OpenStack: A Business Perspective

Workloads, economics and enterprise adoption of OpenStack clouds

openstack
CLOUD SOFTWARE

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Executive Overview

In today's business environment, companies are constantly challenged by fast-paced, ever-changing market conditions. Companies of all sizes, in all industries, even capital-intensive and brick-and-mortar businesses, might find themselves in competition with web-based companies.

Online companies like Amazon, Uber and Airbnb have changed the way the world does business. To remain relevant and competitive, enterprises must transform IT with online and mobile applications that deliver secure, on-demand, self-service capabilities directly to customers.

They must also enable and empower software developers who, through their online lens, offer a unique understanding of the business from the customers' point of view. For developers to quickly react to the constantly changing customer demands and market conditions, they need an IT strategy and infrastructure that is cost-effective, flexible and agile. OpenStack® provides an open and flexible framework that many enterprises use as their underlying technology to drive business transformation to a software-defined infrastructure and support their business operations, including software development.

> "Notable Fortune 100 enterprises like BMW, Disney, and Walmart have irrefutably proven that OpenStack is viable for production environments." -- *Lauren E. Nelson, Senior Analyst, Forrester Research*[1]

OpenStack provides the platform for rapid development, testing and deployment of mission-critical and massively scalable applications. Self-service access to on-demand IT resources offer developers the freedom to innovate, while automated operations allow more control and methodical capacity planning. The global OpenStack ecosystem provides packaging, maintenance and support that enterprises expect from a business-critical IT environment.

With open APIs and support from virtually all major IT vendors, OpenStack offers freedom from vendor lock-in and the opportunity to move workloads among private and public clouds based on business criteria. And because it is designed and delivered openly, businesses can contribute requirements and even code to ensure it fits their needs.

> "...in trying to find something that would fill that niche of an elastic, programmatic infrastructure, the choices there aren't as numerous. Certainly there are public cloud options like Amazon Web Services, but those don't really fit our needs. We have a lot of data centers, and a lot of content needs to stay inside of our network. So within those requirements, OpenStack was the clear favorite." -- *Matt Haines, Time Warner Cable*[2]

This booklet is intended to help business executives and project managers understand the benefits of cloud computing and OpenStack though real-world use cases and an overview of the technology. It covers the organizational and cultural impact of the evolution to agile IT. Lastly, it will offer guidance on how to further evaluate and get started with OpenStack.

What is Cloud?

Cloud computing has created a paradigm shift and become influential in today's IT community. Increasingly business organizations are utilizing cloud as a new platform for many business operations. Cloud has been described from a number of different perspectives.

The most widely accepted definition is the one given by the National Institute of Standards and Technology (NIST), U.S. Department of Commerce:

> "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."
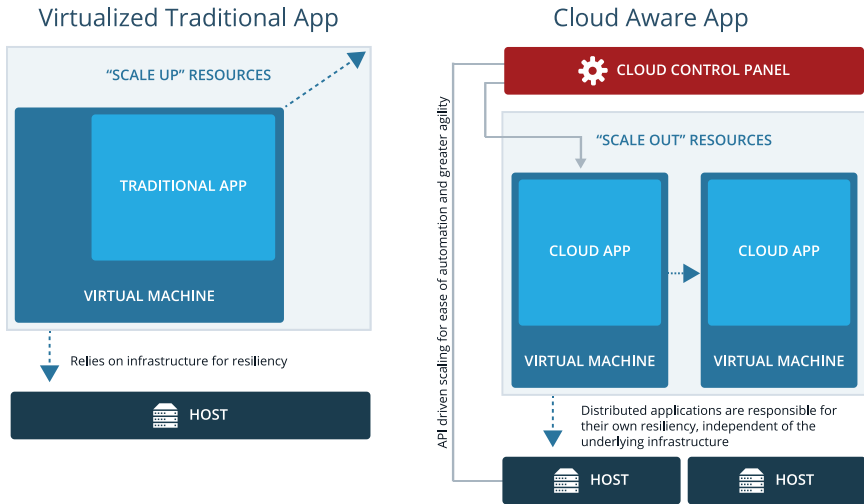
The cloud model is comprised of five essential characteristics: on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. It includes three service models: Software as a Service, Platform as a Service, and Infrastructure as a Service. And it has four deployment models: Private, Public, Community, and Hybrid.[3]

To understand the differences between traditional and cloud infrastructures, look at how they differ in design philosophy. First, consider the traditional infrastructures that were built on virtualization technologies. These technologies offered consolidation on a smaller number of larger servers. The solutions worked well because most servers hosted applications with monolithic architectures, such as Oracle or Microsoft® Exchange. Each instance of this type of application is still encapsulated in a single virtual machine and grows by scaling up on a single physical server.

