WHITE PAPER

OpenStack and Red Hat

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IDC OPINION

Virtualization continues to be an important technology and foundation for cloud. However, the hypervisor is commoditizing, and the virtualization market today is moving to a layer of software above the hypervisor called cloud system software. While a hypervisor abstracts the resources of a single server, cloud system software abstracts across large pools of compute, storage, and networking. These resources are wrapped into cloud APIs, managed in an automated fashion, and made available through Web portals. Cloud providers have used this approach to build their public clouds, and now this type of software is becoming widely available in the market for enterprises to deploy on premises and create infrastructure-as-a-service (IaaS) private clouds.

OpenStack is an open source cloud system software project that has broad participation from the IT industry. OpenStack consists of several core modules and has established a process to incubate and develop new modules that can extend functionality. One of the main goals of being an open cloud system is interoperability, with the idea that clouds built on OpenStack should have a reasonable level of portability between them. Because OpenStack is open source, the inner workings of an OpenStack cloud and its APIs are fully transparent and anyone can participate in the development process if they choose to. As with previous open source projects such as Linux, OpenStack is becoming available in a wide range of forms. It is used by service providers to produce finished cloud services, embedded into appliances and converged infrastructure, as well as developed into commercially supported software offerings. With tremendous momentum and industry backing, OpenStack is poised to become a major factor in the emerging cloud system software market. Drawing on its experience and methodology with enterprise Linux, Red Hat is bringing to market a commercially supported and tested version of OpenStack, which will target customers that want an enterprise-ready distribution of OpenStack.

SITUATION OVERVIEW

Much of the virtualization market has moved beyond the hypervisor as that layer commoditizes and into a layer of system software above it to create IaaS clouds, which IDC terms cloud system software. Cloud system software presents an additional higher level of abstraction above the hypervisor, and instead of presenting virtualization APIs, it exposes broader cloud APIs. Cloud system software also goes beyond compute virtualization, tightly integrating similar virtualization and cloud technologies in storage and networking. Full cloud software suites can also include higher-level systems management software.

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The cloud system software market is diverging into two primary classes. One type is a public cloud–inspired model pioneered by Amazon that:

- Is designed for maximum scale and cost efficiency
- Focuses on availability by zones instead of per virtual machine (VM), with more of the availability responsibility as part of the application architecture
- Provides infrastructure and application cloud services such as object storage, elastic scaling, load balancing, database, analytics, and search
- Leans toward inexpensive commodity hardware
- Focuses on new apps written and optimized for cloud environments
- Is designed to create services, which apps are then written to utilize

The other primary type of cloud system software is an evolution of traditional enterprise server virtualization seen more in private cloud deployments that:

- Is compatible with existing applications and operating systems
- Focuses on ensuring mission-critical VMs never go down, with availability primarily a function of the infrastructure on a per-VM basis
- Accommodates enterprise hardware and architectures (fault-tolerant servers, SANs, VLANs, etc.)
- Is designed and tuned to meet individual application requirements

OpenStack is an open source cloud system software project with tremendous industry momentum and backing. Control of the project, which was started by Rackspace and NASA as an open alternative to proprietary solutions, has been passed to the OpenStack Foundation. The foundation is charged with promoting the development, distribution, and adoption of OpenStack. Key members of the foundation include:

- **Platinum:** AT&T, Canonical (Ubuntu), HP, IBM, Nebula, Rackspace, Red Hat, and SUSE
- **Gold:** Cisco, Cloud Computing Association in Taiwan, Cloudscaling, Dell, DreamHost, eNovance, Ericsson, Intel, Juniper, Mirantis, Morphlabs, NEC, NetApp, Piston, VMware, and Yahoo!

Platinum and Gold members must commit a set amount of monetary and developer resources to the project, but membership levels also extend to individuals and corporations that don't need to pay fees and can participate in development or community building. Each Platinum member holds a seat on the board of directors, while Gold and Individual members hold a set number of board seats, as a group, that are determined by election. Fees from Platinum and Gold members fund the project, and the OpenStack Foundation has currently secured more than $10 million in funding.

A technical committee oversees the software development and direction and is composed of the technical leads for each project as well as several elected positions. Currently, there are about 550 developers on the project.

OpenStack is in the process of creating a user committee that will organize and aggregate user feedback for the developers and the board. The charter of this committee is being drafted and will represent the approximately 7,000 individual members from 100 countries and 850 different organizations.

