OpenStack, Eucalyptus, Docker – How Open Source Technologies are Changing the Intelligence Cloud Landscape

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HP Cloud Chief Technologist
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The Promises of Cloud

Maximum Agility
Cloud scales up and down fast

Cloud Services provisioned and de-provisioned in Minutes not Days

Cloud optimizes IT costs
5.2% 3.7%

Before Cloud After Cloud

IT Spend (% of revenue)

Cloud protects sensitive data

Cloud speeds application development

Application Updates Per Year

2010 2015 2020

The Promises of Cloud in Government

- Optimizing government business processes
- Protecting sensitive and citizen data
- Delivering universal, always-available access
- Disaster avoidance vs. disaster recovery
- Improving quality of government service and management
- Enhancing collaboration of internal departments
- Enhancing interactions between government and public
- Enhancing interactions government-to-government
- Accelerating collaboration of information resources
- Lowering costs
Cloud Adoption to Accelerate led by Hybrid Cloud

Expected 4 year adoption curve

- 7% by 2014
- 40% by 2018

Market Share

Cloud Native
- Innovators 2.5%
- Early Adopters 13.5%
- Early Majority 34%

Enterprise IT: Follows and Makes Market
- Late Majority 34%
- Laggards 16%
Hybrid Cloud gives you flexibility

Hybrid cloud is the secure consumption of services from two or more resources

“Control Cloud”

Private Cloud
Managed Private Cloud
Virtual Private Cloud

On Premise or Cloud-Enabled Hosting

Public Cloud

Technology compatibility & enabling

Brokering
The Path to Hybrid begins with Private

Traditional IT environments

- Authoritative Sources
  - HR
  - ERP
  - CRM
- Email & Collaboration
- Help Desk Systems
- Identity Management
- Oracle
- SAP

82-90% of IT budgets for Operating IT

Common Platform

- Service Catalog
- Service Brokering

Private Cloud

- Efficient delivery of IT operations and user centric

Cloud Enabled Hosting

Cloud Native

- PaaS – Rapid development
- IaaS – Distributed & scale out

Integrated platform that is application centric

https://
Top Private Cloud Customer Objectives

Hybrid IT

Use the right destination for the right application

- Public Cloud
- Private Cloud
- Traditional IT

Security | Availability | Performance
Cost | Compliance

Brokering Services

Internal Services Providers broker cloud for their business

- IaaS
- PaaS
- SaaS
- Managed Cloud
- Private Cloud
- Public Cloud

Developer Centric

Enable developers to rapidly develop cloud-native applications
Hybrid IT

Use the right destination for the right application

Key Factors:
- Security
- Availability
- Compliance
- Data Sovereignty
- Performance
- Open
- Cost

Centralized Management Layer

Common foundation & Open technology

Classic IT applications

Cloud Native applications

Bridge old and new
### Cloud Native Concepts

#### A Transformation of Architecture and Principles

<table>
<thead>
<tr>
<th>Concept</th>
<th>Notation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale Out</td>
<td>![Scale Out Icon]</td>
<td>Not scale-up</td>
</tr>
<tr>
<td>Open Source</td>
<td>![Open Source Icon]</td>
<td>Not closed</td>
</tr>
<tr>
<td>Simple</td>
<td>![Simple Icon]</td>
<td>Not complex</td>
</tr>
<tr>
<td>Distributed</td>
<td>![Distributed Icon]</td>
<td>Not monolithic</td>
</tr>
<tr>
<td>Grassroots</td>
<td>![Grassroots Icon]</td>
<td>Not top-down</td>
</tr>
<tr>
<td>API</td>
<td>![API Icon]</td>
<td>Not integration</td>
</tr>
</tbody>
</table>

**Cloud Native Concepts**

![Cloud Native Icon]
A Transformation to an Internal Service Provider

Today’s IT Reality

- Employees and citizens are becoming more technology aware
- Alternatives exist in the market for direct consumption
- Technology is viewed in terms of service value from the user
- Users & developers want simple
- Security, compliance, availability
Transforming to put Developers First

Faster application deployment enables accelerated innovation

- Agility is paramount
- 30x increase in application releases
- “Even when delivering at cadences of less than a week, 20% of organizations want to go even faster”

- Developers need flexibility
- “Expects to deploy 50%-70% of code to cloud environments by 2015”
- Want open flexible architectures for application portability and prevent lock-in

