CLOUDSTACK VS OPENSTACK

Apache CloudStack: It Just Works for Service Providers

appcore®

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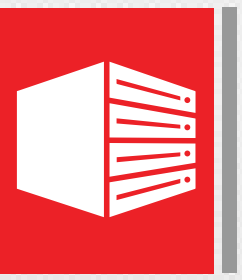

INTRODUCTION

CloudStack vs OpenStack

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Whose side are you on? If you are looking to implement a cloud orchestration platform, be prepared to choose. Right now there seems to be a “war” going on between the two platform giants: CloudStack and OpenStack. Each equipped with unique features, comparing the two is imperative in making the right decision for your business. It’s a decision that should not be made lightly.

That being said, there are other viable orchestration providers in the cloud landscape, but it seems that most service providers tend to land in either the OpenStack or the CloudStack camp. This results in a debate between cloud administrators as to which is better: CloudStack vs OpenStack. Before making a commitment to one or the other, service providers must fully understand the benefits and the technology behind the scenes.

This document is meant to educate and inform service providers about the difference between the two from a technology and business perspective. We have evaluated the overall architecture and stability of each from the service provider’s viewpoint in order to clarify the platform battle.

PLATFORM HISTORY

Understanding their Background

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APACHE CLOUDSTACK PROJECT

CloudStack is an open source cloud computing software developed to create, manage and deploy cloud infrastructure. It was launched by Cloud.com and made generally available in May of 2010 as free software under the GNU General Public License.

In July 2011, Citrix purchased Cloud.com that resulted in Citrix donating CloudStack to the Apache Software Foundation (ASF), where it was accepted as part of the Apache Incubator.

Today CloudStack is a single top level ASF project built around a committee of developers and a VP/Chair. The project is led by Hugo Trippaers - Engineer at Schuberg Phillis, who is also active in the Open Daylight project. Even though the project has a smaller community of committers than OpenStack, it is a cohesive single project that is commercially backed by a primary contributor, Citrix.

Today over 50% of the Apache CloudStack code development is produced by a team of Citrix developers, many of whom came from the Cloud.com acquisition. Not only is Citrix involved in the development of new features and bug fixes for the CloudStack platform, but Citrix produces a commercial distribution of CloudStack called Citrix CloudPlatform. .

Originally, CloudPlatform was a customized distribution of the CloudStack code base, which contained a significant feature divergence. As of the release of CloudPlatform 4.2 in September of 2013, all Citrix customizations have been committed back to the Apache CloudStack

project; further justifying that Citrix is committed to the open source project and is continually working on products and services utilizing the core platform.

The goal of the Apache CloudStack project is to continue to develop a stable cloud orchestration layer that is capable of supporting various workloads. The cohesive project continually supports infrastructure, hypervisors and varying platforms with a commitment to a solid upgrade path, quality assurance and regression.

OPENSTACK PROJECT

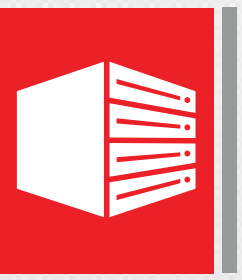
OpenStack is an open source cloud computing platform for public and private cloud environments. Jointly launched in July of 2010 by Rackspace Hosting and NASA, the project intended to help organizations offer cloud computing services running on standard hardware.

The early code for OpenStack came from NASA's Nebula platform and from Rackspace's Cloud Files platform. In 2011, developers of the Ubuntu Linux distribution adopted OpenStack with an unsupported technology preview of the OpenStack "Bexar" release for Ubuntu 11.04. Ubuntu's sponsor Canonical then introduced full support for OpenStack clouds, starting with OpenStack's Cactus release.

In 2012, Red Hat announced a preview of their OpenStack distribution, beginning with the "Essex" release and introduced commercial support in July 2013. During the same time NASA released an internal audit citing lack of technical progress and other factors as the primary reason

for dropping out as an active developer of the project.

