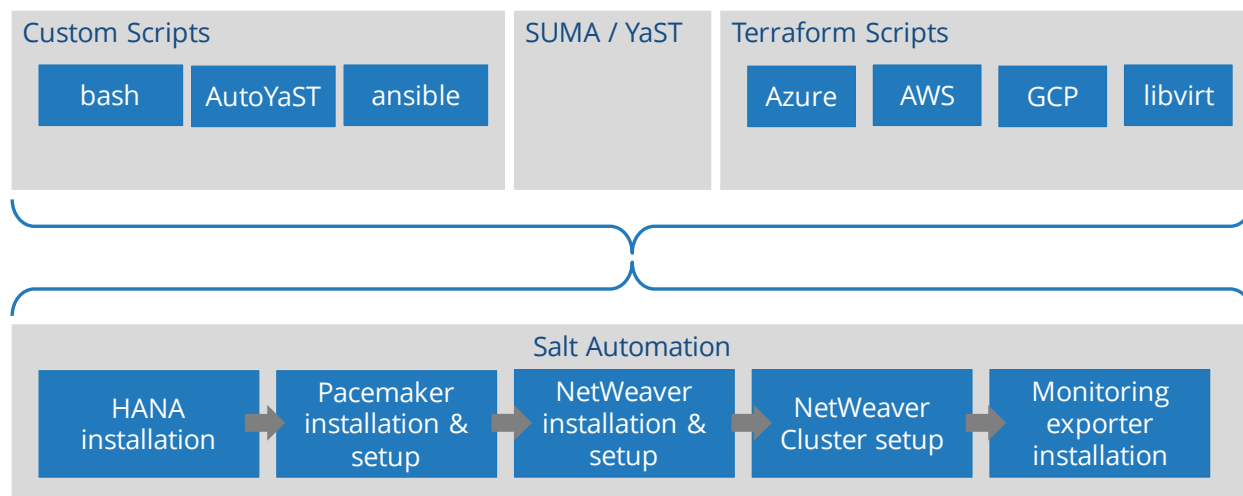
Further, SUSE is continuing to support the traditional approach to automate SAP implementations on bare metal servers on premises through custom scripts using AutoYaST with the Installation Wizard included in SLES for SAP Applications or prebuilt cloud images codeveloped with major hyperscalers.

The entire deployment automation can also be managed through the SUSE Manager interface. Using this interface, one can choose the steps needed. Through the support for the prebuilt deployment configurations (available as Terraform templates), one can also select the right deployment type easily.

SUSE recognizes additional manual steps such as network setup; IP configurations may be required to complete SAP deployments on the public cloud. SUSE is increasingly simplifying such steps through meaningful defaults. SUSE is also investing in container-based deployment automation to minimize the tool footprint and improve scalability for SAP workloads that are validated for container deployments.

## FIGURE 3

**End-to-End Deployment Automation of SAP in the Cloud**

| Custom Scripts | | | SUMA / YaST | Terraform Scripts | | | |
|---|---|---|---|---|---|---|---|
| bash | AutoYaST | ansible | | Azure | AWS | GCP | libvirt |

Salt Automation

| HANA installation | → | Pacemaker installation & setup | → | NetWeaver installation & setup | → | NetWeaver Cluster setup | → | Monitoring exporter installation |

Source: SUSE, 2020

## *Monitoring*

With SAP deployments on the public cloud, customers and cloud service providers share responsibility for managing the underlying infrastructure. In such environments, the customers may not have the same level of access to the underlying infrastructure as on premises. To overcome this, they prefer monitoring solutions that can provide more capabilities and granularity. Further, they also prefer solutions that can work across multiple cloud service providers and on-premises environments and thus are exploring open source projects.