Building an Application-Centric Cloud Stack

Cloud Native Infrastructure Services

- IT provides the underlying infrastructure for development services
- Install, Configure and Manage
- Service portability and flexibility

Rapid application and service creation
Simplified Operations
Building an Application-Centric Cloud Stack

Cloud Native Infrastructure Services
- IT provides the underlying infrastructure for development services
- Install, Configure and Manage
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Cloud Native Development Platform
- Developers focus on developing

Rapid application and service creation
Simplified Operations
Building an Application-Centric Cloud Stack

Cloud Native Infrastructure Services
- IT provides the underlying infrastructure for development services
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- Service portability and flexibility

Cloud Native Development Platform
- Developers focus on developing

Service Catalog
- Automate the delivery of services
- Rapid creation of services

Rapid application and service creation
Simplified Operations
Why open source and OpenStack software?

A strong IaaS platform for hybrid cloud computing

**The agility of open source**
- No vendor lock-in with access to a rich ecosystem
- Transparency of governance and development
- Easier migration from older datacenters to cloud
- Rapid innovation through contributions from a wide array of SMEs across multiple use cases

**The innovation of OpenStack technology**
- Stable with a long-term vision and consistent growth
- Open APIs implemented as RESTful Web services
- Interoperability between public and private clouds
- Strong global community with more than 10,000 supporters and 200 companies
Typical use cases

Using an open source hybrid cloud to drive business goals

- Provide open-source based cloud services to external customers
- Accelerate application testing & Development
- Provide the cloud-native infrastructure to develop, deploy, and deliver cloud native apps
## What Does Cloud Native Mean?

<table>
<thead>
<tr>
<th>TRADITIONAL IT</th>
<th>CLOUD NATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale up/hardware defined reliability</td>
<td>Scale out/apps designed for no infrastructure reliability</td>
</tr>
<tr>
<td>Virtualized</td>
<td>Lightweight runtimes (containers, processes, PaaS platforms)</td>
</tr>
<tr>
<td>3-tier architectures, stateful, tight couplings</td>
<td>Loosely coupled, micro services connected through APIs</td>
</tr>
<tr>
<td>Operating System, VM aware, and dependencies</td>
<td>Operating System and VM abstraction</td>
</tr>
<tr>
<td>Admin controlled</td>
<td>System controlled (auto-scale, self configuring, auto-recovery)</td>
</tr>
<tr>
<td>Waterfall → Agile</td>
<td>Agile → CI/CD, DevOps</td>
</tr>
</tbody>
</table>
What is OpenStack® Software

- **Massively scalable** cloud operating system that controls large pools of compute, storage and networking resources
- **Community open source** with contributions from 2000+ developers and 350+ participating organizations
- **Open web-based API Programmatic Infrastructure as a Service**
- **Plug-in architecture**: allows different hypervisors, block storage systems, network implementations, hardware diagnostics, etc.
- **Fastest growing and rapidly adopted** Open Source project
- **HP is a Platinum member** gaining transparency into governance, roadmap, blueprints, and development.
What is OpenStack® technology?
Open Source Cloud Computing platform
OpenStack Architecture
Based on OpenStack platform's highly modular design

Operation Environment
- Operational (Horizon) Dashboard
- Storage Dashboard
- Monitoring Dashboard
- Logging Search Dashboard
- Deployment (TripleO) Service
- Nova ESX Configuration (EON)
- Bare metal Service (Ironic)
- Deployment Artifacts
  - Machine Images
  - Boot Images
  - Deployment Templates
- Recovery Management (Backup/Restore)
- Infrastructure & Service Monitoring (Icinga)
- Centralized Logging (Logstash, Elastic Search)
- Service Fail-over Management (HAProxy, Keepalived)
- Linux
- Physical Infrastructure

Execution Environment
- Administrative Dashboard (Horizon)
- Sherpa
- Centralized Logging (Logstash, Elastic Search)
- Operational Services
  - Deployment Artifacts
    - Machine Images
    - Boot Images
    - Deployment Templates
- Orchestration Service
- Object Storage Service (Swift)
- Image Library Service (Glance)
- Compute Service (Nova)
- Network Service (DVR, VXLAN, VLAN)
- Block Storage Service
  - iSCSI
  - 3PAR
  - VMDK
- Block Storage Service
  - MySQL
  - RabbitMQ
- Database Services
  - DB
  - LDAP (Hybrid)
  - AD (Hybrid)
- Orchestration Service (Heat)
Interfaces for HP OpenStack