Currently, OpenStack is comprised of ten sub-projects, each having their own technical lead. The community collaborates around a six-month, time-based cycle in which a new lead is assigned to each sub-project, resulting in ever changing and distributed leadership. The project is managed by the OpenStack Foundation, a non-profit corporate entity established in September 2012 to promote OpenStack software and its community.



UNDERLYING TECHNOLOGY

Architecture Behind the Scenes

UNDERLYING TECHNOLOGY

Architecture Behind the Scenes

	apachecloudstack open source cloud computing	openstack CLOUD SOFTWARE
Compute	• Orchestrated through the core management server • Supports multiple hypervisors including XenServer, VMware, KVM and Hyper-V	• Sub-project: Nova • Contained as a separate management process and API • Designed primarily to support XenSever/KVM with limited support for VMware and Hyper-V
Block Storage	• Management server communicates with the hypervisor • Latest integrations allow native provisioning, snapshots and thin provisioning	• Sub-project: Cinder • Separate management process and API to orchestrate the provisioning of volumes • Communicating volume location to the compute project
Cloud Networking	• Coordinated using a combination of core management and virtual machine appliances • Deployed automatically and services individual customer networks	• Sub-project: Nova or Neutron • Cloud networking routes systems through the networking management node(s)
Templates, Snapshots and ISOs	• Known as Secondary Storage in CloudStack, it was designed to store templates, snapshots and ISOs • Provides a bridge between end users and the storage area	• Sub-project: Swift • Utilized to provide storage for resources that aren't needed for normal VM operation via a replicated object storage pool • Template management is provided through Glance, another sub-project
User Interface	• Part of the core management server application • AJAX base web US • Handles requests of the system for admins and end users	• Sub-project: Horizon • Combines several APIs from various sub-projects into a single web user interface
System Usage	• Core management server collects events related to resources • Usage and Events Such as starting, stopping or changing a VM	• Sub-project: Ceilometer • Responsible for collecting usage event data and for translating it into consumable data
Authentication/ Authorization	• Integrates with LDAP and Active Directory • Includes several levels of access and nesting to create a hierarchy of resources pools	• Sub-project: Keystone • Responsible for being the single source of identity truth across the entire environment

As an IT professional, making the decision about which cloud infrastructure and technology components to implement can be overwhelming especially when it comes to choosing one orchestration platform over the other. A large portion of the discussion between CloudStack vs OpenStack centers around the architecture design of each project. CloudStack takes an integrated, holistic approach, whereas, OpenStack's design architecture is complex and features individual projects with their own separate APIs to integrate as a provider.

After evaluating both, there are some distinct considerations that separate the two. The outline below details specific architecture features and functionality of CloudStack and OpenStack.