SUSE partnered with Azure to develop advanced monitoring capabilities on SAP deployments on the cloud using open source projects: Prometheus (a monitoring and alerting tool) and Grafana (a visualization tool), which are now available for both on-premises servers and cloud instances. These capabilities include monitoring at various granularities including operating system, cluster, or the

database itself. Prometheus is included in SLES for SAP Applications to collect data from the server systems and SAP applications both on premises and in the cloud, with an exporter to a monitoring application. SUSE Manager leverages Grafana to aggregate the data and render it graphically to a screen. This gives SAP Basis administrators a way to visually identify potential problems and act before business operations are negatively impacted. Further, Azure is standardizing on SUSE-provided Prometheus exports for monitoring SAP HA deployments on Azure.

## *SAP Infrastructure Consulting and Implementation Services*

SUSE Global Services provides consulting, training, and support services that help businesses design and deploy their SAP environments in the cloud. The team also provides additional services for validating high-level design documents and deployment configurations prior to going into production. SUSE supports a customer's journey for cloud-optimized SAP environments with access to technical and product experts who will help them with:

- Formulating business objectives and requirements, reviewing if and how SLES for SAP Applications can make their infrastructure more effective, and suggesting solutions and migration paths
- Designing and validating the environment, including best practice recommendations, resulting in a high-level design to be used in deployment
- Deploying the environment by reviewing migration targets and the applications that will be migrated, staging the applications on SLES and recording configurations, and documenting the final solution
- Optimizing mission-critical, highly available clustered workloads with expertise, health checks, and best practices

## FUTURE OUTLOOK

IDC expects that cloud-native deployments of SAP applications will continue to grow significantly in comparison to on-premises deployments. Figure 4 shows growth in certified server hardware for SAP HANA deployed on premises and cloud deployments for 2020-2023.

With cloud, businesses say they can take advantage of scalability, elasticity, availability, reliability, geodiversity, and disaster recovery (DR) capability. But for large SAP landscapes, cloud deployment is still being approached carefully. Some businesses start very slowly – they may have a target of moving 5% of their SAP landscape to the cloud by end of year – mostly because they still do not have enough confidence to move larger portions of their SAP workloads to the cloud. Once they have gained some experience with the processes and migration models, they may further grow their cloud deployments. IDC expects that open source tools will play an increasingly important role in developing the kind of cloud environment where businesses will be comfortable migrating their SAP landscapes to.

However, businesses say that certain data, such as classified data, will always remain on premises. And for some businesses, if they have the expertise, they will keep their SAP landscape on premises because they believe it allows them to control the hardware better than in the cloud, where they experience a lack of visibility. For yet other businesses, the real-time nature of their SAP data prevents a cloud deployment – they need to deploy SAP physically next to a plant, for example, to ensure the lowest possible latency. Of course, on-premises deployments are more and more becoming cloud based, with cloud SP-like SLAs; more automated; and ultimately containerized. Therefore, here too, open source tools will be instrumental in de-siloing, automating, containerizing, and orchestrating SAP software.

IDC expects that over time, SAP applications will indeed become containerized. SAP is already working on containerizing many of its applications, including SAP HANA and S/4HANA. IDC does not expect results soon from this — no doubt highly complex — work. But once SAP applications are containerized, businesses will have tremendous new freedoms to move them from on premises to the cloud and back, or from one cloud to another cloud, without the headaches that such migrations cause today.