<table>
<thead>
<tr>
<th>Open interfaces</th>
<th>OpenStack</th>
<th>Target audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUI (Graphical User Interface)</td>
<td>Horizon (Dashboard)</td>
<td>• Cloud Administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tenants</td>
</tr>
<tr>
<td>CLI (Command Line Interface)</td>
<td>CLI (Python clients)</td>
<td>• Cloud Administrator</td>
</tr>
<tr>
<td>API (Application programming interface)</td>
<td>RESTful API</td>
<td>• DevOps Developers</td>
</tr>
</tbody>
</table>

Helion OpenStack

ESX, KVM

Physical Infrastructure
HP Helion OpenStack Deployment Configuration

KVM deployment

Seed VM
Seed Host

1 X
Undercloud

2 X
Overcloud Controller

1 X
Overcloud Mgmt Controller

2 X
Overcloud (Swift)

Object Storage

Block storage options

3 X
HP StoreVirtual VSA
HP 3PAR StoreServ
HP P4000

N...
Compute
Scale-out Swift
Block/Object Storage (Ceph)
## Storage Decisions

<table>
<thead>
<tr>
<th></th>
<th>Block storage</th>
<th>Object storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Used to...</strong></td>
<td>Add additional persistent storage to a virtual machine (VM)</td>
<td>Store data, including VM images</td>
</tr>
<tr>
<td><strong>Accessed through...</strong></td>
<td>A Block Storage device that can be partitioned, formatted, and mounted</td>
<td>RESTful API</td>
</tr>
<tr>
<td><strong>Accessible from...</strong></td>
<td>Within a VM</td>
<td>Anywhere</td>
</tr>
<tr>
<td><strong>Managed by...</strong></td>
<td>OpenStack Block Storage (Cinder)</td>
<td>OpenStack Object Storage (Swift)</td>
</tr>
<tr>
<td><strong>Persists until...</strong></td>
<td>Deleted by user</td>
<td>Deleted by user</td>
</tr>
<tr>
<td><strong>Sizing determined by...</strong></td>
<td>User specification in initial request</td>
<td>Amount of available physical storage</td>
</tr>
<tr>
<td><strong>Example of typical usage...</strong></td>
<td>1 TB disk</td>
<td>10s of TBs of dataset storage</td>
</tr>
</tbody>
</table>
HP 3PAR StoreServ and Cinder

OpenStack API

Compute
Networking
Storage

HP 3PAR StoreServ
Storage

HP Helion OpenStack
Block storage drivers

OpenStack/Cinder

iSCSI
FC

HP 3PAR iSCSI driver
HP 3PAR FC driver

HP 3PAR StoreServ
HP 3PAR Device Deployment using OpenStack Cinder

QoS Based Provisioning

**OpenStack/Cinder**

<table>
<thead>
<tr>
<th>iSCSI</th>
<th>FC</th>
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</table>

**HP 3PAR iSCSI driver**

- Volume create/delete
- Volume attach/detach
- Snapshot Create/Delete
- Create Volume from Snapshot
- Get Volume Stats
- Copy Image to Volume
- Copy Volume to Image
- Clone Volume
- Extend Volume
- Volume Migration (backend assists)

**HP 3PAR volume type settings**

- Thin Provisioning
- QoS (min/max BW, IOPS, Priority, latency)
Why Swift?

- Swift is Highly Scalable Object Storage
- Scales as the cluster grows
- Designed to run on commodity hardware
- No single point of failure
Swift Use Cases

- Storing large amounts of unstructured data - Large images, video, audio, document
- Backup Recovery & Archive
- Scientific data
- Web Mobile applications
- Infrastructure as a Service
OpenStack Swift Architecture

Access Tier (Concurrency)
- All objects in Swift have a URL
- RESTful API over HTTP to operate on objects
- Objects have metadata
- Objects replication 3x in unique zones which could be a node, drive, rack

Storage Tier
- Cluster scales by adding nodes
- No data migration required
- Failed nodes remove, new nodes added without downtime
Identity Service

What is it?

