



## WHITE PAPER

# Oracle OpenStack for Oracle Solaris

Sponsored by: Oracle

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September 2014

## IDC OPINION

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As server virtualization has matured and become commonplace, the focus today is on the layers above virtualization to allow infrastructure to be exposed through cloud APIs and services. Public clouds have put increasing pressure on enterprise IT to offer similar services internally. According to IDC's *2013 Virtualization and the Cloud Multiclient Study*, more than half of enterprises are pursuing private cloud. One of the key players in the cloud platform battle is OpenStack, an open source project focused on building software to create infrastructure-as-a-service (IaaS) clouds. OpenStack initially cut its teeth in the service provider market but is now spreading to the enterprise with the backing of most of the key enterprise vendors. This broad industry support is important to OpenStack as one of its key goals is to create an interoperable platform that can become a de facto standard in a highly fractured cloud market. However, OpenStack for the enterprise is still a work in progress. While code development in the project continues at a furious pace, enterprise success requires much more than features and code. Both the project and the vendors bringing it to market are still addressing issues of accommodating enterprise requirements and workloads in the areas of performance, security, management, and availability. Further, the enterprise market needs an ecosystem of services, technical support, documentation, training, and testing/certification. IDC believes that OpenStack will be a major contender in the enterprise cloud platform wars as the leading open source option. Enterprise customers are beginning to familiarize themselves with OpenStack today and are sifting through a dizzying array of commercial OpenStack solutions.

## SITUATION OVERVIEW

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Server virtualization was a milestone technology that provided new levels of efficiency and agility for the datacenter, and today, the large majority of workloads (82%) are deployed in a virtualized environment. With virtualization being a foundation already in place, the goal is to extend virtualization beyond servers to storage and networking and build a layer of cloud system software and cloud management on top of this infrastructure to provide it as a cloud service. Enterprise IT is under increasing pressure to be more agile and serve the business better by becoming more of an internal service provider, a cue taken from the public cloud services that have reset users' expectations of how IT services can be obtained and used. While most enterprises have identified private cloud as a goal, it is not widely deployed today, and the journey to private cloud is just beginning as enterprises begin to weigh their technology options.

OpenStack is an open source project that enables users to build and operate IaaS clouds. OpenStack is important because it is the leading open source cloud platform, with a sizable community as well as development momentum. Besides OpenStack just being the open source option, the broad vendor participation in OpenStack brings the possibility of a de facto cloud standard or API becoming prevalent in the industry. Further, the fact that the platform is open has drawn deployments by both public cloud service providers and private enterprises, enabling an interoperable hybrid cloud scenario.

## The OpenStack Community

The OpenStack project is governed by the independent OpenStack Foundation, which is made up of the following:

- OpenStack Foundation staff members who carry out the direction set by the board of directors
- A board of directors that represents the various corporate sponsors as well as individual members
- A technical committee that oversees software development and technical direction and includes the various project technical leads
- A user committee that represents end users and incorporates their feedback into the development process

The OpenStack Foundation is funded primarily by corporate sponsorships, which are available at various levels with different levels of financial and developer commitments and benefits. Individual memberships are also available for free. Currently, the OpenStack Foundation has over 9,500 members that span 100 countries and 850 organizations and has raised over \$10 million in funding. The list of corporate sponsors is a who's who of IT vendors, with nearly every influential vendor participating from a wide variety of disciplines. The strength of the community has vaulted OpenStack to the forefront of open cloud platforms and will be key to its long-term viability.

## OpenStack Technology Overview

OpenStack is actually a collection of multiple modules that are developed under the umbrella of OpenStack and integrated together. Some modules provide basic functionality like compute, storage, and networking and are in every distribution, whereas other modules, like Trove for database as a service, are optional. New modules can be proposed and accepted into the project for incubation that then graduate into modules that are integrated in a release. In addition, modules are developed by third parties outside of the official OpenStack project. The current official OpenStack modules as of the Icehouse release (OpenStack release names follow the alphabet, so "I" is the 9th release) are as follows:

- Nova – management of compute virtualization
- Cinder – block storage service
- Swift – object storage service
- Neutron – software-defined networking (SDN)
- Glance – image management service
- Keystone – authentication
- Horizon – Web dashboard

