A Practice of Cloud Computing for HPC & Other Applications

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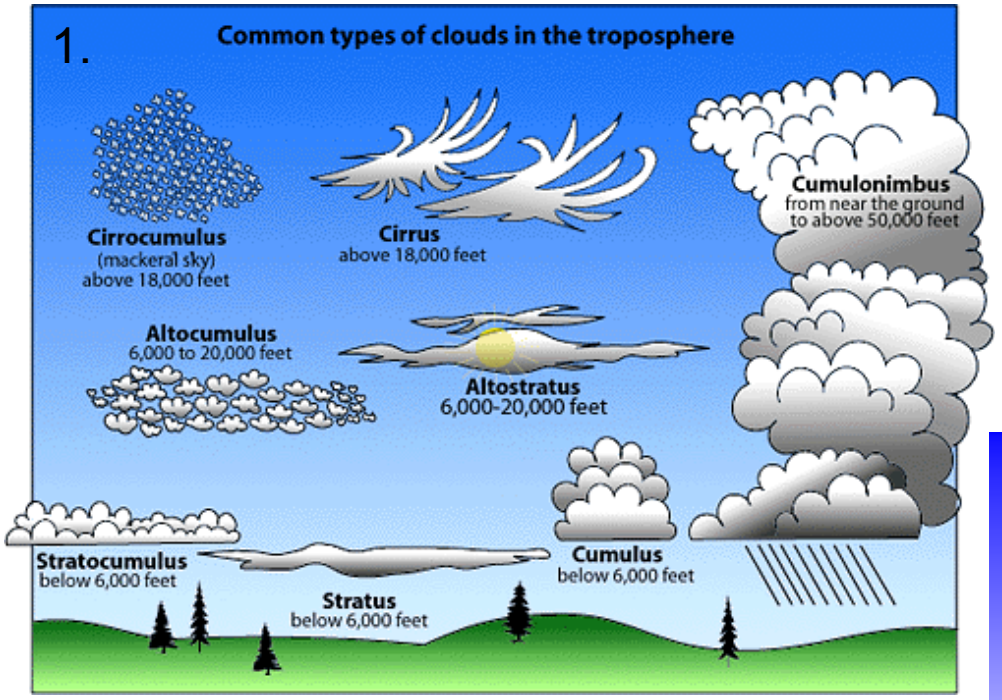
IT Transformation to
Cloud Computing

Example: NY Times TimesMachine

- Massive data archives
  - > Every newspaper from 1851 to 1922
  - > http://timesmachine.nytimes.com
- Utilizes Amazon Web Services (public cloud) and Hadoop (OpenSolaris)
- 405,000 very large TIFF images, 3.3 million articles in SGML and 405,000 xml files -> converted to a more web-friendly 810,000 PNG images and 405,000 JavaScript files
- Created in less than 36 hours by utilizing hundreds of machines

Cloud Types and Cloud Development



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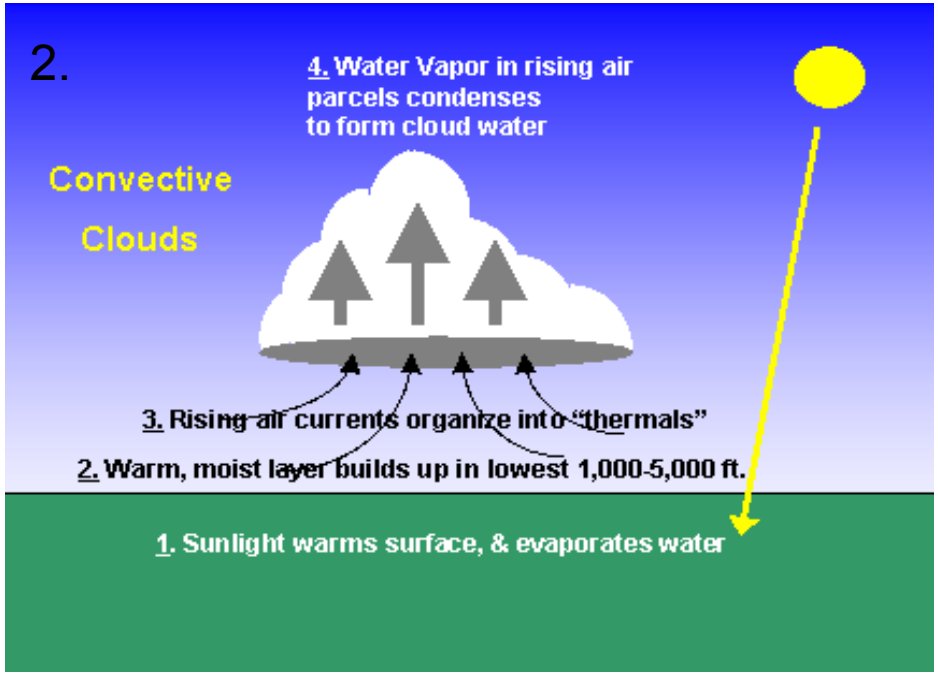
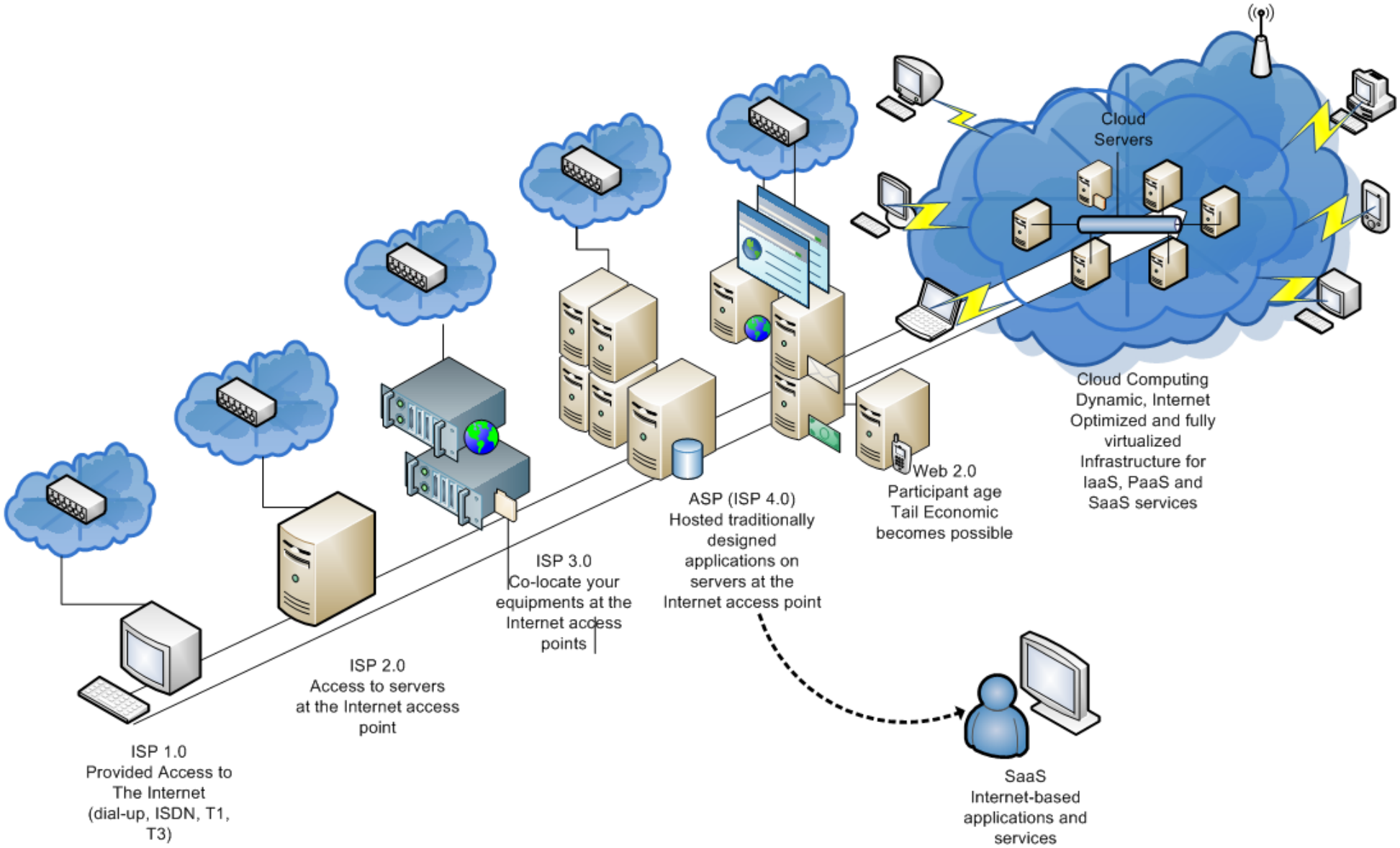
1. Clouds Come In Many Different Types



