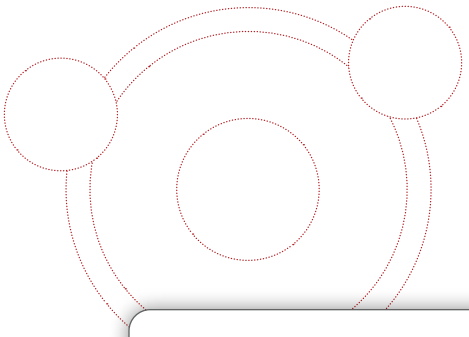
cloudscaling

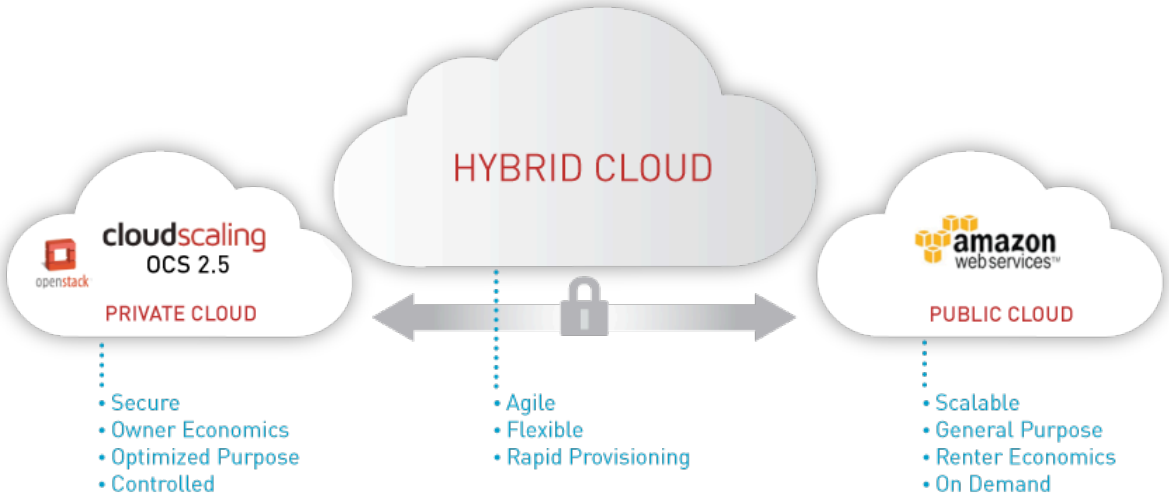


Building an AWS-Compatible Hybrid Cloud with OpenStack

AWS is Transforming IT

Amazon Web Services (AWS) commands a significant lead in the public cloud services market, with revenue estimated to grow from nearly $4 billion in 2013 to $24 billion over the next 10 years. Having been designed to deliver highly optimized elastic cloud infrastructure on a large scale AWS is accelerating the shift towards on-demand cloud computing models for organizations across all industries.

While AWS delivers unprecedented power and ease-of-use for users, it's not the most cost-effective and performant infrastructure for all workloads. It's great for lower volume and variable workloads, but it can quickly get expensive at scale. Users also have limited control over cost/performance/hardware optimization, limited geographic coverage, and a trust dependency on third party QoS and SLAs. Many workloads also can't be deployed on public clouds due to regulatory compliance and security constraints.



Several open source projects including OpenStack have entered the market to provide private cloud alternatives using the same model as AWS to emulate many of its cloud services. These alternatives enable the deployment of elastic cloud infrastructure on-premise with owner (versus renter) economics, which can be less than half the cost of elastic public clouds. This approach is also ten times less expensive than legacy IT approaches which typically use converged infrastructure, dead-end technologies such as fiber-channel SANs, and expensive proprietary x86 blade server architectures.

Open source private cloud deployments are secure, controlled, and can be cost/performance optimized for specific applications and high volume workloads. As both the public and private cloud models have characteristic advantages, the optimal model is to leverage both with a hybrid cloud first strategy.

