Executive Summary

HP believes that an open development model is the only way to foster needed cloud standards, remove the fear of proprietary license lock-in for cloud customers, and create a large ecosystem that spans cloud providers. The market has chosen the OpenStack™ ecosystem. The OpenStack project’s dynamic developer and vendor community fosters innovation and rapid development of the OpenStack technology cloud infrastructure.

HP's use of OpenStack technology and participation in the OpenStack project means that HP’s customers get innovative cloud technology and can more easily port code and integrate applications with no vendor lock-in using an open source approach, open APIs, and tools from multiple vendors. HP’s participation in the OpenStack project means HP will be at the forefront of public cloud development and advancement as the OpenStack project evolves to deliver massively scalable services.
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The Need for an Open Cloud

As the cloud matures and continues to drive the IT agenda around the globe, customers, partners and solution providers continue to seek out openness, scalability, security, and rapid time-to-market – all attributes delivered through open cloud technology. Enterprises are considering a variety of cloud business models to meet their infrastructure needs including:

- Private clouds – owned, deployed and managed by the customer
- Managed clouds – owned by the customer but managed by a 3rd party service provider
- Public cloud – offered as a service, where customers only pay for what they use.

Most enterprises envision having a hybrid cloud strategy where workloads are deployed in either multiple clouds (private or public) or are migrated to multiple clouds over the lifetime of the workload. Examples of this are:

- Development/test environment – deployed in one cloud while production workloads are deployed in a different private or public cloud
- Bursting – a private cloud workload can burst into the public cloud to handle spikes in usage/traffic
- Migration of a private cloud workload to a public cloud (or vice versa) for scalability, compliance or security reasons.

Openness implies the ability to move workloads between these various cloud alternatives without being locked into any single vendor’s cloud solution. If the workloads are developed and managed through an open set of APIs that is widely supported by the hybrid clouds, the workload is “fungible” and can be deployed across multiple clouds.

According to Gartner, 80% of Fortune 1000 enterprises will be using some cloud computing services by the end of 2012.1 That means the build out of these services needs to happen fast, and be measured for ROI using a new economic model based on Opex vs Capex.

As the demand for openness and cloud solutions increases, one key industry trend that supports both is Open Source Software (OSS). OSS is pervasive and growing. Currently, there are over 600,000 open source projects, and the number is currently doubling every 24 months. Seventy percent of cloud customers are considering open cloud solutions. In addition, more than half of the organizations surveyed have adopted OSS solutions as part of their IT strategy, with nearly one-third citing benefits of flexibility, increased innovation, shorter development times and faster procurement processes. Lower total cost of ownership was a key driver.

OSS makes up nearly one-third of the responding organizations’ overall enterprise software portfolio (applications and infrastructure), which is about the same as the proportion of internally developed software. The presence and influence of OSS cannot be denied. Open Source brings with it unprecedented cross-discipline innovation and deep adoption through many vertical markets. Organizations, particularly those with mainstream IT structures, cannot afford to ignore open source and its growing influence. To do so would place such organizations at a technical, competitive, and financial disadvantage in the years ahead.

With the HP Cloud Services, you get open-source based, developer-friendly clouds you can trust. Cloud offerings provided by HP Cloud Services are based on open source and are developer-focused – with features designed to help your business thrive.

HP has shown this commitment by contributing to and supporting the OpenStack project, a leading open source community, chartered with developing a cloud operating system for controlling compute, storage, and networking resources through a web interface. The rest of this paper describes OpenStack technology, HP’s contribution to the OpenStack community, and the benefits derived by customers who are deploying an open cloud architecture.
OpenStack Software

OpenStack™ software is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface. But the OpenStack project is also a community where ideas, and code, can be shared and leveraged by all participants. The OpenStack project is backed by an independent Foundation and global community with more than 7,000 members representing 850 unique organizations across 88 countries. All the code is freely available under the Apache 2.0 license.

Some of the key OpenStack projects are listed below.

- **OpenStack Compute**: Open source software and APIs for massively scalable virtual compute instance deployments (project code name Nova)
- **OpenStack Object Storage**: Open source software and APIs for static object storage that’s massively scalable (project code name Swift)
- **OpenStack Block Storage**: Open source and software and APIs for the creation, attaching, and detaching of the block devices to servers (project code name Cinder)
- **OpenStack Image Service**: A multi-format image registry that is for disk images and offers discovery, registration, and delivery services (project code name Glance)
- **OpenStack Identity Service**: An identity service that enables common authentication across all OpenStack projects (project code name Keystone)
- **OpenStack Virtual Network Service**: Network connectivity as a service (project code name Quantum)
- **OpenStack Dashboard**: A graphical interface for administrators and users to access, provision, and automate cloud based resources (project code name Horizon)

Additional project details can be found in the Appendix.