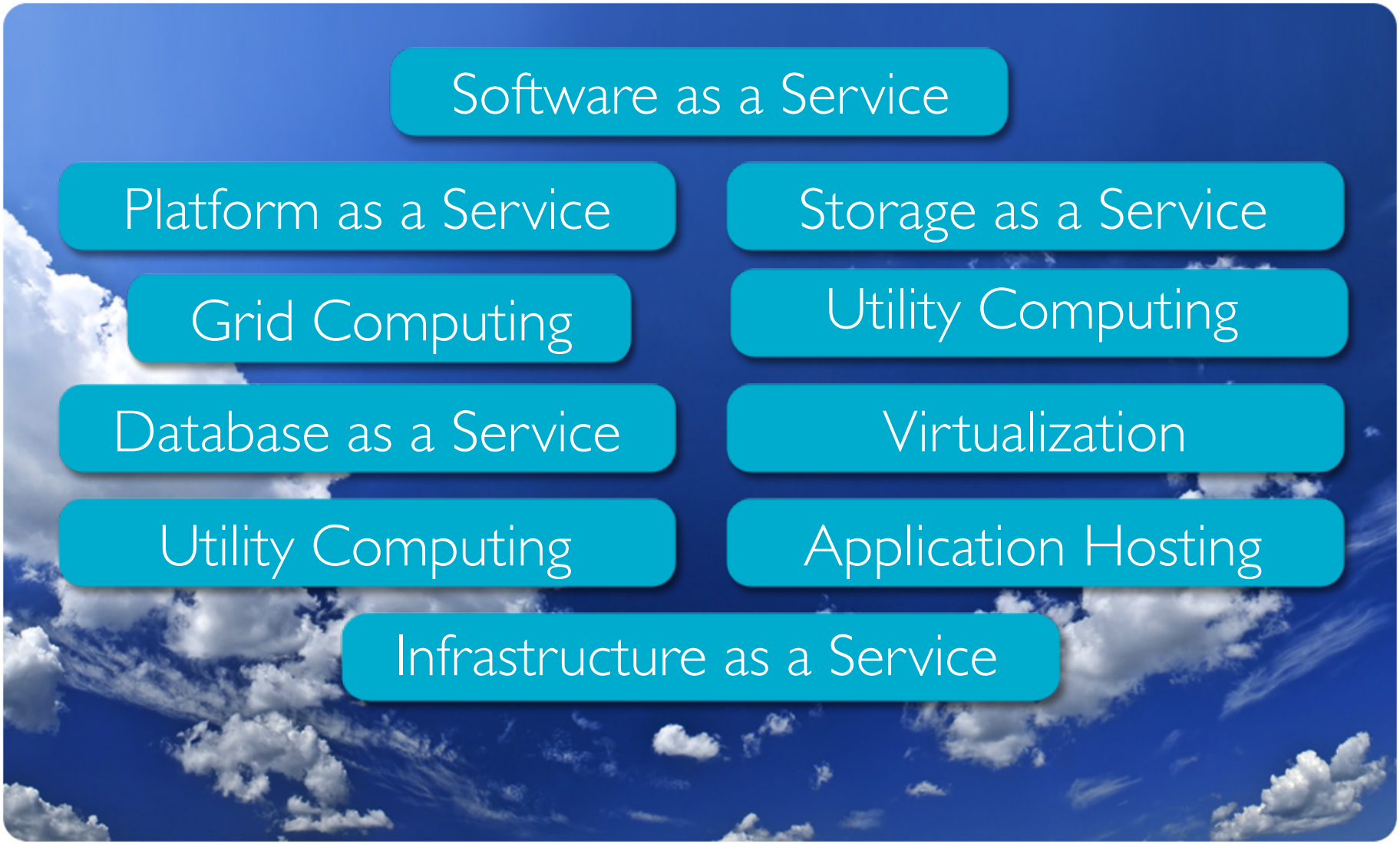
2. Clouds Need An Environment To Develop