## FIGURE 4

### Worldwide SAP HANA On Premises Versus Off-Premises Server Forecast, 2020-2023
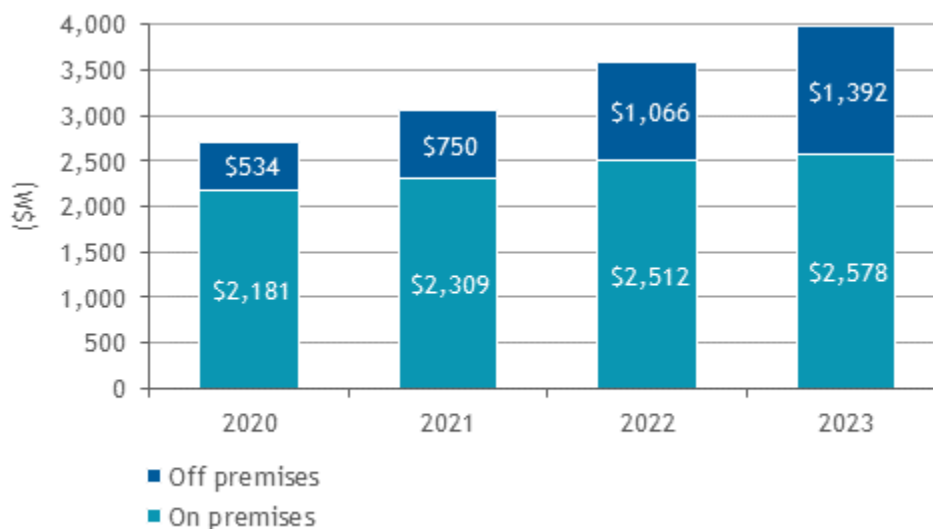


Source: IDC, 2020

## CHALLENGES/OPPORTUNITIES

## For Businesses

Although the hurdles when upgrading an SAP landscape to S/4HANA, whether on premises or in the cloud, are by all accounts outweighed by the benefits, the hurdles are nevertheless real. So are the complexities of managing an SAP landscape and keeping it available. SAP serves as a core component of many businesses' digital transformation toward becoming an intelligent enterprise, but much of SAP's software still feels somewhat traditional and monolithic. SAP is working on that, and businesses can expect their SAP software to become more flexible and modern. Meanwhile, though, there is an expanding wealth of powerful open source tools and services that businesses can leverage to migrate, automatically deploy, monitor, integrate, and protect their SAP applications in the cloud as well as on premises. These tools fit neatly around their Linux distribution for SAP HANA, and they greatly alleviate the migration and management complexities of an SAP landscape.

## For SUSE

The challenges for SUSE in the SAP market are threefold, and none of them are necessarily unusual for a software company: there is an equally formidable competitor in the market, the technical challenges to deliver continuing innovation are not trivial, and the company has deep dependencies on SAP in this market. There is, however, a single answer to all these three challenges: open source. Ultimately, the software that both SAP-certified Linux distributors develop is open source software that originates from the community and finds its way back there, so competition is a relative concept. The second point is also relative since technical challenges tend to fire up the open source community as the astounding open source innovations of the past decade have proven. And, finally, with regard to SAP dependency, SAP is moving its software, with SUSE's collaboration, closer to the very open source concepts that SUSE is a part of, including containerization and Kubernetes orchestration. In other words, this is becoming more of a healthy codependency.

## CONCLUSION

When, several years ago, SAP decided to run SAP HANA on Linux only and integrate its business software with the database to create SAP S/4HANA, the software company anchored its flagship products in the open source ecosystem. The two Linux providers that have been certified for SAP HANA – SUSE and Red Hat – have since built an impressive open source foundation for SAP HANA and SAP S/4HANA, both on premises and in the cloud. This has enabled customers to integrate SAP software with other applications and to improve important aspects of their SAP landscapes, such as deploying, operating, upgrading, automating, and maintaining availability for the mission-critical software.

This white paper looked at the many solutions that SUSE offers for SAP as part of its SLES for SAP Applications offering. SUSE's basic road map for SAP includes support for the next-generation Intel Xeon Scalable processors and for the second-generation Intel Optane DC NVDIMMs and IBM Virtual PMEM DRAM, as well as a nondisruptive upgrading capability beyond the Linux kernel.

Recently, the company has also become more focused on the cloud, which is where SAP customers are going, one way or another, for significant portions of their landscapes. Key features are a three-node high-availability cluster setup through satellite application services, deployment automation (automated setup of SAP HANA or S/4HANA in the cloud in few hours), and advanced monitoring capabilities based on open source tools Prometheus and Grafana.

IDC believes that SUSE continues to provide critical open source solutions to SAP customers that greatly improve the operational experience with SAP HANA for these companies, all of which ultimately directly translates into better business results.

## About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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