With OpenStack Technology, the Community Creates the Cloud

OpenStack community members believe in the four “opens”: open source, open design, open development, and an open community. Participants in the OpenStack community can freely create and contribute code and work with the community to develop standards for future cloud technology.

Anyone can run OpenStack code, build on that code and submit change requests back to the OpenStack project. Based on open source principles, the OpenStack project and cloud services based on OpenStack technology put choice, freedom, and community at the fingertips of customers and developers worldwide.

OpenStack community members believe that an open development model is the best way to foster open APIs and frameworks, remove the fear of proprietary license lock-in, and create a large ecosystem that spans cloud providers. HP is dedicated to providing choice and avoiding vendor lock-in in the OpenStack solutions and services we bring to customers, partners and developers.
HP’s Commitment to OpenStack

The OpenStack project is about delivering an open source cloud platform that’s massively scalable and rich with features. The HP Cloud is built around OpenStack architecture, including Nova (compute), Swift (object storage), and Glance (image management).

HP Cloud Services Open Architecture

HP has taken a leadership position in the OpenStack community. HP is also recognized as one of the largest contributors to OpenStack projects: Object Storage (“Swift”), OpenStack Compute (“Nova”), OpenStack Image Repository (“Glance”), OpenStack Virtual Network Service (“Quantum”), and OpenStack Identity Service (“Keystone”). HP led the Glance project for the Essex version and contributes resources (services, data centers, power, bandwidth, etc.) to:

- openstack-ci (continuous integration and automation)
- openstack-qu (quality assurance)
- cross community driven “TryStack” test sandbox
- incubated database-as-a-service project

HP’s ongoing contributions span various initiatives within the community with the goal of improving service performance, functionality, and usability.

Governance of the OpenStack project is by the independent OpenStack Foundation. HP is a Platinum Member of the Foundation and provides ongoing contributions such as code, designs, testing automation, documentation, and technology roadmap guidance, as well as financial and operational support to the OpenStack project. HP also holds a Board of Directors position on OpenStack Foundation. We have a representative on the Technical Program Committee. A member of HP’s legal team also participated in the committee which drafted governance documents for the new Foundation.

Our Platinum Membership means that we are committed to the OpenStack mission to protect, empower, and promote OpenStack software and the community around it. This includes users, developers, and the entire ecosystem. HP will provide valuable leadership to the OpenStack project and work to ensure the project delivers high quality software releases and maintains a healthy community. HP is also committed to ensuring that the APIs developed for the technology are consistently and uniformly implemented to promote interoperability and guard against API fragmentation. HP is dedicated to ensuring that the OpenStack project will grow, become ubiquitous, and prosper.

OpenStack Lets HP Give You What You Want Better and Faster

Because HP Cloud Services are based on OpenStack technology, as well as standard web-based APIs, customers, partners and developers can use these services and avoid vendor lock-in in OpenStack services. You get access to a dynamic developer community that regularly builds useful new innovations. And you get the benefit of solutions from a partner ecosystem of solutions, projects and services.

Cloud interoperability – across multiple vendors as well as public, private and managed clouds – is increasingly required from customers and developers as they consume cloud services. HP aims to enable you to port your code and integrate applications without lock-in in OpenStack services, using standards, open APIs, open frameworks, and tools from multiple vendors.

HP’s participation in the OpenStack project means that HP aims to be deeply involved in public cloud
development and advancement as the OpenStack project evolves to enable even more massively scalable applications.

Most importantly, HP Cloud Services provides the cloud services you need so that you can focus on your business.

An Open Source-Based HP Cloud You Can Trust

(whether you’re a Developer, Independent Software Vendor (ISV), or Business of Any Size)

With HP Cloud Services, you get the ability to quickly consume cost-effective, secure and scalable cloud services, and you only pay for the resources you use. HP Cloud Services offerings are built on a foundation of OpenStack technology and additional technology from HP. HP sells Cloud Services directly to customers via the hpcloud.com website as well as through an enterprise sales team for larger customers.

Business-oriented:

With HP Cloud Services, you’ll get a public cloud you can trust, with the advantages of performance, efficiency, scalability, security, interoperability, great customer support, and access to cloud solutions and services from HP’s partners.

At HP, building secure solutions is integrated into everything we do. HP Cloud Services includes sophisticated identity management, node hardening, multi-factor authentication, a comprehensive logging solution powered by HP ArcSight, standard kernel auditing enhanced with HP AppArmor, an IPS design using HP TippingPoint, and Distributed Denial of Service (DDOS) protective mechanisms. HP’s comprehensive security review process includes architectural and code reviews as well as regular penetration testing. Security is our business.