CLOUDSTACK ARCHITECTURE

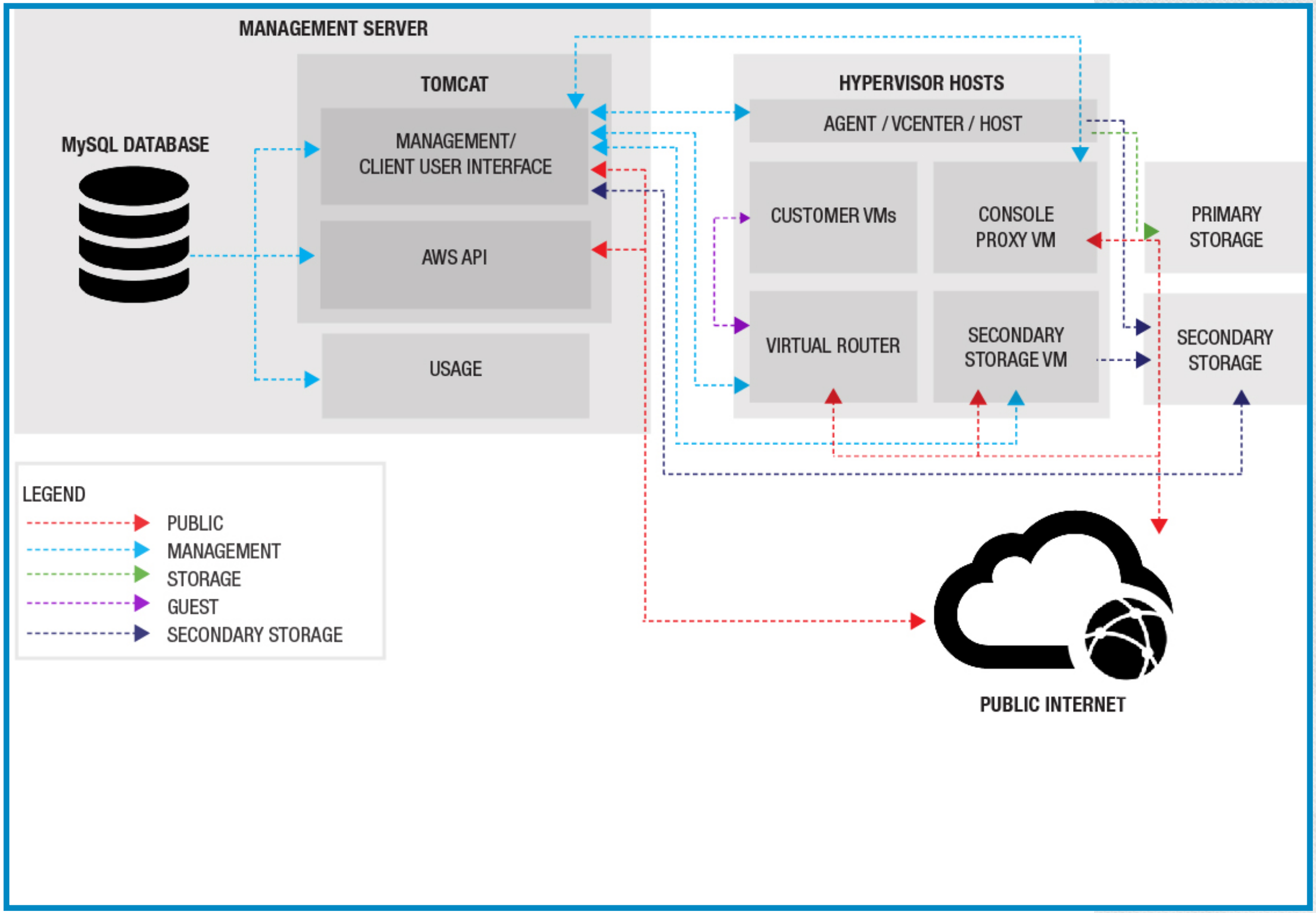
COMPUTE

The compute section of the overall CloudStack architecture is the Infrastructure-as-a-Service (IaaS) foundation. The CloudStack compute layer's sole purpose is to provide a running virtual machine. Each compute node is orchestrated through the core management server and supports multiple hypervisors and virtualization platforms, including XenServer, vSphere, KVM and Hyper-V. It leverages the native capabilities of the hypervisor and is continually adding deeper integration for all hypervisors. CloudStack has now added support for VMware vMotion and vStorage Motion in an effort to handle traditional enterprise style workloads.

BLOCK STORAGE

The management server communicates with the hypervisor to provision volume resources and utilizes the protocols supported by

CLOUDSTACK ARCHITECTURE DIAGRAM



the respective hypervisor. The latest integrations allow native storage area network (SAN) communication from the management server to facilitate provisioning, snapshots and thin provisioning. This allows more advanced capabilities of the back-end SAN to be leveraged. The block storage orchestration is designed so the management server is not involved in the block level operations; instead it is only used to manage volumes.

CLOUD NETWORKING

Networking is vital to provide optimal performance for your cloud environment. Through CloudStack, networking is orchestrated using a combination of the core management service and a virtual machine (VM) appliance. This is deployed by the management server automatically and services individual customer networks. There are two primary modes of networking operation within CloudStack: Basic (AWS style) layer-3 and Advanced (VLAN) layer-2 isolation.

CloudStack networking also features custom network service offerings. This allows administrators to tailor the cloud networking to meet customer needs including external load balancing and firewall integration, custom CIDR and VPN connection. A VM appliance provides all customers enhanced network functionality without additional management servers to configure and maintain. This design provides flexibility in creating multi-tier isolated networks to support n-tier enterprise applications and site-to-site VPN to existing resources and networks.