Key points in understanding OpenStack include the following:

- The OpenStack project is made up of many individual subprojects. The modular design of OpenStack is meant to provide maximum flexibility, and modules can generally be used in combination or stand alone. A set of modules tagged as "core," such as compute, storage, and networking, are the essential required parts of OpenStack. Optional modules are labeled as "integrated" and represent a wider ecosystem of add-on functionality. A new module starts in "incubation" status and can be promoted to "core" or "integrated" status if it attracts enough interest and matures.

- The OpenStack project does not include a hypervisor; instead, it relies on existing industry hypervisors. It works, with varying levels of support and features, with ESX, Hyper-V, KVM, and Xen. Xen and KVM are the best supported currently, with KVM being the most popular and used in most of the reference architectures.

- The scope of the OpenStack project is very broad, addressing compute, storage, and networking for infrastructure as well as extending into systems management, automation, security, and portals. While OpenStack does not include every software piece needed to create a large-scale, complex cloud, the scope of the project will grow over time as modules are proposed, incubated, and released.

- OpenStack is a technology and not a solution in and of itself. An analogy would be comparing OpenStack to the Linux kernel. The Linux kernel is a core technology, but it takes much more than the kernel to make a full operating system distribution. Likewise, OpenStack is a core cloud technology, but it still requires other elements to deploy and operate a cloud. OpenStack can be used by cloud providers to create cloud services and by enterprises to create private clouds. Real-world, commercial OpenStack products may use the technology in different ways, with a variety of enhancements that may make various OpenStack-based products and services look very different from each other.

FUTURE OUTLOOK

Today, most OpenStack deployments are by public cloud providers that are early adopters of technology and use OpenStack in a do-it-yourself (DIY) deployment and support model. IDC believes that 2013 will be the year that OpenStack goes commercial, with offerings emerging that are targeted at enterprises that want tested code, documentation, installers/tools, updates, and support. Many factors will

contribute to the success of OpenStack in the market in 2013 and over the next few years, such as:

- **The hypervisor.** IDC expects that for reasons of cost and support, customers deploying OpenStack will continue to use primarily KVM and Xen open source hypervisors. As hypervisors commoditize, IDC believes that customers will care less and less about the hypervisor used. Existing hypervisors will be used where existing workloads and certifications are to be migrated, but IDC expects the majority of workloads will be new workloads. IDC's 2012 *Cloud System Software Survey* shows this trend, with 53% of enterprises willing to adopt a new hypervisor when deploying cloud system software.

- **APIs, openness, and lock-in**. OpenStack has developed its own open API as part of the project. Cloud APIs have been a big focus of the industry, with controversy over openness, standards, and lock-in:

  - Standards, while useful, always lag behind innovation. Cloud standards exist today, but they are not complete or do not move fast enough for cloud vendors or projects. To further confuse matters, multiple standards may also exist for the same thing. Just because something is approved as a standard doesn't mean that people implement it or use it. An "open" API should follow relevant and popular standards as fit, but standards will not drive API development or offer a universal solution to API compatibility and lock-in.

  - One of the core tenets of OpenStack API openness is that the community develops the API under a transparent and collaborative process, with the results being fully open source. In this sense, until there is a universal cloud API standard (which will likely never happen), the OpenStack APIs are as open as anyone can practically expect. It is expected that multiple cloud providers implementing OpenStack will have at least a base level of interoperability with each other. To use the OpenStack trademark requires that the core OpenStack APIs be unaltered and fully supported. However, the level of interoperability and the usefulness of this compatibility in reducing migration pain remain to be tested. In reality, even the core APIs are implemented slightly differently by various providers, which could be just enough to hobble seamless migration. Many cloud providers and distributions enhance OpenStack with proprietary add-ons and API extensions, which may make core API compatibility a moot point if there are other functions that prevent the migration of a customer's workloads. Furthermore, it is often difficult for customers to tell which functions are compatible and which are proprietary, if they wish to stick to core OpenStack for portability. IDC believes that core API compatibility will make migrations and interoperability easier, though the extent of seamlessness is still in question. The OpenStack Foundation has implemented a compatibility working group to help address this issue. It is possible that the foundation will tighten up the requirements for using the OpenStack trademark as well as implementing a reference stack that deployments must test against. Cloud lock-in is a problem that isn't fully solvable today, but OpenStack is one of the largest coordinated industry efforts to address it, trying to strike the right balance between enforcement/standardization and openness/innovation.