HP Cloud Services believes in personal, reliable support services, so we built a world-class team to respond quickly when you need support. HP Cloud Services delivers exceptional customer support with live, rapid technical service in minutes and proactive 24/7/365 monitoring of services. Our personalized developer support includes interactive live chat, phone, e-mail, and community forums across multiple geographic regions.

You can rely on HP Cloud Services. HP Cloud Compute, HP Cloud Object Storage and HP Cloud CDN services have entered general availability, backed by industry-leading SLAs. We anticipate other services to follow soon.

Open source-based:

When we say we’re committed to the OpenStack project, we mean we’re contributing our code back to the core OpenStack project. In fact, the HP Cloud team is one of the top contributors to the OpenStack project, having provided over 13,000 lines of code change across all OpenStack projects including Swift, Nova, Glance, Quantum, and Keystone. Through open source-based technology, we’re building into HP Cloud Services’ offerings the features, performance, efficiency, and scalability you need. Our open source commitment means no vendor lock-in in the OpenStack services, access to the open source community, and transparency into the OpenStack technology-based components of our infrastructure design. We’re committed to helping the OpenStack project be successful, and most importantly, enabling your success and freedom to choose. See the Appendix for more detail.

Developer-focused:

To enhance developer experiences, HP Cloud Services are built with developer touch points in mind, with a foundation of REST API compatibility, multi-cloud language bindings, and a single Command Line Interface (CLI) for all services. HP Cloud Services supports multiple APIs that promote interoperability across clouds and web services from multiple vendors. And with HP’s Converged Cloud strategy, developers can leverage interoperability across private, managed, and public clouds, all from HP.

HP Cloud Services aims to deliver a highly intuitive and accessible development environment that makes developing new applications faster and easier. Developers are free to use a variety of tools and multiple languages, such as Ruby, Java, PHP, and Python and get access through simple, intuitive UI, CLI, APIs, web management tools, and reporting delivered directly and uniquely by HP Cloud Services.
**Additional Features from HP**

While OpenStack software provides a great base of services, it doesn’t necessarily provide everything you need. HP has extended OpenStack software in a variety of ways that make it more suitable for use by enterprises grouped by project.

**Nova** (Compute)
- Scalability across Availability Zones and Regions

**Swift** (Object Storage)
- Replication across Availability Zones and Regions

**Cinder** (Block Storage)
- Cross-region synchronization

**Keystone** (Identity Management)
- Global identity
- Account management – Multi-tenants/account
- Billing, CRM linkages

**Quantum** (Networking)
- Extensions – support user defined networks, SDNs, Intrusion detection, load balancing

**With HP, You Come First**

HP understands that one size doesn’t fit all. HP offers comprehensive, connected and flexible solutions across private, managed, and public clouds to meet your needs. The **HP Converged Cloud** strategy aims to offer a single, common, open source-based architecture with converged management and security to support private, managed, and public clouds, as well as traditional IT. HP’s cloud offerings include the following:

- **HP Cloud Services**: Providing an open, developer-friendly, and business-oriented public cloud and public cloud partner ecosystem for developers and businesses of all sizes

- **HP Software Solutions and Converged Infrastructure**: For consolidating, standardizing and virtualizing environments, enabling customers’ move to the cloud

- **HP CloudSystem**: An integrated solution for implementing on-premise clouds combining Converged Infrastructure and HP Software

- **HP Professional Services**: To assist with strategy, design, implementation and support of hybrid cloud environments

Across all these solutions, HP aims to give customers choice and flexibility, bringing together the power of HP’s enterprise-hardened technology with the speed and flexibility of open source.

HP is a trusted ally and is committed to helping you make an informed decision about your cloud technology. We deliver open source-based and innovative solutions that allow you to seamlessly connect to the cloud, freeing you to innovate and focus on your business while we handle your storage, compute, and cloud database requirements. With more than 45 years of infrastructure technology services experience, only HP has the breadth of capabilities to deliver a robust public cloud with a variety of private and hybrid offerings that address your unique needs.

**Learn more**

Go to www.hpcloud.com or call us toll-free at 888-616-0708.
Appendix

OpenStack Compute – Architecture and Use Cases

The OpenStack Compute cloud operating system enables enterprises and service providers to offer on-demand computing resources, by provisioning and managing large networks of virtual machines. Compute resources are accessible via APIs for developers building cloud applications and via web interfaces for administrators and users. The compute architecture is designed to scale horizontally on standard hardware, enabling the cloud economics that companies have come to expect.