Cloud platforms are designed to support different classes of applications such as MongoDB and Hadoop, that are architected to scale horizontally, and are resilient against virtual machines shutdowns. Resources can be expanded by adding more application instances and rebalancing workloads across those instances. These distributed applications are responsible for

their own resiliency and are independent of the underlying infrastructure and advanced hypervisor features. Although OpenStack is designed for the scale-out cloud architecture model, it can also be used to support traditional applications.

Figure 1: Virtualization vs. cloud

Virtualized Traditional App   Cloud Aware App

"SCALE UP" RESOURCES

TRADITIONAL APP

VIRTUAL MACHINE

Relies on infrastructure for resiliency

HOST

API driven scaling for ease of automation and greater agility

CLOUD CONTROL PANEL

"SCALE OUT" RESOURCES

CLOUD APP   CLOUD APP

VIRTUAL MACHINE   VIRTUAL MACHINE

Distributed applications are responsible for their own resiliency, independent of the underlying infrastructure

HOST   HOST

Cloud Trends

Cloud computing is quickly evolving with new technology advancements at lightning speed. Containers, bare-metal and platform services are constantly changing the cloud landscape. Organizations bet on these technologies to stay competitive in their relevant industry. To mitigate technology risks, enterprise IT requires an agile and open cloud platform like OpenStack that incorporates new technologies, and is supported by a wide commercial ecosystem.

OpenStack's global footprint is expanding to industries such as government/ defense, film/media, telecommunications, banking, retail, travel and transportation. According to an OpenStack user survey,[4] operational efficiency, faster innovation, time-to-market, cost-savings and open platform are the leading business drivers for OpenStack adoption. As organizations continue to accelerate their cloud journey, a hybrid cloud strategy is a preferred choice for enterprise IT.[5] The OpenStack Powered[6] interoperability program and federated identity help organizations create an interoperable hybrid cloud platform.

What is OpenStack?

OpenStack is a collection of open source software projects that allow users to develop and manage a cloud infrastructure in a data center. Rackspace Hosting and NASA jointly launched the OpenStack cloud software initiative in July 2010 to help organizations offer cloud-computing services on industry standard hardware. Four months later, the first official release, code-named Austin, provided cloud compute and object storage capabilities to support Infrastructure as a Service (IaaS). The initial projects controlled pools of compute, storage, and networking resources throughout a data center through a dashboard that gave administrators control and enabled users to instantly provision resources. The community committed to delivering releases every six months as the projects evolved.

Figure 2: Six Years of OpenStack history
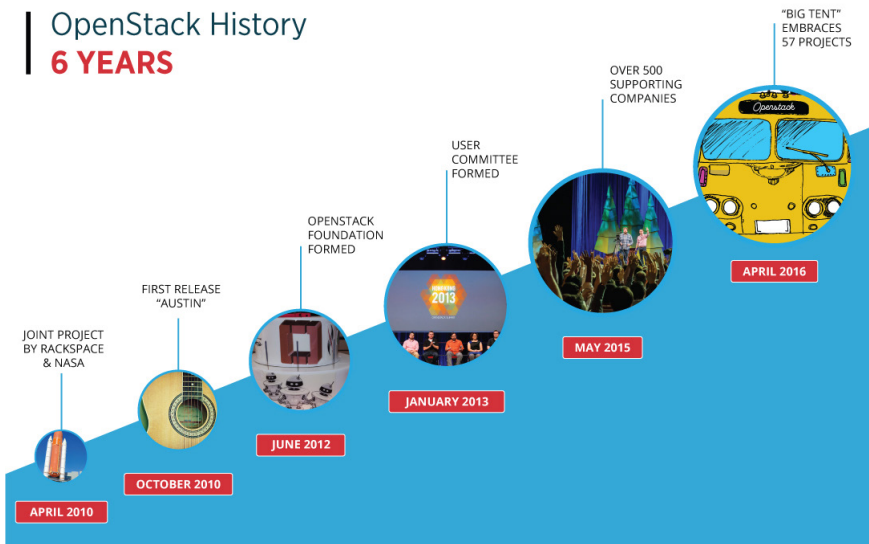
The OpenStack Foundation was formed in 2012 as an independent not-for-profit organization to promote the development, distribution and adoption of the OpenStack cloud software. The Foundation allows for neutral third-party intellectual property management and shared resources to level the playing field for all participants.