- **Deployment and support model.** The pace of OpenStack development is blistering, with new releases every six months. In this early innovation cycle of cloud, where each release brings significant new features and enhancements, there are no minor releases. In general, the pace of cloud development is much faster than the pace of traditional enterprise IT. Major cloud providers enhance and roll out new cloud services every few months. OpenStack is on a similar trajectory, and there likely won't be any stabilization for at least the next couple of years. This presents a conundrum for enterprises and OpenStack vendors:

  - Upgrades have been a growing problem for OpenStack as deployments increase. There is no built-in mechanism for nondisruptive upgrades, and each upgrade often breaks things with previous versions. The project is beginning to investigate solutions, and commercial OpenStack distributions see this as an area of value-add. Maturity of the code and API over time will help bring some level of stabilization that will help.

  - Even if the upgrade problem can be solved over time and made nondisruptive, it's not clear that enterprises can follow the public cloud model of continuous deployment. Enterprises are generally very conservative and like to extensively test, deploy, and then support a product for a very long time. However, this approach will be at odds with the continuous innovation and deployment philosophy of cloud. Many enterprises are rolling out private clouds because end users are unhappy with the services provided in-house and are bypassing IT by going to the public cloud. If IT is to win back these users, it must provide a competitive alternative to the public cloud, and that means keeping pace with the public cloud. If IT can't innovate quickly enough, then whatever private cloud is deployed will be viewed as obsolete in a short matter of time, and users will once again bypass IT for the public cloud to get the services they want.

  - Due to the pace of OpenStack releases, support life cycles will be different from typical enterprise Linux cycles, at least initially. Today, most OpenStack distribution vendors are using n and n1 version support life cycles, which means that enterprises might have to upgrade once a year to remain on a supported version. Over time, as the project matures, these life cycles will likely extend, but for now, OpenStack customers need to accept a high rate of change.

- **Enterprise features and support.** OpenStack was originally developed from the point of view of a public cloud provider. While the software is being adapted to meet the needs of enterprise private cloud, that ecosystem will take time to build. For example, enterprises will want to use their existing SANs and other infrastructure, and many may expect virtualization-style high availability that isn't part of OpenStack today. However, going too far down this road may not be the best option for OpenStack. Much of the existing legacy workload fits in better with classic server virtualization and may not be a fit for the cloud. Focusing on the emerging opportunity (i.e., the new cloud applications) rather than trying to chase legacy compatibility may be the right use of resources for enterprise customers and OpenStack developers to help them avoid bloat and scope creep. Today, the difference between virtualization and cloud isn't always clear, much less the difference between cloud architectures, so expectations and use cases will have to be set accordingly.

RED HAT PROFILE

Red Hat became involved with OpenStack in mid-2011. At the time, interest in the project was growing rapidly and Red Hat engineers began contributing code to the project. Today, Red Hat has invested in a large cloud engineering team and is a top contributor to upstream OpenStack code as well as to the core supporting open source projects such as KVM and libvirt.

Red Hat was a significant contributor to the formation of the OpenStack Foundation, drawing on its previous experience and involvement in open source communities. Red Hat is a founding member of the OpenStack Foundation and a Platinum member with board representation.

Red Hat is best known for its enterprise Linux distribution, and much of the value that Red Hat developed with Red Hat Enterprise Linux (RHEL) is being carried over to Red Hat OpenStack:

- Red Hat has proven capability and experience in preparing and delivering open source code for enterprise use, developing processes, infrastructure, and expertise in:
  - Backporting bug fixes, security patches, and features to allow a particular version to be maintained and relevant for longer support life cycles
  - Rigorous testing and QA necessary for enterprise-class products
  - Worldwide enterprise-level support along with consulting and training services
- A large ecosystem of ISVs, IHVs, and service provider partners that develop, test, and certify solutions based on Red Hat platforms is being extended to the OpenStack product. The Red Hat certified partner program includes:
  - Guest OS certifications (Red Hat's KVM-based hypervisor is Microsoft SVVP [Server Virtualization Validation Program] certified, meaning that Windows is certified to run and supported as a guest operating system on Red Hat's hypervisor.)
  - A broad list of hardware certifications spanning servers, storage, and networking
  - Applications that are certified to run and supported on Red Hat Enterprise Linux and leverage other Red Hat software
- Red Hat has leadership and influence within the upstream OpenStack development process with the ability to advocate for customers within OpenStack.
- Red Hat is continuing its fully open source philosophy with all development done upstream in OpenStack rather than as proprietary, closed source add-ons. This keeps new innovation in the core code and prevents unnecessary forking, interoperability, and incompatibility issues.