SECONDARY STORAGE - TEMPLATES, SNAPSHOTS & ISOs

In CloudStack, secondary storage was designed to store templates, snapshots and ISOs. It is orchestrated through a combination of the core management server and a VM appliance deployed on a per zone basis. It provides a bridge between end users and the storage area of templates and snapshots. Secondary storage includes the functionality to utilize NFS or object style storage but it does not provide the storage system. This allows for inexpensive nearline storage to be used since these resources do not affect general VM performance.

USER INTERFACE

A key component of any cloud solution is the user interface (UI) that handles requests of the system, either by admins or end users. CloudStack provides an embedded UI as part of the core management server available to both admins and end users of the system. This interface can also feature load balancing across multiple management

servers providing highly available orchestration services. A REST-based API powers the user interface as well as exposing further functionality not provided directly through the UI.

SYSTEM USAGE

Compiling usage information and translating it into useful data is an optional component of CloudStack's architecture. In order to gather usage data, the core management server collects events related to resources such as starting, stopping or changing a VM. This is automatically enabled for an environment and does not require any configuration by the admin. The optional external usage process then converts those events into usage records for a specific time period.

For example: A virtual machine was running with 2 CPUs and 204MB of RAM for 3.7 hours. A volume of 20GB has been allocated for 2 hours.

The usage service is easily configured through the same configuration mechanism as the core management server.

AUTHENTICATION/AUTHORIZATION

The architecture design of CloudStack features authentication and authorization in the core management server. Additionally, there are options to integrate with LDAP and Active Directory provided by the core management server. This unique architecture layer includes several levels of access and nesting to create a hierarchy of resource pools.

CLOUDSTACK ARCHITECTURE CONCLUSION

It is apparent that CloudStack was designed as a singular system that operates in a cohesive manner. All the components work together and operate from a single unified core with a single operational database. It is true that there are some aspects of distributed management servers through the various VM appliances that it manages, but these are completely automated by the core management. There is no need to separately administer these other instances. Possibly the best direct benefit to having a single unified core is that there is a single API.

OPENSTACK ARCHITECTURE

The OpenStack project has been developed modularly which has its benefits but also creates various roadblocks. Plus, the project is made up of multiple sub-projects influenced by several vendors and managed by separate technical leads rotating every six months. The commitment to adding new features at such a fast rate is a concern to many, especially those who value stability and quality assurance for their customers. The outline below describes OpenStack's feature set and functionality within their architecture framework.

