SUSE

Buyers Guide

The Enterprise Linux Playbook

SUSE Linux Enterprise, Red Hat Enterprise Linux, Canonical Ubuntu, and Oracle Linux

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1 Executive Summary

Business continuity is only as reliable as the underlying infrastructure – whether that's in the data center, multi-cloud, or at the edge. It keeps businesses running, people connected, and customers engaged. To stay relevant and competitive in today's rapidly changing business environment, companies need to be able to adapt quickly. The best way to adapt is to port an infrastructure across multiple environments that is easily managed and consistent with what people are used to handling. Choosing the right enterprise Linux platform is a crucial decision – one that is both optimized for the underlying hardware and enabled to support a broad range of applications securely.

Essentially, the right enterprise Linux for you delivers on these attributes:

1. Simplifies the complexity of managing hybrid cloud infrastructure and applications.
2. Enables workloads to run anywhere, using containers and/or virtual machines across on-premises and cloud environments.
3. Enables secure operation of all mission-critical workloads to ensure reliable execution anywhere.
4. Provides consistent uptime through high availability.

To help readers assess the relative strengths and weaknesses of the market's leading enterprise Linux platforms (OS plus extensions), this buyer's guide assesses the following attributes and capabilities:

Innovation, Architecture & Security

Security and Compliance
This category includes authentication, data protection, cryptography, and certification to ensure that platforms adhere to criteria and standards set forth by governments and regulated industries.

Virtualization and Containerization
Virtual machines and containers are driving forces in the evolution of software-defined infrastructure. As a result, today's enterprises must invest in management tools to accommodate the power and flexibility of container and virtual environments.

Cloud Readiness
We think about "cloud" as an operational model rather than a place. This model includes operational aspects, shared services, and application delivery architecture represented in cloud-native applications and continuous integration and delivery. The cloud model is expanding to enable IT organizations to deliver similar services and cost efficiencies from

corporate-owned or co-located data centers. And most recently, encompassing edge computing and IoT.

Adaptability
The OS platform needs to be adaptable and consistent across various operating environments. It should include a set of APIs and services that abstract away the details of the underlying hardware infrastructure to make it possible to write applications that can work with the widest range of architectures, servers, storage, and network options available. As a result, you can easily deploy and transition business-critical workloads across on-premises and public cloud environments. How that's enabled and simplified determines how we measure the adaptability of the platform.

Edge Readiness
Edge computing is a distributed model in which computing takes place near the physical location where data is being collected and analyzed, rather than on a centralized server or in the cloud. This new infrastructure involves sensors to collect data and edge servers to securely process data on-site while connecting other devices to the network.

Architectural Independence
Ultimately, having a common and consistent OS platform across all hardware architectures and environments ensures that every system can be a viable part of a hybrid cloud strategy. Additionally, adapting to the underlying architecture and supporting a broad range of application workloads is a key measure in this category.

Management, Extensions & Automation

Systems management
Full-featured systems management should provide automation built into the structure of everyday tasks, such as deployment, configuration, auditing, and software installation. It should also support multiple enterprise Linux distributions across varied operating environments in a consolidated fashion. And while the organization's infrastructure expands, contracts and transforms – systems management should provide a sophisticated approach to deployment and configuration.

Lifecycle Management
This is a business management approach to improve and sustain product performance. Life cycle management is a practice that can make or break your ability to upsell, cross-sell, and otherwise grow an existing customer relationship – and it helps companies cultivate brand loyalty by identifying opportunities for adding value to the customer equation at key points in time.

Workload Portability

As application workloads are migrated from development environments to production, or from data centers to the cloud, or from on-premises to the edge, or iteratively back to development – it is important to make those transitions as smooth as possible. Migrations can be challenging, but providing compatible underlying platforms and consistency are key to providing a seamless experience.

High Performance Computing

HPC is the practice of aggregating computing power in a way that delivers much higher performance than one could get out of a typical desktop computing or workstation to solve large, complex problems in science, engineering, or business. Therefore, the right open-source Linux platform must enable and support HPC workloads through hardware optimizations, scientific and computational libraries, application frameworks, and scheduling and monitoring tools.