Flexible Architecture

OpenStack software is architected to provide flexibility as you design your cloud, with no proprietary hardware or software requirements and the ability to integrate with legacy systems and third party technologies. It is designed to manage and automate pools of compute resources and can work with widely available virtualization technologies as well as bare metal and high-performance computing (HPC) configurations. KVM and XenServer are popular choices for hypervisor technology and recommended for most use cases. Linux container technology such as LXC is also supported for scenarios where users wish to minimize virtualization overhead and achieve greater efficiency and performance. The HP Cloud uses KVM hypervisors and exposes the OpenStack APIs, enabling enterprises and developers to manage their workloads in HP Cloud and in other OpenStack-based private and managed clouds they might have.

Popular Use Cases supported by HP Cloud via OpenStack Compute

- **IT departments** acting as cloud service providers for business units and project teams
- **Processing big data** with tools like Hadoop

- **Scaling compute** up and down to meet demand for web resources and applications
- **High-performance computing (HPC)** environments processing diverse and intensive workloads

OpenStack Storage Capabilities

In addition to traditional enterprise-class storage technology, many organizations now have a variety of storage needs with varying performance and price requirements. OpenStack has support for both Object Storage and Block Storage, with many deployment options for each depending on the use case.

Object Storage is ideal for cost effective, scale-out storage. It provides a fully distributed, API-accessible storage platform that can be integrated directly into applications or used for backup, archiving and data retention. Block Storage allows block devices to be exposed and connected to compute instances for expanded storage, better performance and integration with enterprise storage platforms.

Object Storage Capabilities

- OpenStack object storage provides redundant, scalable object storage using clusters of standardized servers capable of storing petabytes of data
- Object Storage is not a traditional file system, but rather a distributed storage system for static data such as virtual machine images, photo storage, email storage, backups and archives. Having no central "brain" or master point of control provides greater scalability, redundancy and durability.
- Objects and files are written to multiple disk drives spread throughout servers in the data center, with the OpenStack software responsible for ensuring data replication and integrity across the cluster.
- Storage clusters scale horizontally simply by adding new servers. Should a server or hard drive fail, OpenStack object storage replicates its content from other active nodes to new locations in the cluster. Because OpenStack object storage uses software logic to ensure data replication and
distribution across different devices, inexpensive commodity hard drives and servers can be used in lieu of more expensive equipment.

**Block Storage Capabilities**

- OpenStack block storage provides persistent block level storage devices for use with OpenStack compute instances.
- The block storage system manages the creation, attaching and detaching of the block devices to servers. Block storage volumes are fully integrated into OpenStack Compute and the dashboard allowing for cloud users to manage their own storage needs.
- In addition to using simple Linux server storage, it has unified storage support for numerous storage platforms including Ceph, NetApp, Nexenta and SolidFire.
- Block storage is appropriate for performance sensitive scenarios such as database storage, expandable file systems, or providing a server with access to raw block level storage.
- Snapshot management provides powerful functionality for backing up data stored on block storage volumes. Snapshots can be restored or used to create a new block storage volume.

**OpenStack Networking**

Today’s datacenter networks contain more devices than ever before: servers, network equipment, storage systems and security appliances many of which are further divided into virtual machines and virtual networks. The number of IP addresses, routing configurations and security rules can quickly grow into the millions. Traditional network management techniques fall short of providing a truly scalable, automated approach to managing these next-generation networks. At the same time, users expect more control and flexibility with quicker provisioning.

OpenStack Networking is a pluggable, scalable and API-driven system for managing networks and IP addresses. Like other aspects of the cloud operating system, it can be used by administrators and users to increase the value of existing datacenter assets. OpenStack Networking ensures the network will not be the bottleneck or limiting factor in a cloud deployment and gives users real self-service, even over their network configurations.

**Networking Capabilities**

- OpenStack networking provides flexible networking models to suit the needs of different applications or user groups. Standard models include flat networks or VLANs for separation of servers and traffic.
- OpenStack Networking manages IP addresses, allowing for dedicated static IPs or DHCP. Floating IPs allow traffic to be dynamically rerouted to any of your compute resources, which allows you to redirect traffic during maintenance or in the case of failure.
- Users can create their own networks, control traffic and connect servers and devices to one or more networks.
- The pluggable backend architecture lets users take advantage of commodity gear or advanced networking services from supported vendors.
- Administrators can take advantage of software-defined networking (SDN) technology like OpenFlow to allow for high levels of multi-tenancy and massive scale.
- OpenStack Networking has an extension framework allowing additional network services, such as intrusion detection systems (IDS), load balancing, firewalls and virtual private networks (VPN) to be deployed and managed.

This white paper includes content from www.openstack.org – check out the site for latest feature releases.

2 Source: https://github.com/markmc/openstack-gitdm/tree/results/essex