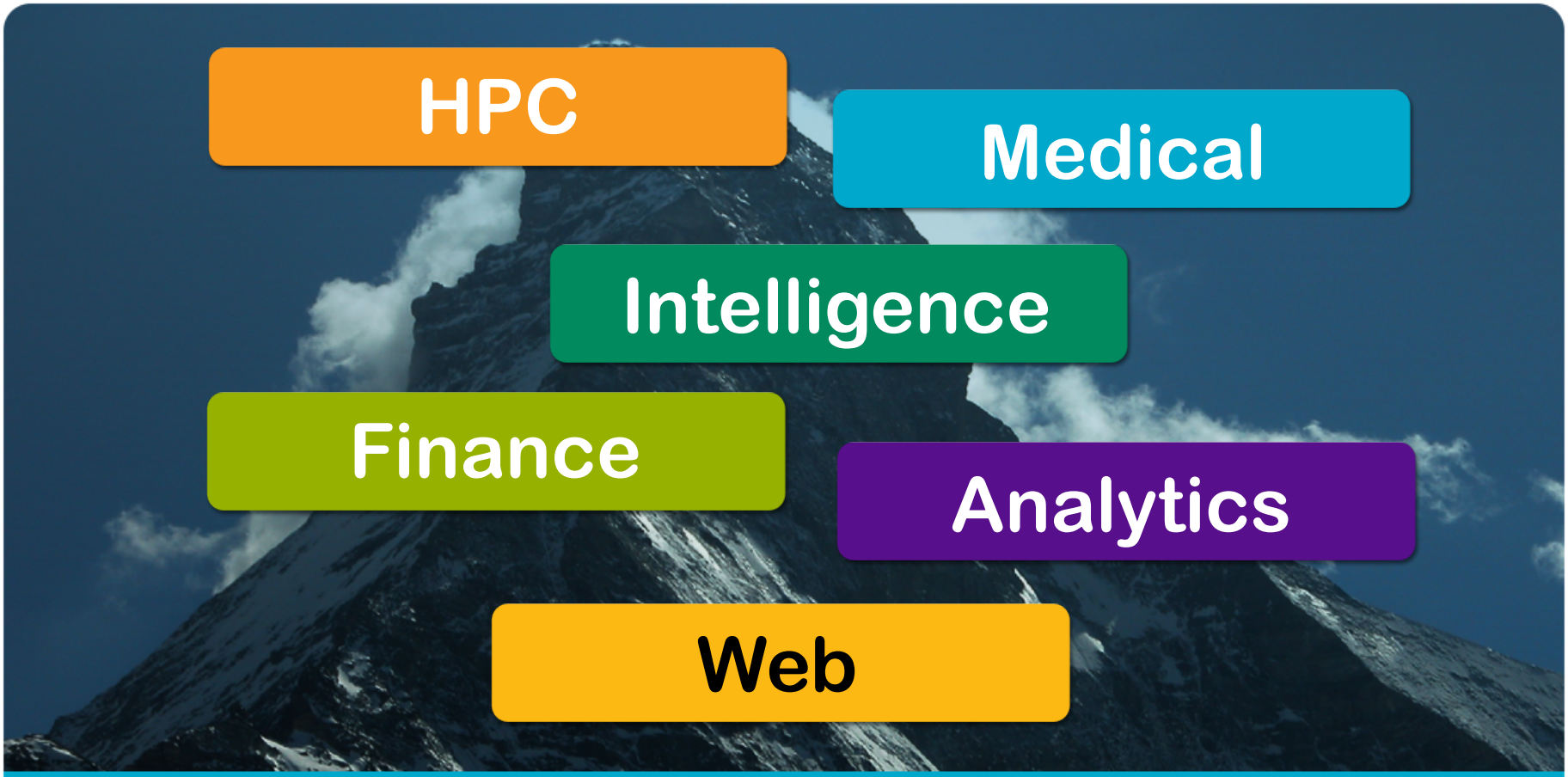
雲的形成要素

IT Transformation into cloud



Everyone is Talking About Clouds





Domains Drive Differences in Hardware and Software Architecture

5 Principal Characteristics of Cloud Computing

- Abstraction of Infrastructure
  - Virtualization at the hyper-visor, OS or higher levels customized file system, OS or communication protocols.
- Resource Democratization
  - Portability & Mobility between clouds is possible.
  - Root if required
- Services Oriented Architecture
  - Access loosely-coupled resources in a standard way. The focus is on the delivery of service and not the management of infrastructure.
- Elasticity/Dynamism of Resources
  - Scale in minutes, Load mgmt & balancing within pooled resources.
- Utility model of Consumption & Allocation
  - All-you-can-eat but pay-by-the-bite (pay-per-use) pricing model

A Practice of Cloud Computing for HPC

Solutions built on Oracle Technology by UNIVA UD

Oracle Enterprise Linux

- Binary compatibility – viable alternative
- More for less

Oracle VM

- Fast!! *It's really fast…*
- Leverage Oracle VM Management

Oracle DB

- High throughput reporting

Oracle e-Business Suite

- PaaS and SaaS is a large part of our GTM
- EBS market share
- Break the silo – share

Sun Grid Engine

- The best open-sourced DRM for HPC

Univa UD: Company Snapshot

- The Leaders in Dynamic IT Enablement
  - Leading Provider of Cloud Management Software
  - Pioneers in Grid which has evolved into Cloud
  - Service governor leader* – "the brain of the cloud"
- World-Class Customers
  - Hundreds of technology implementations
  - Dozens of Fortune 500 customers
- Award-Winning Technology
  - Numerous industry awards and accolades
  - 2009 Top 100 VC Backed Companies – Red Herring
  - Patented technology
- Global Reach
  - HQ in Chicago with offices across North America
  - Services delivered worldwide
  - Resellers in place worldwide

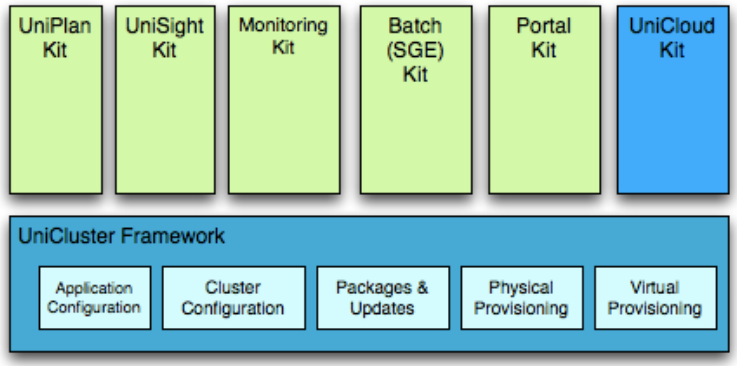
* Gartner Q408

Univa Software Solutions

UniCloud

- A workload management solution for matching workloads with available systems
- Works with physical machines or virtual machines
- A cloud building block