- Trove – database as a service
- Ceilometer – metering and monitoring
- Heat – template-based orchestration

OpenStack creates IaaS by making infrastructure programmable and orchestratable through APIs. Developers can call these APIs in their applications, or users can access the services created from these APIs through a Web portal. Some of the actual infrastructure functionality like object storage and basic networking is provided by OpenStack. But much of OpenStack is a framework that infrastructure components plug into. For example, OpenStack does not include a hypervisor but can control most popular hypervisors through a driver. Likewise, a persistent block storage service requires storage hardware with an OpenStack storage driver, and SDN functionality also requires a networking back end with an OpenStack networking driver. Beyond the basic infrastructure, OpenStack also provides higher-level management software such as a metering service, a template-based orchestrator, and a Web portal/dashboard. While OpenStack is largely IaaS focused, the project has begun to dabble with some platform-as-a-server (PaaS) functionality like database as a service.

The architecture of an OpenStack cloud was originally designed for newer cloud-native applications, which typically differ from traditional enterprise applications with features such as stateless virtual machines (VMs), and elastic scale out. In addition, the availability burden is placed on the application rather than the infrastructure. However, there is still a need for scale-up traditional applications that rely on highly available infrastructure, and contributors to OpenStack are adding features to accommodate these existing applications as well.

OpenStack is an important open source project and technology, but it is not a product by itself. Commercial vendors create OpenStack distributions that include the OpenStack components, but they also need to integrate supporting technology that is outside of OpenStack, such as a host operating system (OS) for the cloud controllers, a hypervisor, and an installer. Thus OpenStack products can vary widely based on which modules of OpenStack the vendor chooses to include and the supporting infrastructure elements required to build a full IaaS cloud.

## Early OpenStack Adoption

OpenStack adoption is in its very early days, with early deployments having the following general characteristics:

- Early adoption has been concentrated in verticals where IT is the core of the business, such as cloud service providers, Web companies, and telcos pursuing Network Functions Virtualization (NFV) initiatives. These companies are willing to pursue cutting-edge technologies and maintain the expertise and staff to implement and operate them.
- Most early adopters are using self-supported DIY open source – often pure trunk code or from a free distribution package – but generally do not pay for a commercial version or support since they often have highly customized installations and are comfortable taking on the support burden themselves.
- The large majority of applications are new custom-developed applications that are tailored to run in a cloud-native environment. Scale-out Web applications are very typical and are often developed with an agile DevOps methodology.

## OpenStack for the Enterprise

The next frontier for OpenStack is the mainstream enterprise, and indeed, that is where the real revenue opportunity is for vendors. IDC has already seen early traction in banking and media and a high level of interest in and awareness of OpenStack among enterprises. However, it will take a large amount of engineering effort for OpenStack to become a mature, enterprise-ready product.

The most common question today among enterprise customers is, "Is OpenStack stable?" The answer is not a simple yes or no. The OpenStack code base has evolved quickly, and the project is now focusing equally on both new features and better QA and testing. The API has also stabilized, with clear revisions and deprecation procedures. What is in the code today largely works well when operated by an expert. And that is the gap that commercial OpenStack products are trying to close – to reduce the expertise required to create a stable, functional OpenStack deployment and make it more foolproof. Key areas of focus are as follows:

- Improving essential operations such as installation, configuration, and upgrades that today are often complex, disjointed, and manual procedures
- More sophisticated tools for the ongoing management and operation of the cloud
- Documentation and training to make information easily consumable and OpenStack skills easier to obtain
- Commercial-quality support and longer support life cycles, which enterprises expect (The OpenStack project releases every 6 months, and the cadence and amount of changes early on have led to product life cycles that have generally been 18 months or less.)
- A testing and certification ecosystem that is critical for vendors and customers to establish to ensure supported and working configurations, as OpenStack is a broad framework that many things can be plugged into

The OpenStack community will continue to develop and evolve the code, but vendors will drive the process of ensuring that the raw technology can be used and operated by the typical enterprise IT admin.

## ORACLE AND OPENSTACK

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Oracle became a corporate sponsor of OpenStack in December 2013, providing monetary support to the project and contributing code. Oracle has committed to developing and commercializing OpenStack, with a particular focus on strengthening its enterprise features and making it operational by enterprise IT.