COMPUTE

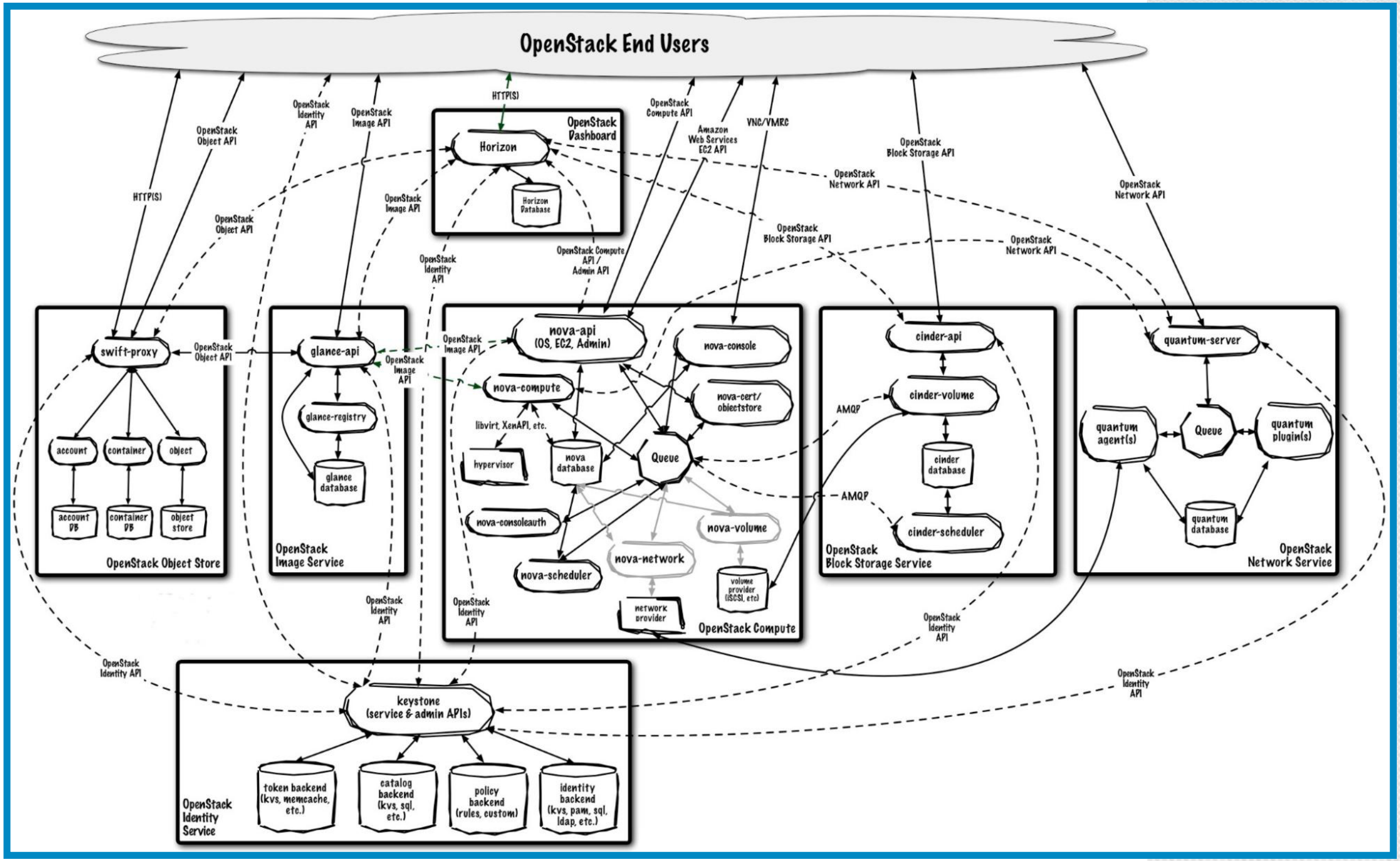
OpenStack's compute layer is part of the Nova sub-project, which is contained as a separate management process and API. The architecture was designed to primarily support XenServer/KVM with limited support for VMware and Hyper-V. It was architected to support compute cloud style workloads through local storage and has limited networking support.

BLOCK STORAGE

Block storage is a separate sub-project called Cinder and it has a separate management process and API. It orchestrates the provisioning of volumes and communication of the volume location to the compute project. It was designed to integrate directly with a significant number of back-end systems as well as supporting a few reference protocol implementations. It is also generally desired to set up one Cinder management server per storage back-end, but newer versions allow supporting multiple back-ends through one management server.

CLOUD NETWORKING

OPENSTACK ARCHITECTURE DIAGRAM - GRIZZLY RELEASE



Depending on the specific version of OpenStack, and the desired networking model, networking is orchestrated through either the Nova network system or the Neutron project. This portion of the system routes traffic through the networking management node(s). The Nova project networking features a simplified set of network capabilities whereas Neutron provides advanced capabilities and plugins to support external integrations. It is important to note that Neutron has limited plugin support for anything besides KVM. Networking through the Nova project is targeted at cloud style networking similar to AWS with a flat private network.

OBJECT STORAGE - TEMPLATES, SNAPSHOTS & ISOs

Object storage in OpenStack is utilized to provide storage for resources that aren't needed for normal VM operation. This is provided by the Swift sub-project as a replicated object storage pool. Template management is provided though Glance, another sub-project of the OpenStack project. Each of these systems has their own separate management processes and APIs. The Swift sub-project is well known in the cloud landscape as it is commonly used outside of a full OpenStack deployment to provide replicated object storage, similar to Amazon S3.