High Availability and Live Patching

High availability of mission-critical systems involves data replication, failover, data recovery, and live patching. Live patching is a technology that improves business continuity and saves costs by reducing downtimes, increasing service availability, and enhancing security and compliance. With Live Patching, you can apply patches to your Linux kernel without rebooting your system.

Real Time Support

A real-time operating system (RTOS) is intended to serve real-time applications that process data as it comes in, typically without buffer delays. Using deterministic timing and prioritization schemes, an RTOS rapidly switches between tasks, giving the impression that multiple programs are being executed simultaneously on a single processing core. An RTOS handles precision timing and optimizes a sequence of tasks based on execution behaviors.

Support & Community

Support and Services
This category includes support subscriptions, premium support services, consulting, training services, and managed services for the OS vendor.

Customer-driven Innovation
Developers, partners, and customers all contribute to and build packages curated and approved by the Linux vendors. As a result, there are thousands of community-supported packages that have been made available through the Linux vendors' networks. How this is achieved is measured in this category.

Community Influence
Open-source communities thrive on the contributions and insights from developers around the world. Likewise, OS vendors play a key role in user communities and help drive the evolution of the panacea of operating platforms.

Vendor Insights

Vendor reputation matters greatly in selecting the right enterprise Linux distribution. SUSE (ETR: SUSE) is a rapidly growing, public company with a clear strategy and is known as an industry leader in open-source expertise and community involvement. The company fosters customer choice and multi-vendor strategies for IT investments. Following its acquisition of Rancher Labs in 2020, it adopted its "Innovate Everywhere" positioning to emphasize how its SUSE Linux Enterprise and SUSE Rancher offerings enable its customers to drive rapid digital transformation from core to cloud to edge.

Following its acquisition by IBM (NYSE: IBM) in 2019, Red Hat continues its strong enterprise operating system footprint in its popular Red Hat Enterprise Linux (RHEL) distribution. While the company's standing in the open source community is excellent, IBM's monolithic and proprietary influences have begun to overshadow its reputation for openness. According to IDC, in April 2020,

> *"With a general lack of understanding for IBM's strategic directions, it is doubtful that Red Hat can rescue IBM's cloud ambitions - while core business for both is primarily traditional infrastructure, and IBM's multi-year transformation to a 3rd platform-driven tech provider has been far too slow."*

Some of Red Hat's messaging also talks about "innovation everywhere" skeptics interpret that as innovation everywhere so long as you start with IBM Cloud, IBM hardware platforms, JBoss, RHEL, and OpenShift. The platform dependencies built into their stack ensure that IBM/Red Hat's vendor lock-in strategy will challenge the genuine openness and heterogeneity of its customer base in the future.

Another long-term player in the Linux space is Ubuntu, an open source project based on Debian supported by Canonical Ltd. (a privately held company registered in the Isle of Man). Ubuntu has a strong market share in the desktop and public cloud spaces and benefits from an enthusiastic community around the project. But unfortunately, there remains the perception that Ubuntu is a general-purpose Linux operating system that's not quite enterprise-ready or secure enough for many mission-critical workloads and organizations. Admittedly, Canonical has recently made positive strides in this area with the release of Ubuntu Pro - a paid-for version of Ubuntu with variants built for AWS, Azure, and Google Cloud.

Lastly, Oracle (NYSE: ORCL) created a clone of RHEL called Oracle Linux in 2006. Although compiled from the same source code as RHEL, it is usually about six months behind. Oracle Linux comes pre-configured for Oracle database systems, so businesses who already use Oracle products should be happy with how Oracle Linux integrates with their existing systems. Though Oracle Linux is stable and well supported, users report that its virtualization support is challenging to configure. Bug fixes and feature upgrades can take a long time to arrive, its community support could be more robust, and Oracle's cloud offerings need work.