Hybrid Cloud is the Forward Path

A hybrid cloud is the combination of two or more clouds (typically public and private) that offers the benefits of both deployment models along with a common approach to deploying and managing applications.

Public facing applications, dev/test workloads and highly variable workloads can be deployed into the public cloud, while more performance optimized workloads, mission critical applications, and those with sensitive

data can be deployed in the private cloud. A common approach to application development, deployment and operations is maintained so that applications can be flexibly deployed to either environment as needed, or they can be architected to straddle both environments for cloud bursting, sensitive data management, or for failover, high availability or disaster recovery.

The most common reasons to deploy hybrid cloud as a complement to public clouds often boil down to cost, control, compliance and efficiency.

Cost

Hybrid cloud enables an "own the base, rent the peak" strategy for cost effectiveness. Cloudscaling OCS private cloud workloads can be less than half the cost of public cloud workloads.

Control

Flexibly deploy workloads to the best fit environment based on cost, performance, capacity, compliance and security requirements.

Span applications across multiple cloud infrastructures as needed.

Tune cloud resource price/performance to efficiently support your applications. Optimizing hardware and virtual machine resources for specific workloads can return 3:1 efficiency gains.

Mitigate single source risk with HA/DR/failover investments.

Mitigate third party risk and dependencies.

Compliance

Deploy sensitive workloads with regulatory and compliance requirements currently on legacy enterprise virtualization to an AWS-compatible elastic cloud on-premise.

Efficiency

Maintain a single common process and toolset for application development, staging and deployment management. No need to introduce additional training and variability.

Whether you start off in the public cloud and expand into using private cloud or vice versa, the hybrid cloud approach is a best of both worlds scenario for elastic cloud infrastructure. It is the eventual destination for most IT teams.

AWS + OpenStack = Powerful Combination

OpenStack has won the battle for open source private cloud infrastructure software by delivering unprecedented cloud innovation. The following characteristics have made it the dominant open source IaaS cloud software:

Open Source and Open Governance

The OpenStack Foundation provides a transparent governance for Open Governance community project development to foster a truly open cloud technology, independent of undue influence by a single or dominant vendor.

Flexibility and Choice

As OpenStack is a framework of components, it can be tuned for many different use cases, much like the Linux kernel that runs on hardware from phones and mainframes. Each deployment can choose or tailor an OpenStack flavor to best meet their requirements.

Velocity and Momentum

In three short years, OpenStack has attracted a global community of innovators, developers, software and hardware vendors and service providers. With a community of nearly 12,000 individuals in more than 130 countries and more than 230 companies standing behind it, OpenStack is clearly the winning IaaS project. The OpenStack project has more than 1,000 developers and 70,000 code contributions.

With AWS as the leading public cloud, it's a natural fit for companies that need to deploy AWS compatible workloads in private clouds on-premise. As OpenStack is the leading private cloud software by every measure, Cloudscaling is dedicated to ensuring it's compatible with the rapidly growing AWS ecosystem.

Cloudscaling develops and supports the Open Cloud System (OCS) as the world's most advanced OpenStack cloud infrastructure. Cloudscaling takes the base OpenStack release and adds drivers, plugins and additional open source software to address functional gaps, then tunes the system configuration to deliver private cloud infrastructure that is both production-grade and public cloud compatible.

Delivering and Managing Hybrid Clouds

A hybrid cloud implementation with Cloudscaling OCS starts with compatible cloud infrastructure services. Cloudscaling focuses on IaaS compatibility with the core building blocks of EC2 Compute, EBS Block Storage and S3 Object Storage as well as supporting Classic and VPC Networking.