UniCloud 2.0



UniPortal

- Self-service cloud portal
- A cloud building block

Reliance

- Rule management framework for leveraging cloud building blocks
- Infrastructure and Application Service Governor
- Allows for machine speed decisions
- Can apply multi-variable, extremely complex rule systems for managing workload through entire lifecycle of the the work.
- "the brains of the cloud"- where your real attention will be

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Solution Key Features

Infrastructure & Application Governance

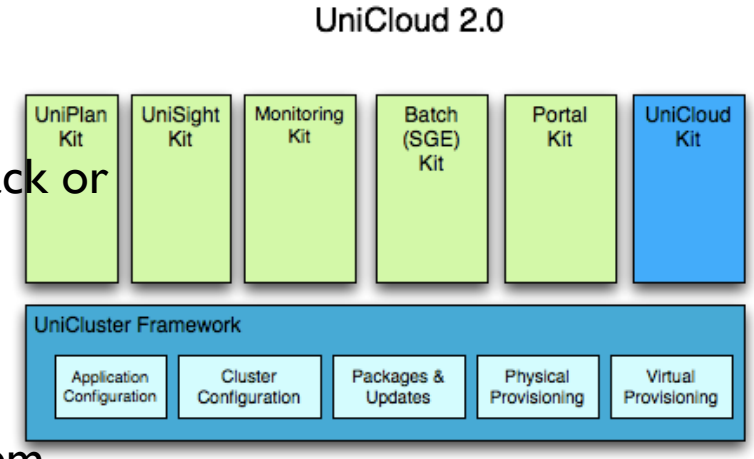
- Policy-driven resource management
- Application oriented

Automation

- Dynamic provision (re)builds the application stack or image on-the-fly
- Kits support application configuration
- Native package management simplifies software updates
- Cluster configuration sets up the required system services
- Network provisioning
- Workload Automation – Sun Grid Engine

Mobility

- Dynamic provisioning avoids lock-in
- Can manage and move applications between environments
  - On-premise bare metal
  - Private cloud using Oracle VM and other hypervisors
  - Cloud: Amazon EC2, Rackspace (soon)



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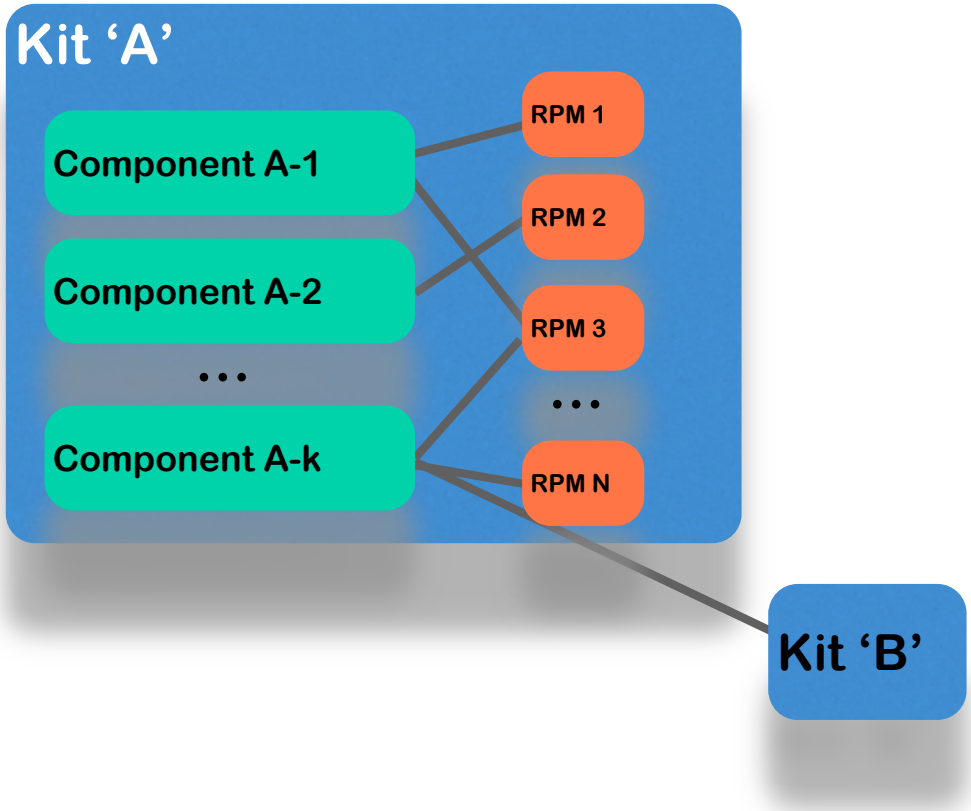
What is a UniCluster Kit?