2 Capabilities Summary

This buyer's guide will delve into the top open-source Linux contenders and provide a concise evaluation against the above capabilities and focus areas. In this analysis, we have used 'Harvey balls' to illustrate how each vendor compares to the other by category:

- The full ball ● is applied to the platform that is best-of-breed in that category.
- The three-quarters ball ◕ is applied to the runner-up in that category.
- The half ball ◑ illustrates acceptable capability in that category.
- The quarter ball ◔ shows weak capability in that category.
- The empty ball ○ indicates the platform has no capability in that category.
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2.1 Innovation, Architecture & Security

	SUSE Linux Enterprise	Red Hat Enterprise Linux	Canonical Ubuntu	Oracle Linux
Security & Compliance	●	◕	◔	◑
Virtualization / Containerization	◕	●	◔	◔
Cloud Readiness	◕	◕	◑	◑
Adaptability	●	◕	◑	◕
Edge Readiness	●	◕	◑	◑
Architectural Independence	●	◕	◑	◕

2.2 Management, Extensions & Automation

	SUSE Linux Enterprise	Red Hat Enterprise Linux	Canonical Ubuntu	Oracle Linux
Systems Management	◕	●	◔	◑

Lifecycle Management	●	◕	◑	◕
Workload Portability	●	◑	◕	◑
High Performance Computing	●	◕	◔	◑
High Availability & Live Patching	●	◕	◑	◕
Real-Time Support	◕	◑	○	◔

2.3 Support & Community

	SUSE Linux Enterprise	Red Hat Enterprise Linux	Canonical Ubuntu	Oracle Linux
Support & Services	◕	◕	◑	◕
Customer-driven Innovation	◕	◕	◕	◕
Community Influence	◕	●	●	○

3 Feature Analysis

Each category in the above table includes technical nuances across the platforms that help measure and qualify the capabilities of the operating systems.

3.1 Innovation, Architecture & Security

3.1.1 Security and Compliance

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◔
- Oracle Linux: ◑

3.1.1.1 SUSE Linux Enterprise

SLE 15 has achieved full certification for CCC/EAL+4 and FIPS 140-2. And after September 28, 2021, it will be the ONLY Linux OS in the world with the highest levels of security and cryptographic certifications. SLE provides a secure CCC/EAL+4 certified package build service/process. It includes FIPS 140-2 level 1 certified cryptographic modules, Common Criteria / EAL+4 (i.e., production processes, Security Technical Implementation Guides (STIG)). In addition, it has a flexible confinement offering for different use cases (AppArmor and SELinux).

3.1.1.2 Red Hat Enterprise Linux

RHEL includes a host-based build process. In addition, it has FIPS 140-2 level 1 certified crypto modules, Common Criteria / EAL+4 (including production processes, Security Technical Implementation Guides (STIG)). Note, though, that CCC/EAL+4 certification is only for RHEL 7.1 and that certification expired on September 28, 2021. In addition, it uses SELinux only, which might be considered too heavy and complex for many customers. Red Hat does, however, have FedRAMP certifications (specifically for cloud service offerings) for its Ansible Tower and OpenShift on Azure.

3.1.1.3 Canonical Ubuntu

There is no secure building method, and the process is not certified. However, there is FIPS 140-2 level 1 certification of crypto modules, Common Criteria / EAL2, and Security Technical Implementation Guides (STIG) for two LTS releases. In addition, appArmor and SELinux are available.

3.1.1.4 Oracle Linux

Oracle, like RHEL, includes a host-based build process. It has FIPS 140-2 level 1 certified crypto modules, Common Criteria / EAL+4 (including production processes, Security Technical

Implementation Guides (STIG)). It uses SELinux only, as it is a snapshot of Red Hat Enterprise Linux.

3.1.2 Virtualization and Containerization

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ●
- Canonical Ubuntu: ◔
- Oracle Linux: ◔

3.1.2.1 SUSE Linux Enterprise

SLE supports several hypervisors – a true "type-1 bare metal" hypervisor (Xen) and KVM. SUSE supported KVM on IBM systems for years before IBM gave it back to SUSE in 2017. With SLE's open approach to virtualization, customers can use the hypervisor that suits their workloads and business needs. While there is no dedicated KVM management tool, SUSE Manager has several features for virtualization management.