	Amazon Web Services	Cloudscaling
Compute	AWS Compatible Instance Types AWS-style Instance Scheduler	Ensures equivalent VM SLA Fully utilizes nodes and ensures QoS
Block Storage	Elastic (scale-out) Block Storage Boot from Block Storage Option AWS-style Block Storage Scheduler Snapshots to Object Storage	High IOPS with strong data integrity Run VMs from persistent volumes Distribute volumes for fault tolerance Easily backup and copy VMs and data
Networking	EC2-style Classic Networking EC2-style VPC Networking EC2-style NAT + Elastic IPs EC2-style Security Groups	Maximum throughput at the lowest cost Network isolation with full IP control Scalable NAT with re-assignable IPs Hypervisor level virtua firewalls
Object Storage	S3 Compatible Object Storage	Triple replicated, scalable object store

OCS is often deployed using certified hardware in a colocation data center such as Equinix that supports Direct Connect networking to AWS. Above the IaaS level, you can choose from multiple approaches to deploying and managing applications based on your application requirements and team's preferred approaches.

While leveraging the command line, scripting and pre-configured virtual machine images is an option, most users leverage additional cloud application automation such as:

- Chef/Puppet - For configuration management.
- Cloud Management Platforms - Solutions such as RightScale and Scalr provide some level of abstraction from the target infrastructure, orchestration of deployment configuration management, and some varying level of monitoring and operational support.
- Cloud Services Platforms - Solutions such as CumuLogic and CloudVelocity provide additional services above the IaaS that extend higher up the stack. For example, CumuLogic delivers PaaS services, SQL and NoSQL DBaaS as well as Elastic Cache and Balancing, while CloudVelocity facilitates cloud migration and disaster recovery for applications.

The critical factor is to choose an approach that is interoperable across both the public and private cloud environments to enable applications to be flexibly deployed and maintained with common tools and processes.

Private Clouds Must be Full Stack Compatible with AWS

Infrastructure compatibility and interoperability are critical to successful hybrid cloud deployments. This is a common area of confusion, as some vendors hold the position that API compatibility is sufficient in that you can just build this compatibility into the software abstraction layer. The reality is that there are multiple levels of IaaS compatibility that contribute to operational fidelity in the real world.

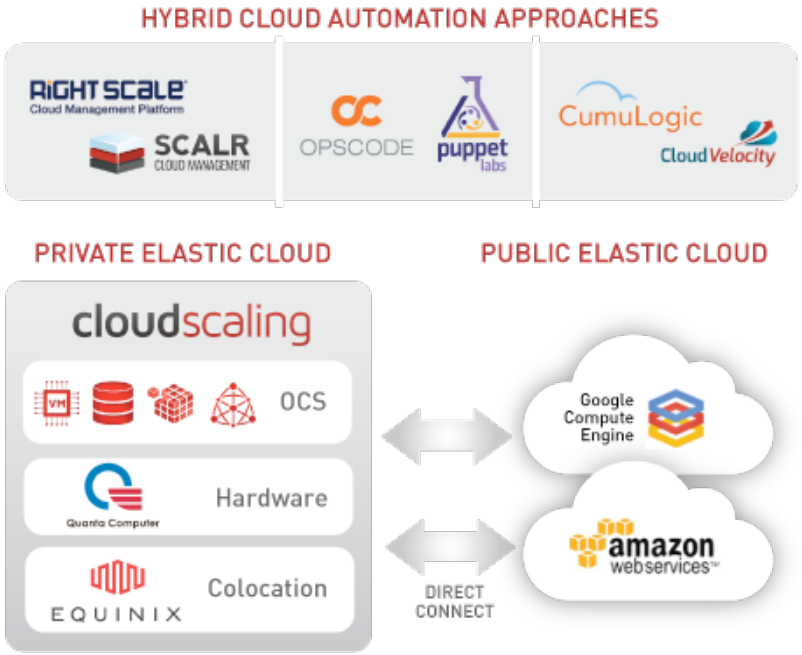
API Compatibility addresses the application programming interface and request/response format. Are all the parameters supported? Are the expected success and error codes returned? This is a critical baseline but only the tip of the iceberg for hybrid cloud application interoperability. What happens if the performance characteristics of the different environments vary? If the backend architecture and implementation of the two hybrid cloud environments aren't similar, the deployed application will receive widely varying QoS.