### Oracle OpenStack for Oracle Solaris

One of the major highlights of Oracle Solaris 11.2 is the inclusion of a full OpenStack distribution, which leverages and integrates with many of the unique features of the Solaris host OS. Solaris 11.2 currently includes the Nova, Neutron, Cinder, Swift, Glance, Keystone, and Horizon OpenStack modules, with other modules in development and testing. Oracle Solaris has committed to following the OpenStack releases in a timely manner while providing enterprise support and life cycles. Further, Oracle has invested resources

into making the installation of OpenStack on Solaris easy and quick while also tackling the problem of smooth upgrades.

- Support for Solaris virtualization technology such as Zones (containers) and Kernel Zones (full VMs) for flexible compute virtualization allows for high-performance, low-overhead virtualization and enables large-scale, mission-critical applications such as databases to be virtualized. While containers have had a recent resurgence, Solaris has been developing containers for a decade to make them mature and reliable. The addition of Kernel Zones allows Solaris to offer both containers and VM technology with the same OS. Both can leverage the same resource management capabilities as well as the management framework. Solaris also integrates physical-to-virtual (P2V), virtual-to-virtual (V2V), and virtual-to-physical (V2P) tools to allow services to be moved between bare metal and virtualized environments at any time.
- Network virtualization via a Neutron plug-in with the Solaris Elastic Virtual Switch is used by Solaris to support what it calls "application-driven SDN," where SLAs are extended beyond just the infrastructure and up to the application layer.
- The ZFS file system as a back end for Swift (object storage) and Cinder (block storage) allows for automatic compression and encryption of data in an OpenStack Cloud Deployment. ZFS encryption can be used to secure data in a multitenant cloud environment, and ZFS compression reduces the overall storage footprint. Other ZFS features such as redundancy, snapshot, and cloning can provide availability and data protection capabilities to OpenStack storage.
- Integration of the Solaris Unified Archives image system with Glance (OpenStack's image service) allows a single archive image to be deployed to Native Zones, Kernel Zones, Oracle VM Server for SPARC, or bare metal and to transition between these types. The system also allows users to snapshot a running VM into Glance for redeployment. Further, Solaris allows users to lock down the root file system of these Unified Archives, a useful feature for customers that need to prove compliance with regulations such as PCI.
- Built-in encryption capabilities allow both data in motion and data at rest to be kept secure, from the creation of a virtual image and throughout its deployment life.
- Solaris 11 introduced the Image Packaging System (IPS) for improved management of software packages. IPS is used to install and distribute OpenStack on Solaris and also handles upgrades. IPS allows a full rollback of any update to its previous state, ensuring fail-proof OpenStack maintenance. IPS is also integrated with Oracle Solaris Zones and Unified Archives for life-cycle management.
- Oracle OpenStack for Oracle Solaris leverages many other OS enterprise features for availability and security, such as:
  - Automatic service restart in case of failure, integrated with Oracle Solaris fault management
  - Full dependency checking for efficient start-up
  - The ability to configure OpenStack services for only the minimum necessary privileges rather than running as root

- Beyond Solaris, Oracle is also committed to supporting various Oracle technologies in OpenStack, such as:
  - Oracle Linux, as both a guest OS and a full OpenStack distribution running on Linux
  - Oracle VM for x86 (Linux Xen-based hypervisor) as a compute node under Nova
  - Support for the full range of Oracle hardware such as SPARC and x86 servers, storage, networking, and engineered systems
  - OpenStack API support in the Oracle Public Cloud
  - Integration of Oracle's management software such as Oracle Enterprise Manager, allowing it to manage OpenStack
- Oracle will also support Oracle technologies integrated into a non-Oracle OpenStack distribution as well as non-Oracle technologies such as hypervisors and servers integrated into Oracle OpenStack for Oracle Solaris.

Oracle is aiming to develop OpenStack into an enterprise-grade platform with its OpenStack initiatives, something that has defined Oracle in the market. Oracle also will develop PaaS features on top of OpenStack as a differentiator, enabling its portfolio of database, Java middleware, and enterprise applications to run as a service on top of OpenStack infrastructure. While OpenStack today is generally used for new cloud-native applications, Oracle sees the opportunity to enable OpenStack for its enterprise application portfolio and to make the technology both feature ready and operationally ready for a typical enterprise customer.