3.1.2.2 Red Hat Enterprise Linux

RHEL's virtualization capabilities are limited, as they only support KVM as a standalone hypervisor with complex pricing. Therefore, a fully open multi-hypervisor strategy might not work. However, their general hypervisor management of KVM is very good. Considering that KVM includes the engine and the management tools, Red Hat has an upstream project (oVirt) and a product (RHV-M) that add features like an API for the backup, a fully RESTful API, resource and event monitoring, and more.

3.1.2.3 Canonical Ubuntu

Here, virtualization support is limited, with support only for the running virtual machines on a supported hypervisor or Cloud Service Provider.

3.1.2.4 Oracle Linux

Oracle's virtualization capabilities are limited, as they only support KVM as a standalone hypervisor with complex pricing. Therefore, a fully open multi-hypervisor strategy might not work.

3.1.3 Cloud Readiness

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑
- Oracle Linux: ◑

3.1.3.1 SUSE Linux Enterprise

SLE was first to the gate with CSP enablement features such as dedicated High Availability storage for SAP environments. Also, SUSE has been working closely with AMD and Google and was first to announce Confidential Virtual Machine support in SLE in December 2020, which is now available in the Google Cloud Marketplace. A Confidential VM is a Compute Engine virtual machine that enables enhanced performance and security for high-memory workloads using AMD Secure Encrypted Virtualization (SEV). Confidential VM includes inline memory encryption to secure the processing of sensitive data in memory. Together with encryption at rest and encryption for data in motion, inline memory encryption allows you to keep your data and apps always encrypted. Google Cloud's Confidential Computing portfolio now includes Confidential VMs, which offer memory encryption to isolate workloads in the cloud further.

3.1.3.2 Red Hat Enterprise Linux

RHEL has been gradually adding CSP features as well. Red Hat also has a joint project with Google around Confidential Virtual Machines – expanding sensitive data protection and compliance requirements, especially for regulated industries.

3.1.3.3 Canonical Ubuntu

Ubuntu provides images for cloud images that are both free and supported. They use the same support models as on-premises, thus have similar limitations for cloud as they do for on-premises.

3.1.3.4 Oracle Linux

Oracle, like RHEL, has been gradually adding CSP features as well. Oracle also has a joint project with Google around Confidential Virtual Machines – expanding sensitive data protection and compliance requirements, especially for regulated industries.

3.1.4 Adaptability

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑
- Oracle Linux: ◕

3.1.4.1 SUSE Linux Enterprise

SUSE Linux Enterprise and Rancher are adaptable across core, hybrid cloud, cloud-native, and edge environments, enabling smooth workload migration. SUSE advantages include high availability (with geo-clustering and live patching) in mission-critical environments, plus system and configuration management across all Linux distributions. In addition, the expanded systems management eases application workload migration, support, and automation.

3.1.4.2 Red Hat Enterprise Linux

Red Hat OpenShift, based on OKD (upstream Red Hat distribution incorporating Kubernetes), is not a multi-vendor distribution, which is its most significant limitation. Instead, IBM Red Hat appears to want to prescribe a monolithic stack of Red Hat products from top to bottom, all the way down to the operating system. This fosters a fear of vendor lock-in for their customers, and IBM Cloud is a big lock-in target. As a result, pursuing a multi-vendor Linux strategy is often discouraged by IBM. In addition, the Red Hat solution does not fully manage other distributions for systems management, making it challenging to implement and maintain heterogeneous IT environments.

3.1.4.3 Canonical Ubuntu

Ubuntu is flexible and adaptable across many environments from core to cloud. However, their cloud focus has sometimes hindered support and optimization for the latest processors and architectural environments. For example, the OpenHPC stack of libraries, frameworks, and tools is only tested on SUSE (openSUSE) and Red Hat (CentOS) platforms for both Arm and AMD/Intel architectures.

3.1.4.4 Oracle Linux

The Oracle Container Engine for Kubernetes (OKE) is an Oracle-managed container orchestration service that can reduce the time and cost to build modern cloud-native applications. Unlike most other vendors, Oracle Cloud Infrastructure provides Container Engine for Kubernetes as a free service that runs on higher-performance, lower-cost compute shapes. DevOps engineers can use unmodified, open source Kubernetes for application workload portability and simplify operations with automatic updates and patching.