The implementation behind the API façade matters. A Fiero dressed up as a Ferrari will present a compatible interface (steering wheel, gas pedal, brakes, etc.), but it will not be considered interoperable or interchangeable at a Grand Prix event.

Similarly, a cloud that is provisioning block storage volumes using a distributed file system is not going to deliver a similar QoS or fault tolerance level to a dedicated block storage service. An xlarge instance implemented in a private cloud is not necessarily going to perform like a c1.xlarge on AWS without very careful architectural planning and hardware/software configuration.

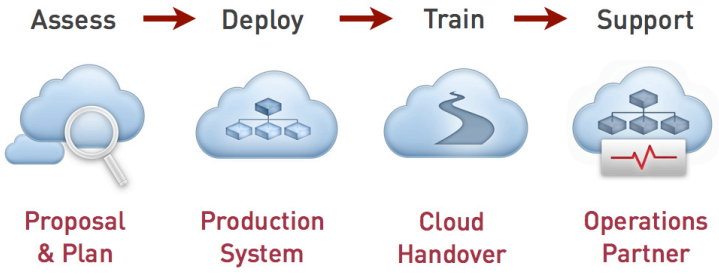
Beyond API compatibility, OCS implements both Architectural and Behavioral Fidelity with AWS to enable effective hybrid cloud interoperability. Examples of this full stack compatibility include:

- EC2 Instance Sizes - Cloudscaling engineers CloudBlockTM designs for AWS instance sizes so they can be implemented with equivalent QoS and performance characteristics out of the box.
- Block-based Architecture - OCS is architected using a block-based architecture that enables management of groups of servers in a pool rather than individually managing servers in a rack. This is the same operational efficiency approach to managing hardware and software lifecycles that is employed by AWS and the largest of cloud service providers.
- EBS Block Storage - Rather than converged storage, Cloudscaling uses proven, scalable and performant technology for dedicated block volume support. For more information, see the white paper on Converged Storage, Wishful Thinking & Reality.
- Intelligent Resource Scheduling - OCS employs AWS-Style compute and block storage schedulers. The Compute scheduler employs a bin-packing algorithm to ensure VMs are grouped and scheduled into the correct CloudBlocks to fully utilize nodes and to ensure instance QoS (protect from resource contention with co-located instances). The Block Storage scheduler ensures that volumes are distributed across all block storage nodes for increased RAID group fault tolerance.
- Classic & VPC Networking - Cloudscaling supports both the AWS Classic and AWS Virtual Private Cloud (VPC) network models deployed on a scale-out, distributed spine and leaf architecture.



Implementing Hybrid Cloud and AssessingTCO/ROI

The Cloudscaling solution isn't just software. It's a step-by-step process of assessing your requirements, creating the supporting bill of materials and deployment plans, provisioning and burning in the hardware, delivering operational training, and then maintaining and upgrading the cloud infrastructure over time.



You can readily implement a hybrid cloud strategy by deploying OCS for interoperable use alongside AWS, all with minimal changes to applications and management processes. Leveraging both the AWS and OpenStack ecosystems clearly delivers the best of both worlds.

To get started, we can provide access to an OCS hybrid cloud environment to demonstrate the compatibility and feature set, as well as an economic assessment to evaluate the TCO and ROI of hybrid cloud for your application portfolio.

ABOUT CLOUDSCALING *Cloudscaling is the leading elastic cloud infrastructure company, delivering production-grade cloud software for on-premise Infrastructure as a Service (IaaS). Our core product, Open Cloud System (OCS) is powered by OpenStack and designed to meet the requirements of next-generation dynamic applications. OCS delivers the agility, performance and economic benefits of leading public cloud providers, but deployable in the customer's data center and under the IT team's control. Cloudscaling is backed by Trinity Ventures and headquartered in San Francisco.*

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