USER INTERFACE

The OpenStack interface, part of the Horizon project, combines several APIs from various sub-projects into a single web user interface. It is another management process running separately from the previously mentioned systems, and must be configured to communicate with each of the other systems. This enables users to have a friendly interface to navigate the different resources under management of the cloud.

SYSTEM USAGE

The Ceilometer sub-project is responsible for collecting usage event data and for translating it into consumable data. It is a very new project, and is not fully integrated into the other sub-projects. Some of the sub-projects have integrated with Celiometer and provide data through a common event bus, thus eliminating the need for periodic polling.

AUTHENTICATION/AUTHORIZATION

This feature set is part of the Keystone sub-project and is responsible for being the single source of identity truth across the entire cloud environment. It also is configured as a separate set of management process and APIs. The system authentication is capable of RBAC permission schemes but it is all-dependent on how the other sub-projects have integrated it and are configured.

OPENSTACK ARCHITECTURE CONCLUSION

OpenStack was designed from the beginning to be a collaboration of somewhat separate projects, which influenced the overall architecture and design throughout the system. This provides options to the user to pick and choose which pieces they want to use or integrate, but also puts more responsibility on the cloud provider to make intelligent design decisions. There have also been instances of spin off projects within the overall OpenStack project. The Cinder project is a good example of a spin-pff, as it was originally part of the Nova volume project, but was split off to reduce the overall size of the Nova project and to dedicate resources to its development.

APPCORE'S CONCLUSION

Appcore has been working with various IaaS software systems since 2008. We have setup multiple configurations of IaaS software solutions including Apache CloudStack, Citrix CloudPlatform and OpenStack, and have installed and managed clouds for service providers. The process of setting up CloudStack is relatively straightforward, taking into account the complexities of the connected infrastructure, whereas OpenStack is cumbersome and disjointed to deploy and configure. To put it simply, the CloudStack management server "just works", right out of the box.

While CloudStack is a monolithic system, it's flexibility and scalability can be used to meet a wide assortment of requirements. OpenStack has a more modular nature, which results in the setup and configuration being more complex. CloudStack provides the functionality to deploy environments rapidly; with easy support for common protocols, it is possilbe to stand up a functional cloud in hours versus days.

COMMITMENT TO CLOUDSTACK

Understand Why Appcore Committed to the CloudStack Platform

COMMITTMENT TO CLOUDSTACK
Understanding Appcore's Committment

Appcore provides cloud automation technology to service providers and we understand there are a lot of orchestration platforms to choose from. In an effort to provide the most stable and reliable platform possible to our customers, we were compelled to compare the best of breed solutions in the market, CloudStack and OpenStack, to fully understand the pros and cons of each before making a commitment to a single platform.

At first Appcore's infrastructure was architected using Apache CloudStack as the foundation and OpenStack Swift as an optional object storage provider. There was also significant research and development aimed at bringing full OpenStack support to the Appcore AMP software. Over time, as Appcore transformed from an Infrastructure-as-a-Service (IaaS) platform company to a software company, our architecture design progressed and evolved. Eventually, the benefits of committing to CloudStack, outweighed the need to support all open source orchestration and was a necessity in order to continue to compete.

APPCORE BRINGS YEARS OF EXPERIENCE AND EXPERTISE TO EACH CLOUDSTACK DEPLOYMENT

As part of Appcore's commitment to CloudStack we bring years of experience to each deployment. With customers running continuously since 2010, we have a broad range of experience with maintenance, upgrades, and troubleshooting/issue resolution. This is evident in our ability to architect cloud environments for our customers and provide the necessary support to ensure they are operating effectively and efficiently.

CITRIX COMMERCIAL BACKING

When Citrix purchased Cloud.com, it was the validation to the cloud market and to Appcore that Citrix was committing to develop an orchestration layer for service providers and enterprises. Again, Citrix showed commitment by backing the Apache CloudStack project and currently provides 50-60% of the developers to keep the project moving forward.