3.1.5 Edge Readiness

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑
- Oracle Linux: ◑

3.1.5.1 SUSE Linux Enterprise

SUSE's edge offerings optimize all aspects that edge applications require – including devices, scalability, and edge environments. SUSE's edge-optimized solution includes K3S and SLE Micro. Today, via its continuous delivery model, Rancher can manage hundreds of thousands of downstream Kubernetes clusters using the standard Kubernetes API and Rancher's Fleet agent.

3.1.5.2 Red Hat Enterprise Linux

Red Hat's Kubernetes solution requires a minimum of 3 nodes, each with a larger footprint than K3S, which can operate as a single-node cluster. For Red Hat to support a single node, they recommend a legacy solution in RHEL known as PODMAN, introducing a non-Kubernetes technology and management toolset. Red Hat has numerous scalability limitations with Advanced Cluster Manager (ACM) and their Ansible Automation Platform. ACM can only manage a limited number of downstream clusters. During a recent session, they noted ACM can only centrally manage dozens to hundreds of OCP clusters. Similarly, Ansible does not scale into the 10,000's of managed endpoints. In an "Ask the Experts" session, Red Hat admitted they are working on a new solution to fix the limitations. Red Hat's market presence is arguably the greatest advantage they have. Familiarity with Red Hat's portfolio across developers and operators makes them a natural choice to extend to the edge. While limited in scalability, Ansible brings considerable capabilities and market presence to automation requirements for edge solutions.

3.1.5.3 Canonical Ubuntu

Ubuntu has been very active in the EdgeX Foundry community – a vendor-neutral open-source project hosted by The Linux Foundation building a common open framework for IoT edge computing. However, while Ubuntu's involvement and thought leadership in edge computing has been significant, what they offer and support for the edge is elusive.

3.1.5.4 Oracle Linux

Oracle Roving Edge Infrastructure accelerates the deployment of cloud workloads outside the data center. Ruggedized Oracle Roving Edge Devices (Oracle REDs) deliver cloud computing and storage services at the edge of networks and in disconnected locations, allowing faster processing close to the data source and enabling faster insights into the data.

3.1.6 Architectural Independence

- SUSE Linux Enterprise: ●

- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑
- Oracle Linux: ◕

3.1.6.1 SUSE Linux Enterprise

SLES on POWER has been fine-tuned and optimized for IBM POWER-based systems – built from SLE's common code base that is used across all the architectures supported. SLES on IBM Z and LinuxONE supports the latest Crypto Card adapters, with strong security and protection for both data at rest and data in motion. SLES on Arm is tested on the newest Arm-based processors and is used in fixed-function and network-aware edge devices. While hardware optimizations and validation have been done as part of the enablement process, the common code base and architectural independence are preserved and maintained. SUSE supports the latest GPUs from NVIDIA and chips from Intel, AMD, Fujitsu (as the basis for "Business Critical Linux"), and HPE (as the basis for "Cray Linux Environment").

3.1.6.2 Red Hat Enterprise Linux

IBM Red Hat has the same architectural independence that SUSE has for the most part, minus some of the hardware enablement on a few of the architectures.

3.1.6.3 Canonical Ubuntu

Ubuntu is flexible with a common code base that works across multiple architectures, but the hardware enablement might lag SUSE and Red Hat.

3.1.6.4 Oracle Linux

Oracle Linux has the same architectural independence that SUSE has for the most part, minus some of the hardware enablement on a few of the architectures.

3.2 Management, Extensions & Automation

3.2.1 Systems Management

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ●
- Canonical Ubuntu: ◔
- Oracle Linux: ◑

3.2.1.1 SUSE Linux Enterprise

Full Linux estate management is available with SUSE Manager. It also includes a full online or offline installer. In addition, air-gapped systems are supported at scale. Check out the Systems Management Buyer's Guide from SUSE for more specifics.

3.2.1.2 Red Hat Enterprise Linux

Red Hat relies on Ansible for systems management and automation. Check out the Systems Management Buyer's Guide from SUSE for more specifics.