## CHALLENGES/OPPORTUNITIES

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### Challenges

- **Maturation of OpenStack.** One of Oracle's main value propositions is enterprise-grade products in terms of security, reliability, availability, performance, and support. Basing OpenStack on the Solaris OS brings many enterprise features to OpenStack, but there is much more work to be done in the OpenStack project itself. As many OpenStack vendors are targeting the enterprise market, they are focusing on new cloud-native applications, while Oracle is striving to be able to run its current enterprise portfolio on OpenStack, which is no small task. OpenStack is a relatively new open source project that is just beginning to draw the interest of mainstream enterprises and is still missing many of the elements that enterprises require.
- **Release life cycle.** OpenStack releases every six months, and there is a high motivation to stay on the latest release as each release has compelling features and fixes. As the project matures, this will lessen somewhat, but for now, OpenStack is improving and innovating at such a fast pace that vendors have to pick up each release. While vendors such as Oracle have developed installers and upgrade systems to ease this task, technology is only part of the problem. Enterprises are generally not able to deploy on such an accelerated schedule, and vendors also have a tough time supporting a particular release for any decent length of time. There is great disparity between enterprise and cloud operator life cycles and operations, and it's not clear what model a highly enterprise-focused vendor like Oracle needs to pursue for cloud products such as OpenStack.

- **OpenStack compatibility.** Until recently, there hasn't been any strict enforcement, testing, or certification of OpenStack interoperability, leading to variances in different OpenStack distributions and public clouds that make portability a challenge. OpenStack has begun addressing this challenge with DefCore and RefStack, which are initiatives to define core OpenStack functionality and test/certify it. But the fruits of that labor may take some time to be realized as this is a complex problem to solve. If OpenStack is to emerge as any kind of a standard, even a de facto one, OpenStack vendors such as Oracle will have to figure out how to work with other OpenStack implementations in order to strengthen the OpenStack market for everyone.
- **Expanding outside the Oracle stack.** Much of Oracle's messaging around hardware and system software has been around the company's so-called "red stack" engineering-optimized systems from top to bottom for Oracle applications. Many of Oracle's infrastructure products have been mainly used with Oracle middleware or applications. However, Solaris was developed as a general-purpose operating system (and still is today) under Sun Microsystems and has a much more diverse install base. But as Oracle ramps up the integrated stack messaging, that perception may carry over to Oracle's OpenStack products, causing customers to perceive that Oracle's OpenStack products are primarily targeted as part of the red stack and not for general-purpose operation.
- **Competitive positioning.** Myriad OpenStack distributions are entering the market, and differentiation is challenging. Every other OpenStack distribution has been based on Linux, and many OpenStack vendors target the Linux market specifically. While Solaris has interesting and unique features to offer OpenStack, convincing potential OpenStack customers that aren't already using Solaris to deploy Solaris could be challenging, although OpenStack distributions based on Linux face the same problem. However, existing Solaris customers will have an easy option for a path to OpenStack. The cloud platform market is very crowded, and Oracle and OpenStack in general will face tough competition from enterprise players like VMware and Microsoft and even public cloud platforms like Amazon and Google.

## Opportunities

- **Unique Solaris advantages.** Oracle is the first company to distribute OpenStack on a host OS other than Linux, and Solaris has a long history of technical innovation and offers many unique features to OpenStack. OpenStack could potentially bring new opportunity and life to Solaris by bringing it into the modern cloud world. Customers building clouds will likely be focused on the OpenStack level and less on the operating system, but surfacing Solaris features through OpenStack may give Oracle the opportunity to introduce Solaris and its OpenStack distribution to a whole new set of customers. Oracle also has unique features from the optimization of hardware for applications, with a number of "software on silicon" features in the upcoming M7/T7 SPARC chip that accelerate database operations.
- **Enterprise private cloud.** The most advanced cloud deployments are by public cloud providers, and enterprises are eager to replicate that style of IT internally. However, enterprises also have different needs, and there will be a demand for an enterprise-grade version of technologies like OpenStack. Oracle, with a deep history and high standards of enterprise support, plans to develop OpenStack into an enterprise-grade product that can run enterprise applications like database, middleware, and ERP that are high performance and mission critical. Oracle, as a major enterprise player, can offer substantial financial, engineering, integration, and ecosystem support and services to OpenStack to bring it to enterprises. The goal is to bring to market an integrated suite of products that are supported by a single vendor.