The OpenStack Foundation's governance model consists of a board of directors providing vision and governance, a technical committee responsible for release management and cross-project needs, and a user committee that supports user advocacy and feedback. Together they have managed the phenomenal growth over the project's first six years.[7]

The broad OpenStack community operates under four principles:

- **Open source:** The code for OpenStack is freely available under the Apache 2.0 license.

- **Open community:** OpenStack is dedicated to producing a healthy, vibrant, and active developer and user community. Most decisions are made by consensus. All processes are documented, open and transparent.

- **Open development:** Roadmaps and code reviews on the OpenStack infrastructure are public. When possible, OpenStack cooperates with other open source projects rather than reinvent the wheel.

- **Open design:** Every six months the development community holds a design summit to gather requirements and write specifications for the upcoming release. The summit is open to the public and attendees include users, operators, developers, and upstream project personnel.

This broad community consists of contributors, including:

- **Software engineers** who contribute to and review code for the projects that form the OpenStack cloud platform.

- **Writers** who provide product and usage documentation and translation.

- **Application Developers** who write applications that run on the OpenStack Cloud Infrastructure.

- **Operators/Users:** People who deploy and operate an OpenStack-based cloud infrastructure and use the applications that run on the OpenStack cloud platform.

- **Community Working Groups:** Focused teams that gather user requirements from particular segments and represent them (e.g. Enterprise, Telecom, etc.) to address a particular functional requirement set (e.g. Logging, Monitoring, NFV, etc.).

- **Commercial ecosystem:** Cloud vendors and service providers that provide tools, applications, packaging, services and support that add value to the base software.

Since 2010, OpenStack has matured beyond the initial deployment and management of compute, storage, and network resources to encompass new services[8] that enable a robust, scalable, and highly functional cloud-computing platform. Project leadership is organized through Project Technical Leads (PTL) who are highly active contributors in their project communities and are responsible for the architecture, development, and eventual release of the OpenStack cloud operating services.

OpenStack continues to maintain its six-month release cycle with three milestones along the way. Each version includes one-year of community support for back porting critical bug fixes, in addition to support from OpenStack distribution vendors.

OpenStack has become a global community with more than 56,000 individual members, consisting of developers, corporations, service providers, researchers, and users/operators across more than 180 countries and over 600 companies. It continues to grow at a rapid pace.[9]

OpenStack Benefits

The emergence of the software-defined economy is driving the architectural transformation of the data center. IT organizations must respond quickly to the demand for new services, while staying compliant with regulations and protecting business and personal data. A new software-defined infrastructure is emerging through OpenStack that orchestrates the deployment and allocation of compute, network, and storage resources for application needs at a competitive cost.

Speed and agility:

OpenStack accelerates time-to-market by providing business units a self -service portal to access necessary resources on-demand, and an API-driven platform for developing cloud-aware applications. Enterprises dramatically reduce provisioning times from weeks or months to minutes with OpenStack, giving them a significant competitive advantage.

> "Our private cloud [based on OpenStack,] provides us with the agility, availability, manageability, efficiency and the foundation for innovation necessary to deliver the best products and services." -- *Sri Shivananda, Vice President, Global Platform and Infrastructure, PayPal*[10]

Optimized resources through interoperability and hybrid cloud:

OpenStack is an open and flexible platform that enables application portability among private and public clouds, allowing enterprises to choose the best cloud for their applications and workflows without vendor lock-in. Products labeled with "OpenStack Powered" have passed stringent API testing to ensure applications written for one OpenStack powered cloud will run on other OpenStack clouds. OpenStack software can also be integrated with a variety of key business systems such as Active Directory and LDAP.[11]

## Vibrant commercial ecosystem:

OpenStack enjoys the support of major IT vendors, including every significant Linux® distribution, virtualization hypervisor, and public and hosted private cloud provider, and plug-ins from all major networking and storage vendors. Any environment an enterprise needs can be built with strong commercial and community support. OpenStack is also easily integrated with existing VMware-based virtualized infrastructures.[12]

Open source and modular design:

OpenStack consists of a stable core and several complementary projects. All are designed in the open with published specifications. Hundreds of users contribute requirements and code back to the projects ensuring the software meets their needs. OpenStack also allows for specific customization and provides access to other open source technologies as opposed to building similar functionality. For example, OpenStack is building on the work of Docker and Kubernetes.