3.2.1.3 Canonical Ubuntu

Canonical Landscape (on-premises version) is provided for both UA-I (Ubuntu Advantage for Infrastructure) and UA-A (Ubuntu Advantage for Applications). Check out the Systems Management Buyer's Guide from SUSE for more specifics.

3.2.1.4 Oracle Linux

Oracle Cloud Observability and Management Platform provides visibility, and machine learning relies on Ansible for systems management and automation. However, this software is not a key part of their portfolio, and it rarely gets updated.

3.2.2 Lifecycle Management

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑
- Oracle Linux: ◕

3.2.2.1 SUSE Linux Enterprise

SUSE Linux Enterprise Long Term Support covers the complete operating system. The kernel refresh policy is closely aligned with upstream availability for faster hardware and feature enablement. In addition, unlimited Virtual Machine pricing provides an advantage for large-scale environments.

3.2.2.2 Red Hat Enterprise Linux

Red Hat has a shorter span of general support and relies more on extended maintenance. Red Hat's pricing is based on the number of Virtual Machines. Backports of selected features and fixes could impact the enablement of new hardware and features.

3.2.2.3 Canonical Ubuntu

Ubuntu offers extended security maintenance for an additional three years beyond general support. They have a choice of support levels for systems or by application. Their shorter support lifecycle could impact hardware certifications and enablement.

3.2.2.4 Oracle Linux

Oracle's lifecycle "sustaining support" provides lifetime support for their products overall. See https://www.oracle.com/support/lifetime-support/software.html.

3.2.3 Workload Portability

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◑
- Canonical Ubuntu: ◕
- Oracle Linux: ◑

3.2.3.1 SUSE Linux Enterprise

A distinct advantage here for SUSE is the full binary between openSUSE Leap (the developer platform) and SUSE Linux Enterprise. That means a 100% binary match between Leap 15.3 and SLE 15 SP3. As a result, you can smoothly move workloads from developer to production environments that run SLE 15 SP3 – and back again – with assured application compatibility. As a result, SUSE provides a seamless developer experience that accelerates digital transformation. In addition, when moving to an SLE-based production environment from a development platform, there is minimal impact to the application workloads, and the migration is relatively easy to do.

3.2.3.2 Red Hat Enterprise Linux

Red Hat effectively killed the "production-ready" structure of CentOS by ending support for CentOS 8 at the end of this year. CentOS is moving to a model more like SUSE's openSUSE Tumbleweed, a constantly updated operating system, therefore not suggested for most production deployments. Going "end of life" for CentOS means it will no longer be supported by the CentOS/Red Hat community with security patches, vulnerability remediation, or bug fixes. The codebase will begin to diverge from the Red Hat base. This puts pressure on companies to migrate their CentOS systems that are in production or near production to something else. Also, there is a more elaborate process to migrate from CentOS to Red Hat – requiring a complete system rebuild and re-install of all 3rd party software.

3.2.3.3 Canonical Ubuntu

Ubuntu flexibility allows it to run with a common code base across many different environments. However, there could be a performance hit, as Ubuntu might lack the enablement of specific hardware adapters and processors. However, there should be minimal impact when porting application workloads across environments, from Ubuntu in one environment to Ubuntu in another.

3.2.3.4 Oracle Linux

Because Oracle Linux is a re-branded version of RHEL, workload migration from one to the other and from CentOS to Oracle Linux should be relatively painless.

3.2.4 High Performance Computing

- SUSE Linux Enterprise: ●

- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◔
- Oracle Linux: ◑

3.2.4.1 SUSE Linux Enterprise

SUSE Linux Enterprise HPC is essentially the SLE OS plus a popular collection of scientific and computational libraries and a set of SUSE-supported third-party tools. This "HPC Module" is a differentiator for SUSE, for which SUSE provides fix-level support for the tools along with the OS subscription. Slurm is available and used for workload management and scheduling. Ganglia is used for performance monitoring, and many more tools and libraries are available. The OS and tools are available for both x86 and Arm64 architectures. While many supercomputers today are x86-based, Arm is being used more often to produce more cost-effective and easier to maintain processors. SUSE is a contributing member in the OpenHPC and OpenACC communities and is involved in other HPC communities hosted by hardware partners like Dell, HPE, and NVIDIA. In analyzing the Top500 reports that get published every six months, SUSE captures the majority of the supercomputer OS share for paid vendor OS when including the Cray Linux Environment (a derivative of SLES). CentOS is much more common in the "smaller" supercomputers - #200-500 in the list. The supercomputer sites that pay for their OS represent about 107 in the Top500 list. Also, no one offers all of the supported 3rd party HPC tools and compute libraries that SUSE does, essentially providing support for an OpenHPC stack tested on both x86-64 and Arm64 architectures.