• Provides OpenStack service access authentication and authorization (who can access what)
• Based on the OpenStack **Keystone** service
• 2 primary use cases
  • Initial Login
  • Access to assigned resources

What will be supported

• Authentication options
  • Local Keystone
  • LDAP or Microsoft Active Directory
• Initial configuration option for Keystone
  • Configuration via editable script file
  • OpenStack user information need to be added to LDAP / AD prior to installation
  • Not easily changeable after installation
  • “All or nothing” service wide setting
## Identity Service

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Support multi-region/physical data center deployments including:**  
  - Private – public cloud  
  - Multi-data center (private and public) | Drive support for multiple authentication sources and inter-cloud identity federation. Provide designs and installation support for service high availability and resiliency for both private and inter-cloud deployments.  
  Continue to identify and drive lower authentication latency.  
  Research, develop, and evangelize blueprints for resource federation. |
| Support identity and resource multi-tenancy. | Must be able to host multiple customers in a single environment with appropriate protections to keep access and data separate.  
  Drive implementation of Keystone v3 API and push for the inclusion of community advanced user and system roles, and domain administration. |
| Expanded Identity Management                  | Support for multiple domain-IdP implementations, keystone-based federation, and federated (SSO) identity use cases.                                                                                               |
| Extended Account Management                   | Provide expanded RBAC support and user settings. Provide support for support-based roles and access.                                                                                                          |
| Flexible UI with improved usability           | Identify opportunities to improve current usability and support new user account management and identity management features. Support more dynamic loading of customer / extended UI panels. |
Metering Service

What is it?

- Collects and stores OpenStack service usage information
- Based on the OpenStack Ceilometer service
- 2 primary use cases
  - General Usage Reporting
  - Billing / Chargeback

What will be supported

- Not included in initial release – engineering dedicated database for scalable performance
- No special installation required
- Collection of raw usage information from Infrastructure service (Nova, Neutron, Swift, Glance, and Cinder.)
  - Each service provides usage metrics and submits to a message queue
  - Ceilometer pulls from the queue and stores metrics into a database
- Access to the Ceilometer raw API – metrics inventory to be documented
- No billing service or application provided by Helion OpenStack; requires external billing application like Talligent Openbook, Zuora, & Cloud Cruiser
## Metering Service Priorities

<table>
<thead>
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</table>
| Provide access to metered service data for all Helion OpenStack infrastructure and platform services. | The top priority of the metering service team should be to ensure that all underlying OpenStack services, infrastructure and platform, are metered and collectible. The primary use cases for this function are:  
  • Billing and Chargeback  
  • End-User service usage monitoring  
  • License Management  |
| Modularize the currently integrated HP Public Cloud billing functions      | The custom billing functions developed to support the HP Public Cloud need to possibly be modularized in a fashion that allows these modules to be independent of the core OpenStack implementation. |
| Provide a separate data aggregation function.                             | Develop a separate data aggregation function, modeled on the current HP public cloud implementation that will enable organizations to more easily provision usage showback/chargeback and billing use cases. |
Infrastructure Monitoring

What is it? Icinga Monitoring

- OpenStack infrastructure health monitoring
- Alerting dashboard to view service health status
- Easily extensible via Icinga community
- 2 primary focus areas
- The OpenStack service (Nova, Neutron, Glance, Horizon, Keystone, etc)
- Supporting technologies (Rabbit, MySQL, etc)

Supported Health Checks:

- Disk Space (free/used, inodes free/used)
- RAM
- Kernel Version (have we booted to the most recent version installed?)
- CPU Information (load etc)
- NTP status (important for logging/authentication/etc)
- Kernel context switches/major pagefaults/process creation levels
- Network Interfaces
- Number of threads
- SSH
- **Plus OpenStack specific service checks**
DNS Service

What is it?

- Create, Edit, and Distributed DNS Zone information for publicly registered and internal DNS domains
  - Assign domain names to compute instances
  - Distribute DNS zone information to DNS servers for end-user access to external DNS servers
  - Public DNS domains need to be acquired outside of the [ ]
- Based on OpenStack Designate Service
- Horizon, CLI, and API access support

What will be supported

- Installed separately from Helion OpenStack
- Initial release will provide CLI/API access; Horizon UI support to be provided in a future release
- Supports private and public cloud deployments
  - Public – Akamai & DYN
  - Private – PowerDNS & Microsoft DNS
- DNS deployments defined during service installation
- Microsoft DNS requires Designate agent install on each MS DNS server
What is Cloud Foundry?