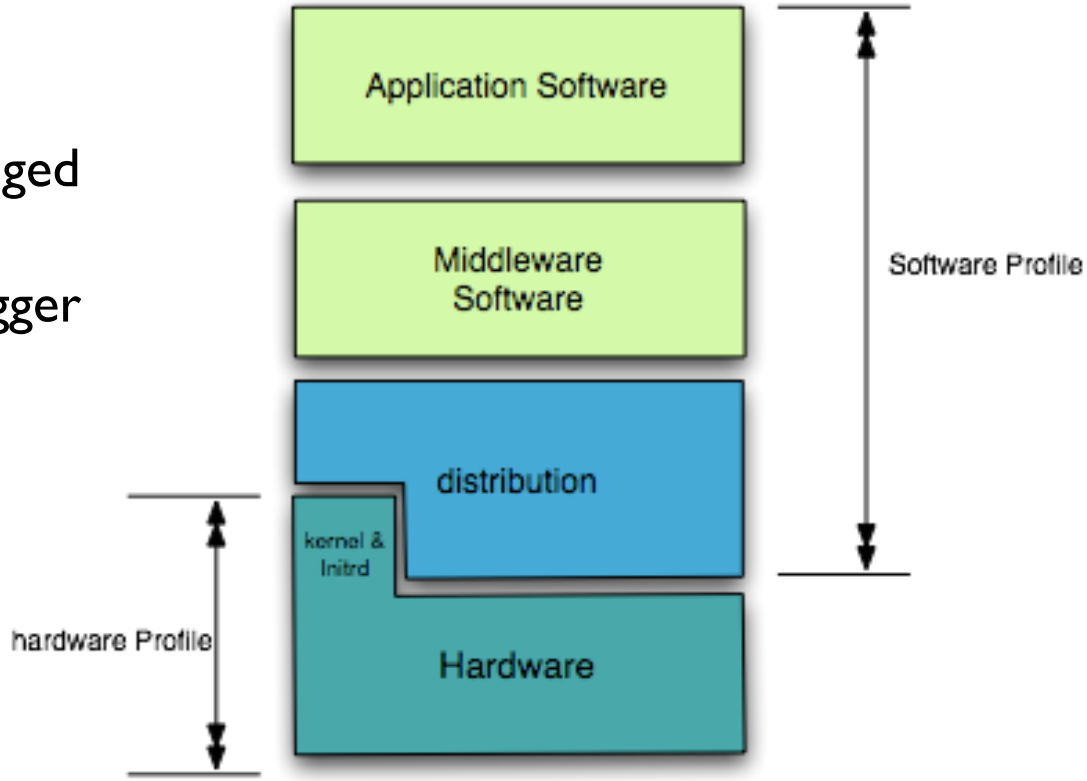


- A Kit is a 'meta-rpm' package for installing software into a cluster
- Kits contain one or many components
- Special Kit and component rpms define plugins for configuring the software, pre/post install scripts and dependencies
- Components contain a 'unit' of software that can be installed onto nodes
- Components encapsulate packages for multiple Operating Systems and Architecture
- Kits abstraction designed to support other package managers – example: rpm, ips.
- Kits provide flexibility – install only what is needed on the cluster
- Kits deploy into existing Operating System repository

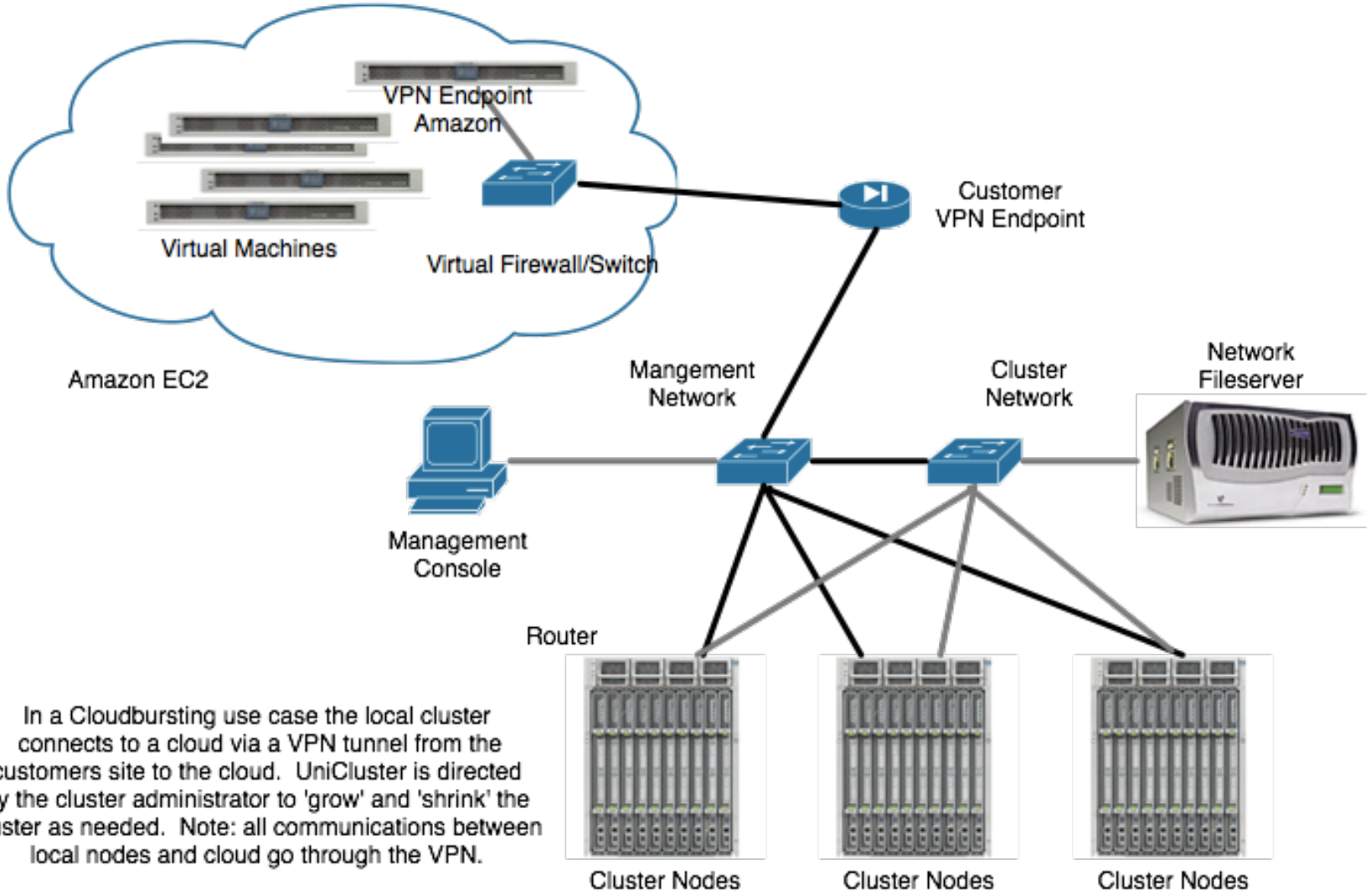
Kits can be added to the cluster several ways: via a yum repository, ISO or physical media

Hardware and Software Profiles

- Nodes are arranged in groups with profiles.
- Hardware Profiles define physical & virtual hardware.
- Software profiles define the ‘stack’ on the machine.
- Software profiles can be changed without reprovisioning action
- Hardware profile changes trigger reprovision.