3.2.4.2 Red Hat Enterprise Linux

Red Hat is sometimes used in HPC environments, especially in IBM-built supercomputers. However, they do not have a specific HPC offering and rely on the same OS in general environments, even for HPC in the cloud instances.

3.2.4.3 Canonical Ubuntu

Ubuntu is rarely used in supercomputer environments and sometimes in HPC bursting instances as a cloud instance.

3.2.4.4 Oracle Linux

HPC on Oracle Cloud Infrastructure provides a platform that includes bare metal compute instances, low-latency cluster networks for RDMA, high-performance storage solutions and filesystems, network traffic isolation, and the tools you need to automate and run jobs seamlessly in the cloud.

3.2.5 High Availability and Live Patching

- SUSE Linux Enterprise: ●
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◑

- Oracle Linux: ◕

3.2.5.1 SUSE Linux Enterprise

SUSE Linux Enterprise is certified for SAP workloads, including live patching in HANA deployments. A High Availability Extension provides a wide range of components (Geo Clustering, OFS2, load balancing, DRBD). Geo Clustering provides long-range failover and disaster recovery. The DRDB algorithms that SUSE and Red Hat use for HA are from the same developer (Linbit). In addition, SUSE includes Live Patching at no additional cost with every SLES subscription and HA for free with SLES on IBM Z. A key feature is the HAWK (High Availability Workstation Konsole) UI which manages the HA clusters using a graphical interface.

3.2.5.2 Red Hat Enterprise Linux

Red Hat's kernel live patching works in a similar fashion as SUSE Live Patching. Their high availability extension is available in their premium offering.

3.2.5.3 Canonical Ubuntu

Ubuntu has no certifications for SAP workloads. Kernel live patching is an online service that is provided for both UA-I and UA-A. In addition, an Ubuntu High Availability package is offered, but it does not include support for STONITH Block Devices or Corosync-Odevice.

3.2.5.4 Oracle Linux

Oracle Ksplice updates the Linux kernel and key userspace libraries while the OS runs without a reboot or interruptions. Like Live Patching from SUSE, Ksplice makes it possible for you to keep up with important updates without burdening your team with the operational costs and disruptions associated with forced reboots.

3.2.6 Real Time Support

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ◑
- Canonical Ubuntu: ○
- Oracle Linux: ◔

3.2.6.1 SUSE Linux Enterprise

SUSE Linux Enterprise Real Time is a true real-time operating system designed to reduce latency and increase the predictability and reliability of time-sensitive, business-critical applications. The offering achieves lower latencies and enables IT to identify which specific application threads are high priority, ensuring they execute without delay and measure time slices with fine-grained precision. SLE RT also helps identify performance bottlenecks, where debugging tools provide visibility into problems while analyzing the runtime behavior of time-sensitive applications. Also, SLE RT supports virtualized workloads with advanced virtualization that synchronizes real-time execution – maximizing performance and ensuring predictability.

3.2.6.2 Red Hat Enterprise Linux

Red Hat offers a real-time version of their OS based on a real-time kernel. Unfortunately, not enough information is known about it at this time. While we do not see many capability differences between this offering and SUSE's, the Red Hat documentation does not detail priority scheduling and interrupt shielding.

3.2.6.3 Canonical Ubuntu

While it is possible to convert Ubuntu into an RTOS using their Real-Time Kernel, it is not officially supported and rarely used.

3.2.6.4 Oracle Linux

The SunOS Real-Time Scheduler can be used in real-time environments. However, these environments require that a process reacts to external events in a fixed amount of time. Such constraints can exceed the kernel's capabilities that are designed to provide a fair distribution of the processing resources to a set of time-sharing processes.