• Leading open source development platform software
• Technology originally developed by VMware
• Spun out to Pivotal Labs in 2011 and open sourced

Polyglot application runtime environment

• Cluster of VMs/Services working together on OpenStack
• Language runtimes include Java, Ruby, PHP, Python, Node.js, Perl
• Services such as MySQL, PostgreSQL, RabbitMQ, Redis, Memcache

Benefits

• Provides developer’s with a wide range of integrated tools
• Prevents vendor lock-in
• Enables application portability across hybrid clouds
Open, Interoperable Platform for Developers

What Is Cloud Foundry™?
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HDP application runtime environment
- Cluster of VMs/Services working together on OpenStack® software
- Language runtimes include Java, (J)New .NET, Ruby, PHP, Python, Node.js, Perl
- Services such as MySQL, PostgreSQL, RabbitMQ, Redis, Memcached
- Docker used to create and destroy application instances on demand
Highly-available Services

Application Services

- Automates critical services required for hybrid and cloud-native apps
- Provides database lifecycle management and automates common administration tasks including backup, restore, and scaling
- Integrates into the Application Lifecycle Service for in-context provisioning

- Supports MySQL 5.5 and is an implementation of OpenStack® project Trove, the integrated database-as-a-service project within OpenStack® software
- Includes a marketplace with a self-service catalog
- Messaging Services provides the ability to provision RabbitMQ clusters and integrates with Keystone
Managed Application Services – Trove

- Provides database lifecycle management and automates common administration tasks including backup, restore, and scaling
- Integrates into the Application Lifecycle Service for in-context provisioning
- Supports MySQL 5.5 and is an implementation of OpenStack® project Trove, the integrated database-as-a-service project within OpenStack® software
Docker

• What is Docker?
  • Docker is an open-source project focused on packaging and deploying Linux Containers (LXC)
  • Adoption and popularity growing quickly

• Benefits
  • Efficient use of resources
  • Eliminates the need of a GuestOS
  • Simplifies the application lifecycle
  • Enables application portability
Eucalyptus Overview

• Private cloud software deployed on existing datacenter resources

• Industry-leading AWS API Compatibility
  ➢ Broadest support of AWS services EC2, S3, EBS, IAM, ELB, Elastic IPs, CloudWatch, Auto Scaling, Cloud Formations

• User Console manages both AWS and Eucalyptus clouds

• Mirrors Amazon Web Services capabilities behind the firewall
Eucalyptus In a nutshell

• On-premise IaaS software for private and hybrid clouds
  – Runs on top of Linux on your own hardware
  – Numerous control components work together with nodes (virtual hosts) to create a cloud
  – Commodity hardware focus; abstracts away physical infrastructure into a service-orientated platform
  – **Implements AWS-compatibility**. Leverages OpenStack eco-system

• Open Source
  – Freely available
  – www.eucalyptus.com/try
Commonly Used AWS Services
Supported AWS Services -
- EC2 (compute)
- S3 (object storage)
- EBS (block storage)
- Autoscaling
- Elastic load balancing
- Cloudwatch (monitoring)
- IAM (authZ and authN)
- Security Token Service
- VPC (virtual private cloud)
- Cloudformation (template and application orchestration)
Eucalyptus Features

**Compute**
- Virtual Machine (instance) provisioning
- AutoScaling of instance groups
- Metric collection of VMs
- Image/template ingress

**Storage**
- Network-attached block storage for instances
- General purpose scalable object storage

**Network**
- Dynamic and flexible IP addresses allocation
- Flexible network topologies
- Instance network isolation
- Load Balancing for instances

**Resource Management**
- Accounts, user and group management
- AD/LDAP sync
- Quotas and resource access policies

**Interface**
- GUI Management Console
- AWS compatible API and services
- AWS ecosystem tools

**Administration**
- Easy to install
- Reporting
- Detailed component logging
Why Eucalyptus?

• Move workloads from AWS to private cloud, due to cost, or security, compliance, etc..