UniCloud: CloudBursting

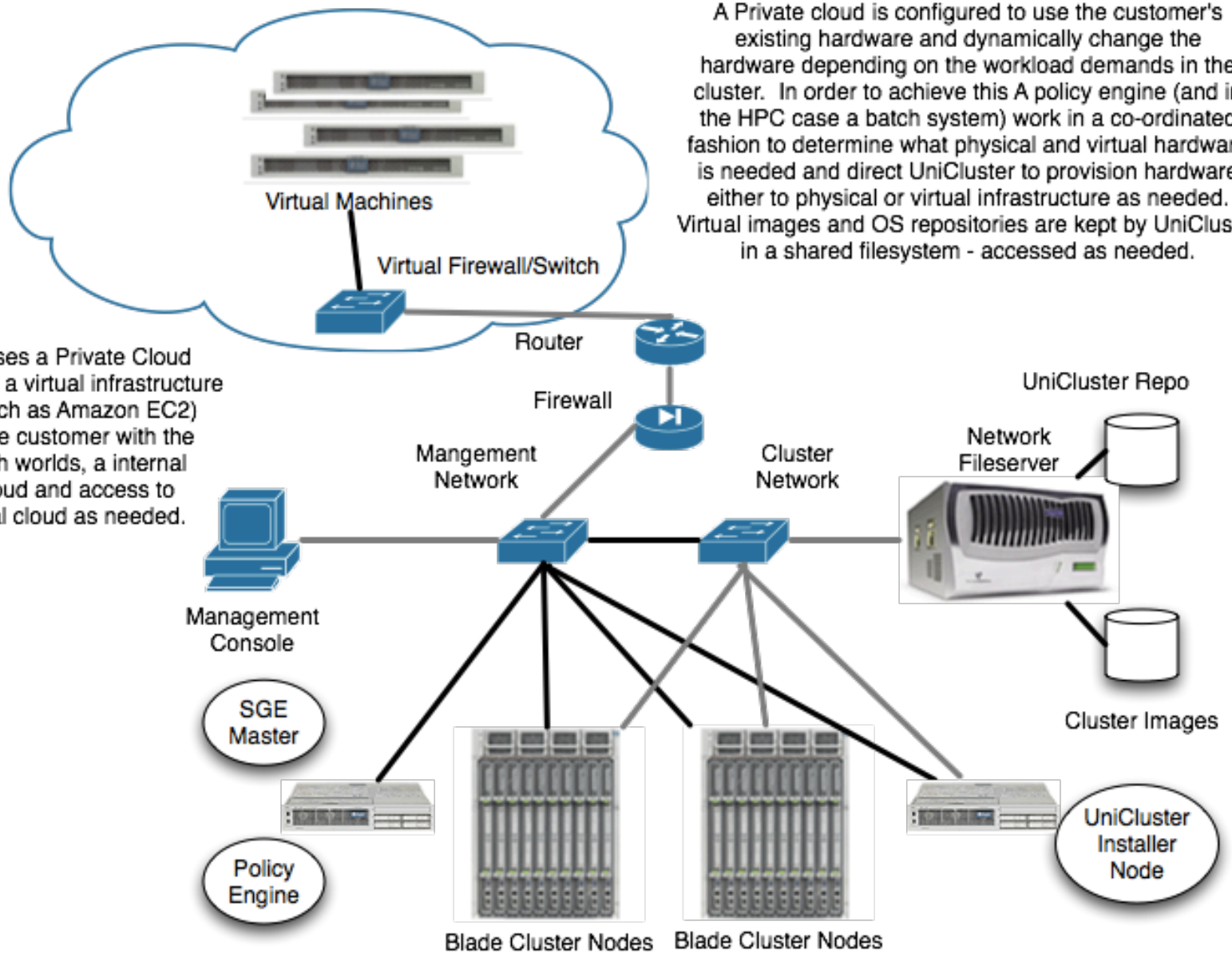


In a Cloudbursting use case the local cluster connects to a cloud via a VPN tunnel from the customers site to the cloud. UniCluster is directed by the cluster administrator to 'grow' and 'shrink' the cluster as needed. Note: all communications between local nodes and cloud go through the VPN.

UniCloud: Private Cloud

A Private cloud is configured to use the customer's existing hardware and dynamically change the hardware depending on the workload demands in the cluster. In order to achieve this A policy engine (and in the HPC case a batch system) work in a co-ordinated fashion to determine what physical and virtual hardware is needed and direct UniCluster to provision hardware either to physical or virtual infrastructure as needed. Virtual images and OS repositories are kept by UniCluster in a shared filesystem - accessed as needed.

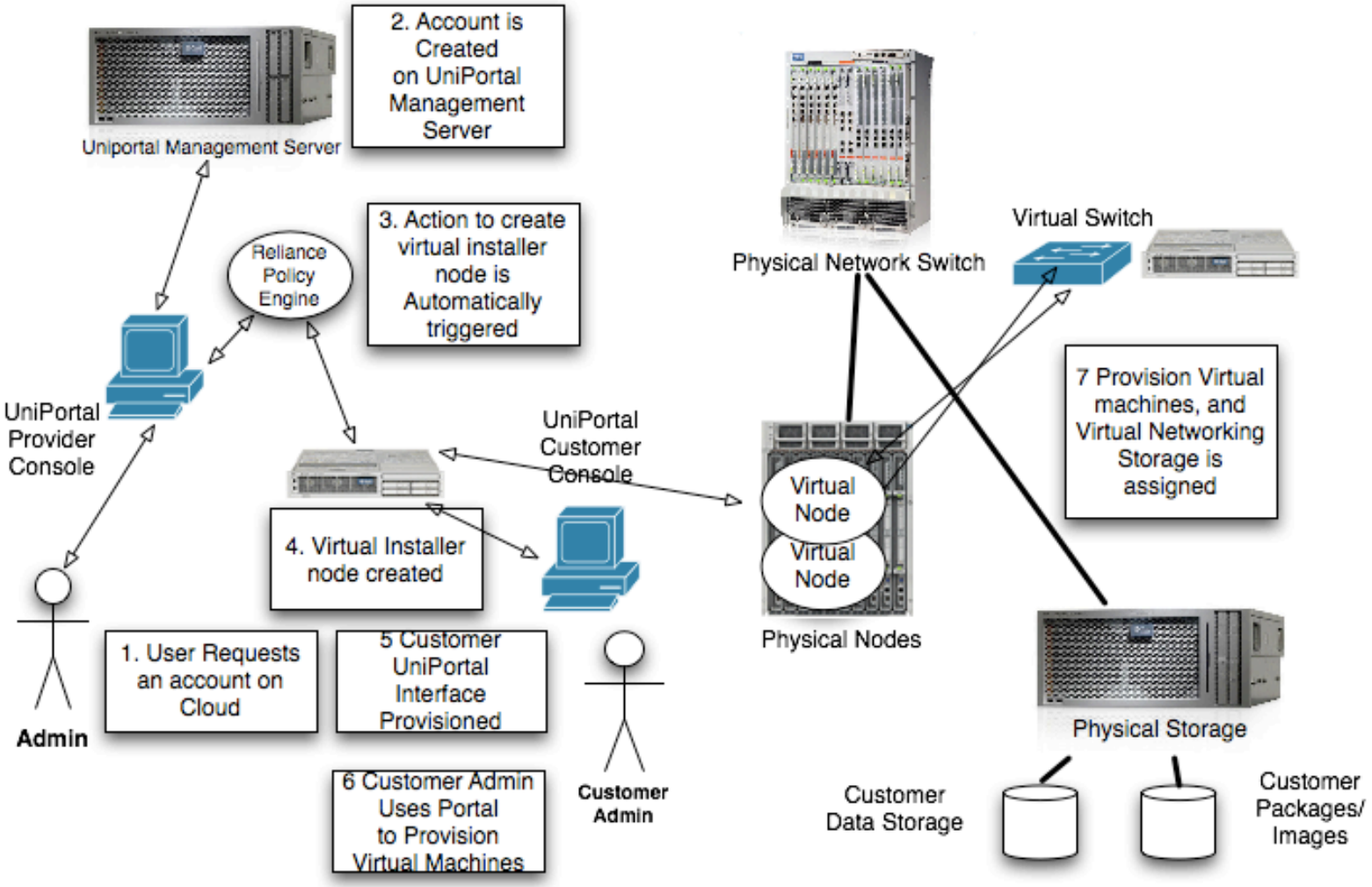
In some cases a Private Cloud is extended to a virtual infrastructure provider (such as Amazon EC2) providing the customer with the best-of-both worlds, a internal private cloud and access to the external cloud as needed.