> "According to Gartner, the modular architecture of OpenStack provides extreme flexibility in terms of implementation, particularly when compared with the fixed-function design of many monolithic commercial CMPs."[13]

Figure 3: OpenStack's modular design
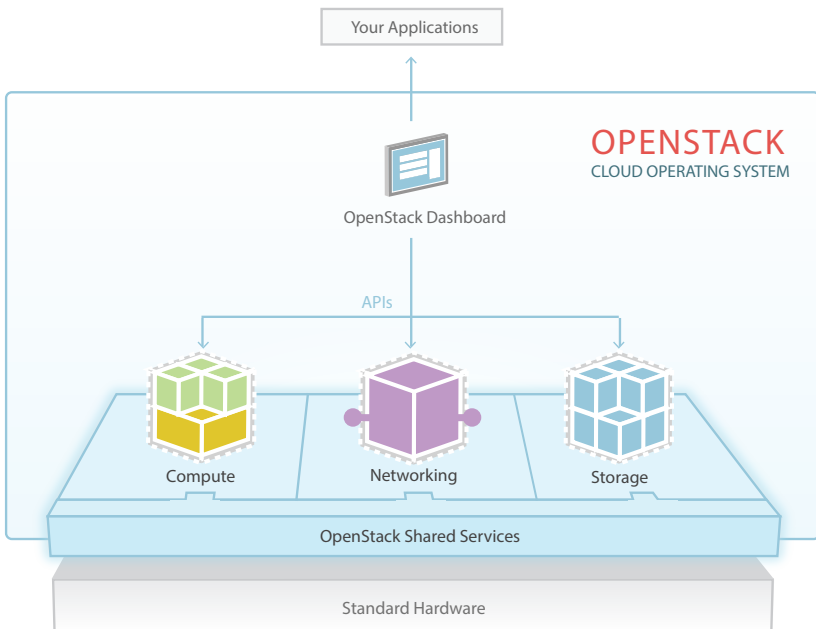
What can OpenStack
be used for?

OpenStack powers a large number of organizations to serve different purposes. The following table gives real-life examples of the most widely deployed use cases and the benefits.

USE CASE	BUSINESS BENEFITS OF OPENSTACK
Agile platform for enterprise apps Comcast[14] powers customer-facing applications and services, such as their X1 video platform guide, as well as internal customer projects for both production and development environments.	• Enable business agility • Enable faster pace of innovation • Improve customer confidence in moving Line-of-business applications to production
Big data The National Supercomputer Center in Guangzhou[15] drives big data analytics and other cloud applications across 6,400 nodes and 800 users. Over 1,000 of these nodes are completely dedicated to big data analytics.	• Rapid and dynamic provisioning of a cluster to provide researchers • Ability to dynamically change the role of nodes providing elasticity • Ability to scale resources as users grow • Open source benefits including ability to contribute to meet their needs
Digital media workflow DigitalFilm Tree,[16] a leading post-production company for TV and film, moves raw footage from location to editors, video effects companies, then back to producers and directors for review. The finished show is sent to cable providers for guide listing and delivery. The workflow uses a combination of interoperable OpenStack private and public clouds.	• Instant-on capacity • Cost control via granular utilization • Lower latency with geographic proximity of compute and storage • Resiliency with multiple copies of replicated data • Secure identity federation provides single point of user control across clouds

eCommerce	• Enable developers to rapidly build new applications that adapt to ever changing needs through self-service flexible infrastructure
[Walmart](#)[17] runs an OpenStack cloud of more than 100,000 compute cores, built in nine short months, to power the needs of their eCommerce 3.0 initiatives across desktop, mobile, tablet and kiosk users.	• Ensure IT cost per transaction goes down instead of up with scale through commodity hardware, scale-out architecture and simplified management
	• Improve resilience of apps, since 10 machines are less likely to fail than one
	• Open source benefits: No vendor lock-in, open APIs, ability to influence and vibrant eco-system
High Performance Computing (HPC)	• Grow IT resources within a fixed budget
[CERN](#)[18] runs an OpenStack-based platform on 115,000 cores and provides physicists with cloud resources to collect, analyze and model petabytes of data per second from the LHC (Large Hadron Collider) detectors.	• Move from a fully custom IT environment to a more standardized one
	• Ability to expand capacity using other research organizations' and public cloud resources, using common APIs and federated identity
	• Ability to influence the direction and roadmap of OpenStack by actively contributing
IT-as-a-service	• Use existing traditional app technology and benefit from cloud methodologies at the same time
[Adobe® Digital Marketing](#)[19] uses OpenStack to convert their existing virtualization environment into self-service IT.	• Infrastructure provisioning times slashed from months to minutes enhancing app delivery
	• Cost reduction through improved efficiencies
	• Start transitioning to cloud-aware apps by porting to OpenStack
	• Avoid vendor lock-in through open source technologies

R&D

NeCTAR,[20] a research institution funded by the Australian government, chose OpenStack to power its cloud for national collaborative research. Today, the NeCTAR cloud runs over 30,000 CPU cores supporting over 6,000 registered researchers.