• Build hybrid deployments with AWS

• Need compatibility with AWS for flexibility in the future

• Increase speed of innovation while maintaining control and managing cost
Eucalyptus Benefits

- Interoperability
- Service functionality parity
- API compatibility
- Image, orchestration workflow mobility
- Toolset, AWS SDKs and design pattern portability
- No mindset change

- Holistic and flexible
- End-to-end offering with compute, storage, network, and services
- Wide variety of hardware to choose from based on application needs

- Deployment and Consumption
- On-premise, managed, managed VPC, public cloud offerings
- Pricing options based on utilization and business needs

- Ease of Deployment and Management
- Administrators can easily install, maintain, and administer the cloud
- Users can quickly derive the value of the cloud (similar to a public cloud experience)
Eucalyptus FastStart
The One-Line Install

Run this command on your CentOS 6.5 minimal server

```
bash <(curl -Ls eucalyptus.com/install)
```

Version 4.0.1 (Released: 2014-08-13)

Increase the size of your cloud. Just run this command on additional CentOS 6.5 minimal servers

```
bash <(curl -Ls eucalyptus.com/install-nc)
```

Version 4.0.1 (Released: 2014-08-13)
**HP – A leading contributor to OpenStack® project**

| **Platinum Member** | 2 Board members (1 designated member, 1 elected Individual member)  
|                     | 5 elected members of the Technical Committee  
|                     | Legal Affairs, Incubation, Election, Training, DefCore Committees |
| **Top Community Contributor** | 1st in contributions, code reviews, and # of contributors, and second in lines of code for Juno *  
|                             | 9 PTLs (1st overall) and 38 core reviewers (1st overall) |
| **Leading OpenStack Deployment** | HP operates one of largest OpenStack-based public cloud infrastructures comprising thousands of compute notes and multiple petabytes of storage |
| **Dedicated Staff** | #1 largest contributor by an employer for Juno*  
|                     | Only company with dedicated resources to infrastructure  
|                     | OpenStack Continuous Integration/Continuous Deployment (CI/CD) runs on HP’s Public Cloud |

*based on Stackalytics as of October 2014 ([http://stackalytics.com/](http://stackalytics.com/))
Hybrid IT environment


PartnerOne for Cloud
Cloud builders. Cloud resellers. Cloud service providers

Common Foundation + Open Technology

$1 Billion Investment

Hybrid IT Environment

Private Cloud
Managed Private Cloud
Managed Virtual Private Cloud
Public Cloud
Professional Services
Advise / Transform + Open Stack Services

Service Catalog
Build Manage Consume

Dev Platform
Develop Deploy Deliver

Hardware
Software
Traditional IT

Develop
Deploy
Deliver
Dev Platform

Build
Manage
Consume
Service Catalog

Professional Services

$1 Billion Investment

Hybrid IT Environment

PartnerOne for Cloud
Cloud builders. Cloud resellers. Cloud service providers
Building a Private Cloud with HP Helion

1. **Hardware**
   - HP Servers
   - HP Storage
   - HP Networks

2. **Automation & Orchestration**
   - HP Helion CloudSystem 8.1

3. **Brokering & Service Catalogue**
   - HP Helion Cloud Service Automation 4.2

**Options**

**IT User Centric Cloud**

**Common Use Cases**

- **Accelerate testing & development***
  Virtualization to cloud; mostly infrastructure services

- **Move traditional packaged apps to the cloud***
  Accelerate application release process and encourage collaboration between developers and operations teams. Migrate existing or deploy new packaged applications to the cloud

- **Manage multi-cloud environments**
  IT transforms from being a builder of IT services to a broker of IT services

- **Deliver Cloud Services to External Customers***
  Deliver IaaS and PaaS services to external companies; self-service portal and automated provisioning for fast access to services (Telcos)

* = applies to service provider and enterprise customers
**Building an Application Centric Cloud**

**Common Use Cases**

- **Develop and deploy Cloud Native Applications**
  Develop and deploy modern applications with the same cloud management tools

- **Accelerate testing & development**
  Mostly infrastructure services

- **Deliver Cloud Services to External Customers***
  Deliver cloud-native IaaS and PaaS services to external companies; automated provisioning for fast access to services (Telcos)

---

**Cloud Native Platform**

1. **Hardware**
   - HP Servers
   - HP Storage
   - HP Networks

2. **Automation & Orchestration**
   - HP Helion OpenStack 1.2

3. **Runtime, Frameworks & Tools**
   - HP Helion Development Platform 1.1

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**Options**

- Services & Consulting
- Managed Services
- Hosting

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**IaaS**

**PaaS**
Thank you

Learn more about HP Helion at hp.com/helion