Red Hat has invested in several OpenStack-based products and suites, including community and enterprise versions:

- **RDO** is a community binary distribution of OpenStack with the objective of nurturing and fostering OpenStack community, development, and testing for enterprise use cases. Analogous to Fedora Linux and its relationship to Red Hat Enterprise Linux, RDO provides the latest cutting-edge code to the community. RDO is also able to instantly generate packages based on the latest repository source code to assist testing and development of upstream code.

- **Red Hat Enterprise Linux OpenStack Platform** (RHEL OSP) is Red Hat's commercial enterprise distribution of OpenStack. Since the OpenStack technology depends on Linux to provide the operating environment for the OpenStack components, Red Hat Enterprise Linux OpenStack Platform combines Red Hat Enterprise Linux with the OpenStack cloud platform to deliver a scalable and secure foundation for building a private or public cloud. Preview versions based on OpenStack Essex and Folsom releases and RHEL have been available for customer testing since August 2012. The GA release of Red Hat Enterprise Linux OpenStack Platform is based on RHEL and the OpenStack Grizzly release and is scheduled for July 2013.

- **Red Hat Cloud Infrastructure** (RHCI) is a suite of products designed to enable customers to transition from traditional server virtualization to private and hybrid cloud. Today, most customers are not yet ready to build a cloud infrastructure, but they are evaluating and planning their transition to private and hybrid cloud capability. RHCI enables customers to transition at their own pace while leveraging their existing virtualization infrastructure investments, providing an evolutionary path to the eventual goal of hybrid cloud. The GA release of RHCI is scheduled for July 2013. The suite includes:

  - **Red Hat Enterprise Virtualization** (RHEV) includes the KVM hypervisor and the oVirt-based management framework for traditional server virtualization deployments and management. It is best suited for existing traditional workloads.

  - **Red Hat Enterprise Linux OpenStack Platform**, previously discussed, provides the platform to build IaaS private or public clouds. RHEL OSP leverages the same KVM hypervisor used in RHEV but replaces the traditional virtualization management with cloud system software and management based on OpenStack.

  - **Red Hat CloudForms** is a hybrid cloud and virtualization management solution that can span multiple hypervisors, public cloud providers, and private clouds, including OpenStack.

CHALLENGES/OPPORTUNITIES

Opportunities

- **Demand for cloud.** As the industry transitions to cloud computing, whether public or private, the demand will grow for cloud system software such as OpenStack that provides the foundational infrastructure.

- **Commercialization of OpenStack.** Open source software is widely deployed, but many customers will want a supported enterprise version. Red Hat's reputation and previous track record with Linux will likely draw interest from those seeking a supported OpenStack distribution.

- **Cloud interoperability and portability.** Cloud computing, while extremely attractive to customers for a variety of reasons, comes with concerns about openness and lock-in. OpenStack is a concerted effort by many industry participants to provide an interoperable and open cloud platform that will help address the problem of workload migration in a hybrid scenario, from cloud to cloud.

Challenges

- **Cloud interoperability and portability.** Interoperability is a key goal and value proposition of OpenStack, but fragmentation among distributions and implementations is an issue. The project must strike a careful balance between standardization and innovation. Another issue is the level of interoperability and portability that should be developed to non-OpenStack clouds.

- **Monetizing public cloud providers.** Very large providers tend to use self-supported open source and not pay for commercial versions or support. While a long tail of smaller providers will build on commercially supported products, these providers often want cut-rate pricing to accommodate their business models and compete with the scale and pricing of larger providers. Enterprise private clouds also tend to use licensed, supported software, but the eventual split of private versus public cloud computing isn't known yet.

- **New deployment and support model.** OpenStack vendors and customers need to transition to a different model for cloud that includes continuous innovation and deployment. That means cloud system software products may have a different life cycle than traditional enterprise software and require more frequent upgrades. Beyond the technical issues with supporting and implementing a faster-changing platform, enterprise processes will also have to be changed, which may pose more of a challenge than the technical issues.

- **Cloud system software maturity.** OpenStack and cloud system software are still in their beginning stages. Many features, compatibility, or stability may be missing and will take time to develop and mature. There will likely be a high rate of change in OpenStack with potentially disruptive changes that may break existing implementations.

CONCLUSION

OpenStack is an exciting new development in the cloud system software market, offering an open alternative to proprietary systems. While cloud interoperability and portability are still extremely difficult problems to solve, OpenStack is the largest and most concerted effort by the industry to address these issues, and the results are promising. Red Hat is applying its experience in commercializing open source Linux for the enterprise and its methodology to OpenStack, which will be of interest to customers seeking a supported, open cloud solution.