- Allows researchers to rapidly deploy and share innovative new applications with their colleagues
- Researchers can use a general purpose cloud for applications rather than using a much more expensive HPC cloud
- Ability to customize IT to suit needs including flexibility in storage infrastructure choice
- Amazon API compatibility allows existing users to port software to NeCTAR

Network provisioning

Telstra's Pacnet Enabled Network (PEN)[21] Platform integrates OpenStack, NFV (network function virtualization) and SDN (software defined networking) to offer on-demand WAN resources across 24 data centers in 9 countries in Asia.

- Network provisioning time reduced from weeks to minutes through self-service
- Customer commitments slashed from 1 year to 1 hour by offering elastic resources
- Significant reduction in Total Cost of Ownership (TCO) by converting expensive networking hardware into software functions

Web services

Time Warner[22] uses OpenStack to deliver web and video services, called TWCTV, across multiple platforms such as iOS, Android, Roku, Chrome, etc. In just six months, Time Warner rolled out OpenStack into production across two data centers in the US, Colorado and North Carolina.

- Fast and agile infrastructure reduces time-to-deployment
- Reduces cost
- Enables DevOps practices through agility and software defined networking (SDN)
- Open source benefits into software functions

Introducing OpenStack into an Organization

There is no single OpenStack implementation strategy. How OpenStack is implemented depends on the organization's specific situation, management philosophy, objectives, company culture, and employee resources. OpenStack, however, continues to demonstrate benefits and ROI.[23]

Consider piloting

OpenStack is a collection of open source software projects that allows enterprises to develop and manage cloud infrastructure in a data center. As users determine how to introduce OpenStack, they must consider what sort of initial pilot will provide the best learning for developers and operations, and how they will track costs and measure success.

One of the most powerful benefits of OpenStack is its ability to automate infrastructure. Many organizations start with a self-service environment to provision machines for development and testing. This allows operations to gain familiarity with a basic OpenStack cloud, and shortens the turn-around time for developers provisioning resources. This capability enables agility, faster time-to-market, and experimentation often resulting in new, valuable applications.

"The organization is finding that it is more nimble with experimental projects. The team was able to put in place the infrastructure in a few hours for a mobile app that was created by a small group of developers during a brainstorming session. The app has now been launched globally and is proving highly popular with customers and making an impact on customer loyalty." -- *Director of Infrastructure, Global Enterprise*[24]

Other organizations experiment with new greenfield applications, rather than attempting to migrate existing mission critical applications. This approach allows the IT team to experience managing an OpenStack environment while developers learn how to take advantage of the cloud architecture.

Employee training

When deploying OpenStack, employee development and training must be considered. Evaluate skills and develop roles and responsibilities for the operations team to run and operate the environment. To overcome a learning curve, the OpenStack community provides invaluable support and training, including resources on the OpenStack website.[25]

> "The [MercadoLibre] team was vigilant in educating their development team and challenging them to adopt the latest best practices for building cloud-ready applications. They sent emails, held brownbag lunches and formal training sessions, and ensured that the cloud environment was properly documented."[26]

Measuring costs and determining value

To anticipate the cost of implementing an OpenStack cloud, organizations must factor in the cost of hardware acquisition and maintenance, operations training and vendor support. Although OpenStack is open source licensed software, certain software subscription or professional support fees might be necessary if the organization is acquiring vendor-specific solutions. There are many examples to help estimate costs. Forrester Consulting offers a view of factors from a large global enterprise with an OpenStack-based e-commerce solution.[27] A global top-10 automaker offers their cost comparison between an OpenStack big data/analytics solution and a traditional legacy appliance.[28] Enterprises continue to present at the OpenStack Summits about building their business cases.[29]

The shift to cloud computing is similar to the transition to client-server computing and web-based clients in many ways—challenging but providing tremendous value.