Not only does Citrix provide support for the Apache CloudStack community, but they also support their third-party vendors through partner programs, training and certifications. Citrix also provides a commercial distribution of CloudStack, known as Citrix CloudPlatform™ that includes patches, additional integrations and support.

In March of 2014, Appcore participated in the Citrix Ready Verification program, which helps customers identify solutions that are recommended to enhance virtualization, networking and cloud computing solutions from Citrix. Appcore AMP completed the rigorous verification process to ensure compatibility with Citrix CloudPlatform, providing confidence in joint solution compatibility.

“Businesses need tools to manage both legacy and cloud-native workloads running in public and private clouds,” said Krishna Subramanian, VP of Product Marketing, CloudPlatforms’ Group at Citrix. “Appcore AMP provides a single management and monitoring interface for both workloads in any type of cloud, enabling Citrix CloudPlatform customers to further simplify manual processes without removing control.”

Citrix’s commitment to the Apache CloudStack community and support for third-party vendors with certification and training made it an easy decision for Appcore to continue building our strategic partnership.

SINGULAR FOCUS AND INFLUENCE

It is important to Appcore and to our service provider customers that there is a clear development focus and roadmap for the progression of CloudStack. The Apache CloudStack project structure lends itself

to a singular focus through a project management committee and VP/ Chair, Hugo Trippaers. This focus creates a cohesive project where all components work in unison to provide a simplified solution.

Not only is there a singular focus, the CloudStack community embraces influence from the outside community. This means that Appcore and other outside contributors, including our service provider customers, can impact the direction and features of the CloudStack project. This level of contribution and engagement allows Appcore to influence the CloudStack roadmap, advocating for new features and enhancements that are relevant to our service provider customers.

WHAT DOES THIS MEAN FOR YOU?

Understanding the Value as a Service Provider

WHAT DOES THIS MEAN FOR YOU?
Understanding the Value

APPCORE'S FOCUS IS STRAIGHTFORWARD: SIMPLIFY THE COMPLEXITY OF CLOUD MANAGEMENT FOR SERVICE PROVIDERS.

As a service provider, you may be asking yourself what does this mean for me and how will I benefit? Appcore's focus is straightforward: simplify the complexity of cloud management for service providers. In order to accomplish this, we have committed to a platform with proven stability and a solid product roadmap. Plus, Appcore continues to add features to our software to automate cloud management based on feedback from our service provider customers.

APACHE CLOUDSTACK COMMUNITY

Appcore's commitment to the CloudStack community opens up the door for you as a service provider. It allows us to be involved in the development of new features and bug fixes that will benefit you. We continue to emphasize the service provider market and make sure that the community is hearing your feature requests and feedback. It is important to us to continue to provide you with the tools to simplify the management of your cloud environment.

APPCORE SPECIALIZES IN ARCHITECTING, DESIGNING, INSTALLING & IMPLEMENTING CLOUD SOLUTIONS

CLOUDSTACK CONSULTING

Appcore is your partner in building your perfect cloud solution. Our commitment to Apache CloudStack benefits customers looking to implement the platform as their cloud environment or anyone looking for technical expertise for additional support. Appcore specializes in architecting, designing, installing and implementing cloud solutions based around your specific business model and customer base. Our approach is developed around collaboration in order to tailor a custom solution, enabling your administrator's continuous engagement throughout the entire process. Our goal is to empower you to have long term success managing your cloud.

APPCORE SUPPORT

For those needing a little extra help, Appcore also includes dedicated support for our service providers to maintain their cloud environments

and maximize their resources efficiently. Our support team is available to consult on how to stabilize your system and offer guidance to ensure long-term stability.

CONCLUSION

Even though the CloudStack project currently has less brand visibility in the cloud landscape, Citrix's commitment guarantees stability to the product and its ongoing development for service providers. All of the above factors combined made it an easy choice for Appcore to commit to Apache CloudStack and Citrix CloudPlatform as the foundation of our software and overall business. As you continue to evaluate the best platform to deploy your cloud environment, hopefully the comparison between CloudStack and OpenStack arms you with the information necessary to make the decisions right for your business.