Service Provider Cloud

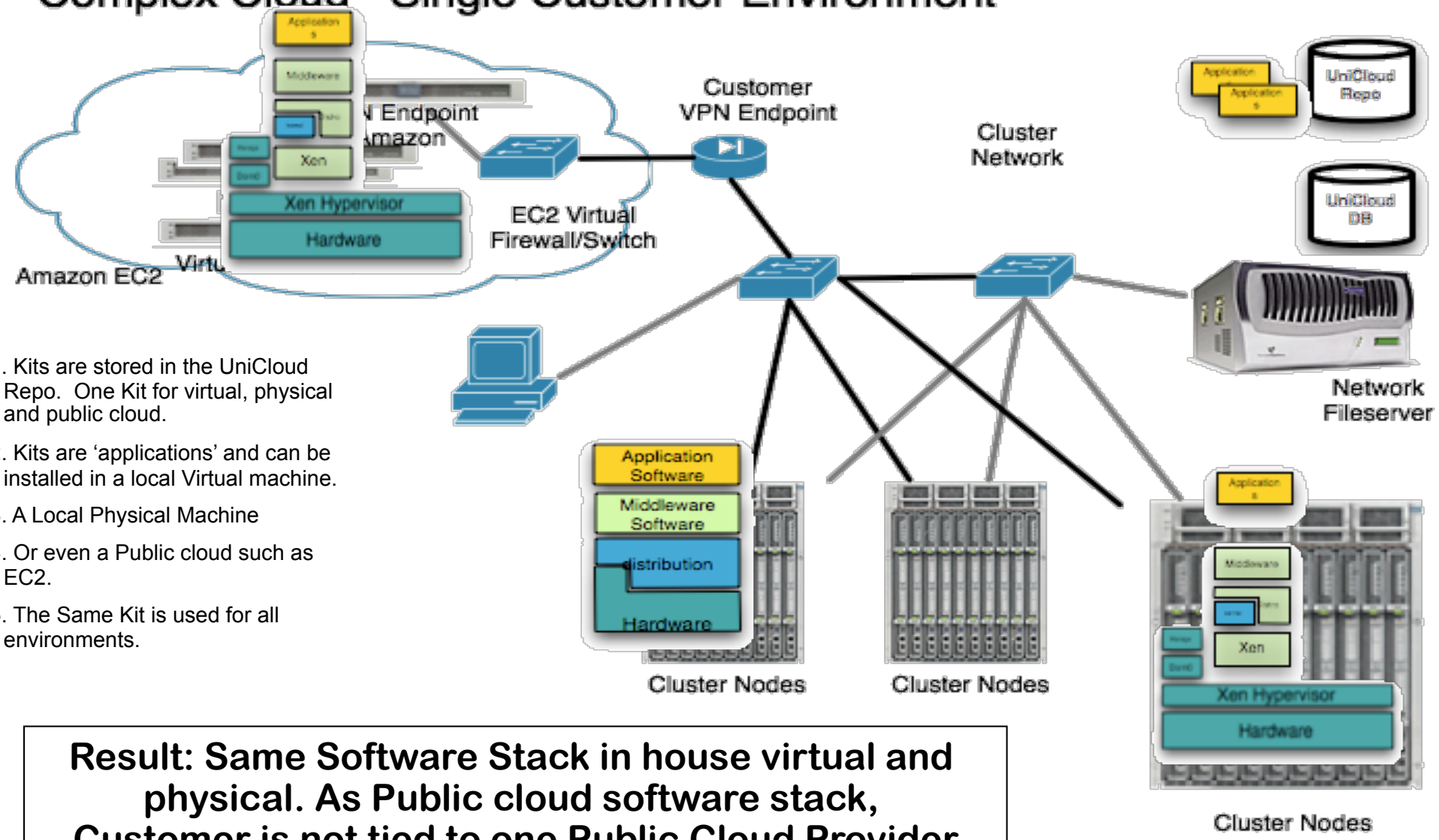
Cloud Provider

A Cloud Provider environment is the most challenging and complex Cloud environment use case. A Cloud Provider Has both the hardware and software infrastructure to dynamically create clouds for each of their customers. Each cloud is completely isolated from all other clouds in the Provider Environment