- **Hybrid cloud.** OpenStack is an open platform, and thus we will see it deployed by both service providers and enterprises. The hope is that it will provide some level of standardization and interoperability to a fractured cloud market. Oracle has an opportunity with OpenStack to integrate its customers' on-premises resources with the Oracle public cloud and other OpenStack clouds into a hybrid cloud. IDC expects enterprises will use a variety of cloud resources, and the ability to stitch these together into a seamless hybrid cloud is key. By supporting its own distributions as well as other OpenStack distributions, Oracle is benefiting customers in a variety of ways as the OpenStack market develops.
- **Enterprise applications.** Oracle holds a key place in the enterprise market as it provides enterprises with key applications such as ERP and database, which are among the most mission critical. Enabling these applications to run on OpenStack will mean that OpenStack has truly become enterprise ready and will help Oracle bring these applications to a modern cloud environment. Oracle also has a large opportunity to enable key platform assets to run as a service on top of OpenStack, such as database, middleware, and Java highly integrated, optimized, and supported from a single vendor.

## CONCLUSION

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OpenStack is a hot new open source project that is developing cutting-edge cloud software in the style of the largest public clouds. The enterprise is the next frontier for OpenStack, and myriad OpenStack solutions targeting enterprises are on the market. As enterprise customers begin to evaluate OpenStack, there are many important considerations to weigh when choosing an OpenStack distribution:

- **Core OpenStack support.** The core OpenStack modules should all be supported and largely unmodified to remain interoperable. Differentiation by forking can be a dangerous road, and while vendors can enhance and extend, the core APIs and code should remain intact.
- **Beyond the framework.** OpenStack is a cloud framework and relies on supporting technology outside of the OpenStack project – such as hypervisors, storage systems, and networking systems – to actually implement the cloud back end. The choice of these back ends is critical, and customers need to determine their requirements in these areas of compute, storage, and networking and decide on an implementation. Vendors can offer their own back-end technologies as well as build an ecosystem of third-party solutions. The ecosystem will be as important as first-party technologies because most OpenStack deployments will plug into a variety of technologies and hardware.
- **Enterprise support.** Successfully bringing open source to the enterprise depends more on the service and support behind the code than on the code itself. With OpenStack releasing often, vendors must decide how closely to track these releases and how long to support it. Enterprises must decide the level of support they need and how well equipped the OpenStack vendor is to offer enterprise support in terms of financial stability and resources, engineering resources, support personnel, and professional services capability.
- **Workloads.** While initial OpenStack workloads are generally custom-developed, cloud-native applications, the enterprise market has a lot of legacy existing workloads that will need to be integrated. These workloads can have very different requirements, such as how availability is handled, and OpenStack distributions vary widely in how they are supported. Some distributions target only new applications in a pure next-generation approach, while others are hybrid approaches, adding support for traditional workloads. Support for workloads is not just in the OpenStack code but also in the back-end compute, storage, and networking as well as vendor testing, certification, integration, and support.

Oracle offers a unique OpenStack distribution that is based on Solaris instead of Linux. Even though OpenStack has been ported to a different host OS, Oracle OpenStack for Oracle Solaris still maintains compliance with OpenStack standards and is interoperable with other OpenStack distributions. Solaris brings many advanced features to OpenStack, particularly for enterprise workloads in the areas of performance, security, availability, reliability, and scalability. Features such as Zones (containers), ZFS, and Unified Archives are integrated and made available through OpenStack. Solaris has been developing container technology for a decade while now adding full VM virtualization as well, with both leveraging the same resource management features and simple management framework. Beyond technical features, however, are the substantial enterprise engineering, road map, and support that Oracle brings to OpenStack. Oracle's history and focus on enterprise is the company's core value proposition, and Oracle plans on developing OpenStack into a hardened and supportable enterprise technology. Oracle also has key assets to build a compelling ecosystem around OpenStack by enabling its database, middleware, Java, and enterprise application portfolio to run on OpenStack infrastructure. As customers sift through a variety of OpenStack vendors and products, Oracle has certainly put a unique spin on OpenStack with Solaris that deserves consideration.

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