3.3 Support & Community

3.3.1 Support and Services

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ◕

- Canonical Ubuntu: ◑
- Oracle Linux: ◕

3.3.1.1 SUSE Linux Enterprise

SUSE provides exceptional customer support, with 90% customer satisfaction with the support received from their customer support engineer – with 2/3 giving the highest possible scores. In addition, SUSE Support is highly approachable, with one customer asserting that "We picked SUSE because you didn't tell us what we should do – you told us how you could help us."

3.3.1.2 Red Hat Enterprise Linux

Red Hat support is extensive and comprehensive as well, like SUSE's support.

3.3.1.3 Canonical Ubuntu

Not enough information about Canonical's support to evaluate it properly, and there are no public case studies concerning their Services.

3.3.1.4 Oracle Linux

Oracle Linux Premier Support advertises an easy switch to Oracle's "Unbreakable Linux Network" by running a set of commands on your current Linux systems. Oracle Linux is 100% application binary compatible with the corresponding Red Hat Enterprise Linux releases. As a result, there is no license cost, no need for a contract, and no usage audits. However, for business-critical infrastructure, Oracle Linux Premier Support is an option.

3.3.2 Customer-Driven Innovation

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ◕
- Canonical Ubuntu: ◕
- Oracle Linux: ◕

3.3.2.1 SUSE Linux Enterprise

SUSE Package Hub offers community-supported packages often used in both Leap and SLE in enterprise environments. Package Hub offers SUSE customers the same choice of thousands of community-supported packages on top of the baseline SLE product and SUSE's enterprise-grade support. This helps drive customer-driven innovation into both the developer-oriented and production environments.

3.3.2.2 Red Hat Enterprise Linux

Red Hat offers a similar approach to SUSE's, with access to thousands of popular Linux packages available.

3.3.2.3 Canonical Ubuntu

Ubuntu is all about community-supported packages and provides access to thousands of approved packages to run in the Ubuntu environment.

3.3.2.4 Oracle Linux

Oracle offers a similar approach to SUSE's, with access to thousands of popular Linux packages available.

3.3.3 Community Influence

- SUSE Linux Enterprise: ◕
- Red Hat Enterprise Linux: ●
- Canonical Ubuntu: ●
- Oracle Linux: ○

3.3.3.1 SUSE Linux Enterprise

SUSE is known for being community-minded and easy to work with. Their ISV/IHV ecosystem is big and growing, and partners feel "at home" with SUSE. 95% of SUSE's revenue flows through a partner, and SUSE does not compete with partners for business. All of the SUSE customer training is delivered by SUSE partners.

3.3.3.2 Red Hat Enterprise Linux

Red Hat has a strong reputation in the Open Source community. Their wealth of resources often provides blanket coverage in many different areas. As a result, they are quite influential, despite gaining a reputation for being more difficult to work with. There is also a fear of vendor lock-in by working with IBM plus Red Hat.

3.3.3.3 Canonical Ubuntu

Ubuntu's influence in the open-source communities is tremendous and very developer-oriented. Their positive reputation is undeniable, with the skills to back up their contributions to the community. However, they are not represented in several key communities hosted by the Linux Foundation, including OpenACC, OpenHPC, and the Open Mainframe Project.

3.3.3.4 Oracle Linux

Oracle relies heavily on Red Hat's influence in the open-source communities.

4 About the Authors

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5 Legal Statements

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Note from the Authors

The views in this whitepaper are those of SUSE. Every effort has been made to ensure accuracy; however, we appreciate that some readers may take issue with our conclusions.

6 About SUSE

With over 25 years of engineering excellence, exceptional service, and a worldwide partner ecosystem, SUSE is a global leader in Enterprise Linux, Kubernetes Management, and Edge solutions.

We collaborate with partners and communities to empower our customers to innovate everywhere –– from core to cloud to edge and beyond. SUSE puts the "open" back in open source, giving customers the ability to tackle the innovation challenges today and the freedom to evolve their strategy and solutions tomorrow.

The company is headquartered in Nuremberg, Germany, and is listed on the Frankfurt Stock Exchange.

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