User should also assign value to the intangible benefits, such as improvements in operational efficiency and user productivity. For example, the ability to automate routine administrative tasks enables organizations to re-focus operational staff to more value-added activities. The on-demand

self-service model reduces demand on helpdesk support and allows users to obtain what they need faster. The ability to provide a quick and easy-to-setup proof-of-concept environment enables a culture of innovation and software development agility. By improving software development lifecycle times, organizations can bring products to market faster.

There is a direct correlation between concepts like developer productivity and operational efficiency to time-to-market. Previously bogged-down processes trapped in endless approvals can be unleashed by post-OpenStack workflows that provide cleaner handoffs between teams and accountability without redundancy and expensive rework.

Culture and organizational changes

One of the greatest challenges to deploying an OpenStack cloud involves organizational and cultural changes in IT and the business. To facilitate a change in the company culture, senior leadership will need to challenge the existing status quo and revise existing policies and procedures. To properly align resources, many organizations begin with a cross-functional team to make initial deployment decisions and determine the optimal architecture. This team can expand slowly as the enterprise gains experience and rolls out the new cloud to more internal organizations. The experienced members of the OpenStack community offer valuable soft skills to help organizations successfully navigate the transition.

Picking the right cloud applications

OpenStack enables a new way to think about application development and deployment. Weary of expensive software licenses, more enterprises want to reduce their dependency on proprietary vendors with open source alternatives.

OpenStack can help speed deployment of both cloud-aware and traditional applications. Cloud-aware applications are resilient to failure and latency. They're service-oriented, elastically scalable, location independent, and secure. Traditional applications require qualification to determine fit for the cloud and may require migration planning. OpenStack supports virtual machines, bare metal, and containers providing a flexible, robust platform for all types of applications. With OpenStack, organizations can speed innovation, explore new opportunities and create business value.

Ready to Start with OpenStack Software?

The diverse and rich OpenStack ecosystem allows for numerous ways to get started, depending on use case, desired control, and organizational capabilities. To learn more about the available options, OpenStack has created these sites: How To Get Started With OpenStack[30] and the OpenStack Marketplace.[31]

As OpenStack is a collection of projects, organizations can choose to assemble their own installation and develop the expertise in building and managing it. Assistance is available from the OpenStack ecosystem of highly skilled members.

Available options to get started with using OpenStack software include:

- Build an on-premise private cloud using open source software,[32] documentation,[33] drivers,[34] and training[35] for your staff.

- Build an on-premise private cloud using one of the distributions or converged appliances.[36]

- OpenStack cloud is also available as a hosted private cloud.[37]

- Consume OpenStack services through a public or hybrid cloud[38] provider.

- Engage with a consultant or integrator[39] to help you decide the best steps to move forward with OpenStack that are right for your organization.

Other options include viewing recorded videos[40] of presentations from previous OpenStack Summits, joining OpenStack mailing lists,[41] and reading various guides.[42] User stories[43] are also available to gain further insights into

how OpenStack empowers the next generation of business, technology, and industry leaders.

Finally, any of the companies participating in the OpenStack Marketplace can provide further information.

Additional Resources

OpenStack Glossary

http://docs.openstack.org/glossary/content/glossary.html

Forrester Research Reports: OpenStack Is Ready - Are You?
and Forrester Total Economic Impact for OpenStack:

http://www.openstack.org/enterprise/forrester-report/

How to Introduce OpenStack in Your Organization,
Sam Charrington. Nov 2014

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16. DigitalFilm Tree User Story: http://superuser.openstack.org/articles/shifting-gears-how-cloud-is-revolutionizing-tv-post-production

17. Walmart User Story: http://www.walmartlabs.com/2015/02/17/why-we-chose-openstack-for-walmart-global-ecommerce/

18. CERN OpenStack User Story: https://www.youtube.com/watch?v=7k3VnWXOjP4

19. Adobe User Story: https://www.openstack.org/assets/pdf-downloads/adobe-dm-case-study.pdf

20. NeCTAR User Story: http://www.openstack.org/user-stories/nectar/

21. Telstra Pacnet User Story: http://superuser.openstack.org/articles/with-openstack-pacnet-reduces-provisioning-time-from-weeks-to-seconds

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38. OpenStack Public Cloud. https://www.openstack.org/marketplace/public-clouds

39. OpenStack Consulting & Integrators. https://www.openstack.org/marketplace/consulting

40. OpenStack Videos. https://www.youtube.com/user/OpenStackFoundation/videos

41. OpenStack Mailing Lists. http://lists.openstack.org/cgi-bin/mailman/listinfo

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