Univa Cloud Use Cases

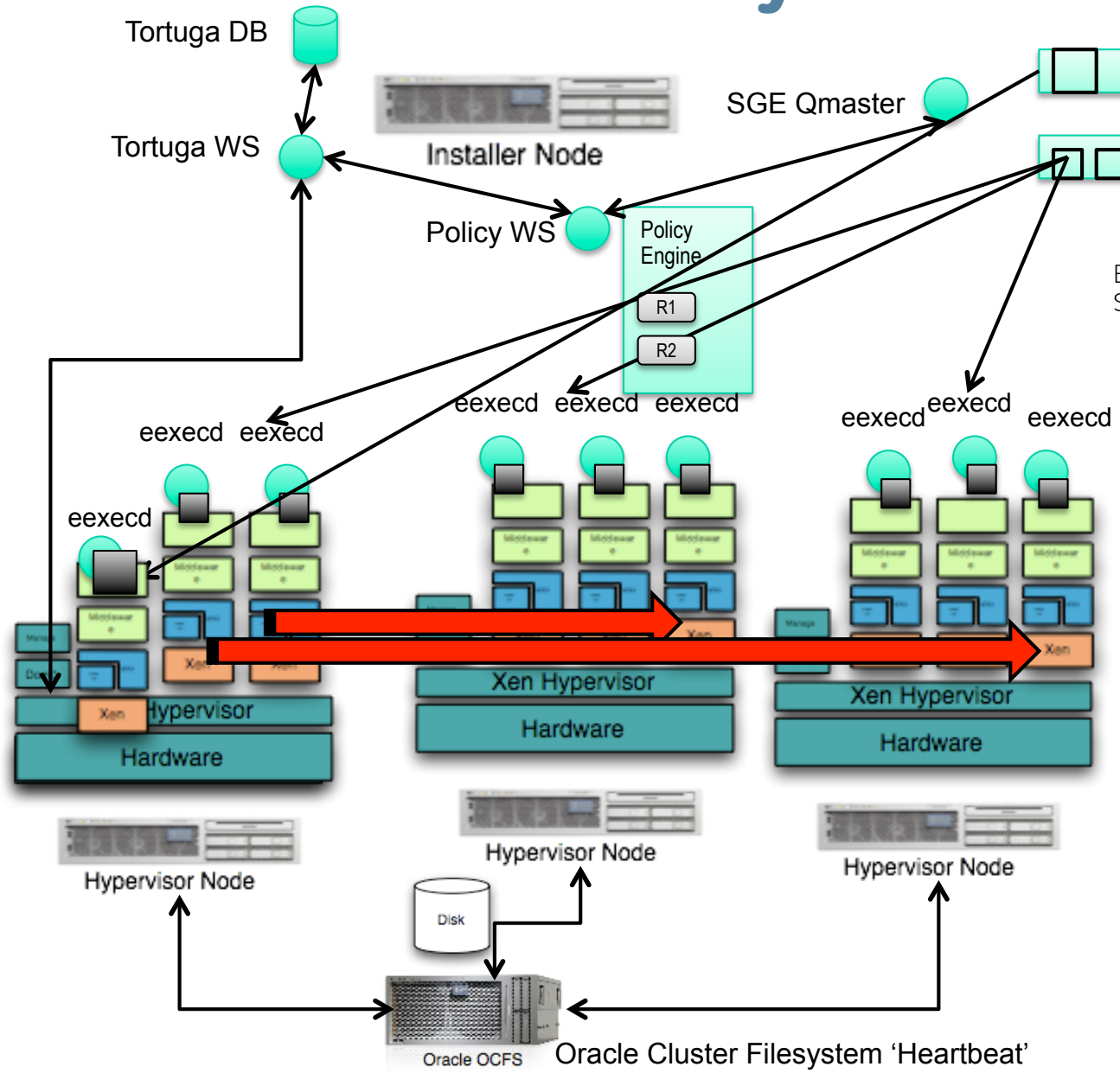
Complex Cloud - Single Customer Environment



1. Kits are stored in the UniCloud Repo. One Kit for virtual, physical and public cloud.
2. Kits are 'applications' and can be installed in a local Virtual machine.
3. A Local Physical Machine
4. Or even a Public cloud such as EC2.
5. The Same Kit is used for all environments.

Result: Same Software Stack in house virtual and physical. As Public cloud software stack, Customer is not tied to one Public Cloud Provider

UniCloud 2.0 Policy Driven Live Migration



3 hypervisor machines. SGE, Tortuga Framework configured in the Cluster

Each physical machine is running two virtual machines SGE 'sees' 6 machines in the cluster.

10 small jobs arrive in the low priority 'Q'
SGE dispatches small jobs to virtual machines

Small jobs 'fill' all of the virtual machines.

A large job arrives in the High 'Q'

The Policy Engine collects data from SGE Qmaster

The Policy Engine triggers on a rule noticing pending jobs in High Q.

Policy Engine Directs Tortuga WS to 'transfer node' which moves VM to other hypervisor

Policy Engine Does this twice.

Policy Engine directs Tortuga WS to ='re-provision to Physical node'

Tortuga automatically reprovisions and configures SGE.

SGE dispatches large job to new machine

Univa Value Add to HPC Customers

Increased Utilization

- ✓ Share machines that were previously "reserved"
- ✓ Run more workload in the same time
- ✓ Accommodate priorities on-the-fly

Increased Optimization

- ✓ Licenses can be fully utilized
- ✓ Reduced "waste"

Lower Total Cost of Ownership

- ✓ Reduced administration time
- ✓ Reduced dedicated hardware
- ✓ Reduced downtime

Rapid ROI via Cost Recovery

Business Impact

Extreme Business Applications

Oracle E-Business Suite

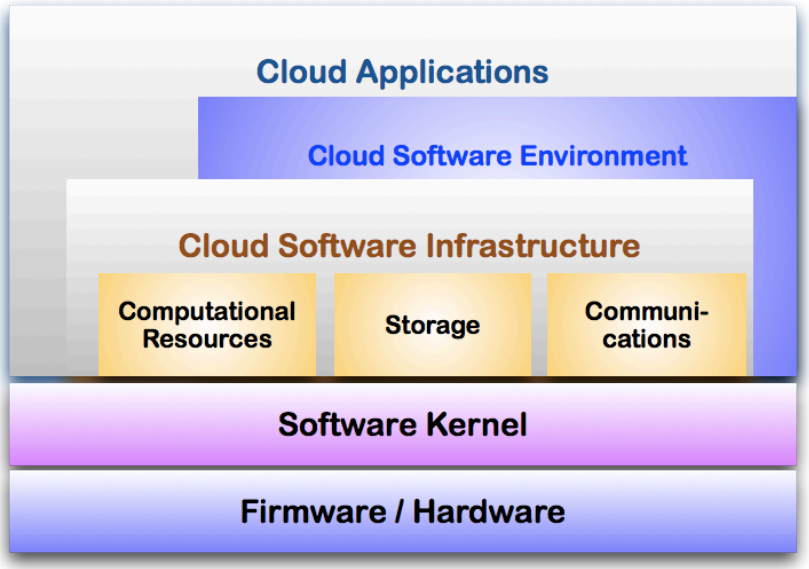
Integrated Business Platform
Oracle e-Business Suite

Features

- Sun integrated networking, computing and storage infrastructure
- Integrated batch workload management with Sun Grid Engine
- Oracle RAC, Oracle e-Business Suite, Oracle Enterprise Linux & Oracle VM
- Policy-driven, dynamic scaling and provisioning by Univa

Infrastructure Abstraction

"Some Thoughts"



Computation Resources

>Many virtualization technologies & products, such as VMware, Xen (XenServer, Oracle VM, etc.), Virtualbox, etc.

>Management over massive VMs.

Storage/Communication

>High throughput & high performance, but low cost?

>I/O QoS

>Isolation for different domains: Cisco Nexus v1000, Open vSwitch, etc.

>I/O Virtualization in native implementation

Security??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THANK YOU!

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