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# Infrastructure as a Service (IaaS)

DLT Solutions LLC  
May 2011



# Contact Information

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## DLT Cloud Advisory Group

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#DLTCloud



# Your Hosts

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- Van Ristau  
Chief Technology Officer, DLT Solutions



- David Blankenhorn  
Chief Cloud Technologist, DLT Solutions  
– Leads DLT's Cloud Advisory Group



# Introduction

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- Cloud Webcast Series
  - Five weekly webcasts (Thursdays May 12–June 9)
    - Webcast #1 –May 12– Introduction to Cloud Computing
    - Webcast #2 –May 19– Software as a Service (SaaS)
    - • Webcast #3 –May 26– Infrastructure as a Service (IaaS)
    - Webcast #4 –June 2– Platform as a Service (PaaS)
    - Webcast #5 –June 9– Securing the Cloud
- Series Objectives
  - Provide the audience with
    - A baseline understanding of Cloud Computing service models.
    - Suggested decision criteria for selecting appropriate Cloud services.
    - An overview of vendor Cloud services available
      - Vendor-neutral discussion with Brand vendor examples.



# Agenda – Infrastructure as a Service (IaaS)

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- IaaS Drivers – What problems are we trying to solve with IaaS ?
- What is IaaS ?
- IaaS deployment models
  - Public Cloud
  - Private Cloud
- IaaS basic services
  - Storage
  - Compute resources
  - Virtual Machines, Storage, Connectivity
    - Public Cloud
    - Private Cloud
- IaaS support services
  - Cloud Acceleration Services
  - Cloud Infrastructure Monitoring
- Pros, Cons, Cautions and Considerations



# IaaS Drivers

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- Complex, labor intensive data centers
  - Recurring hardware costs.
  - Increasing energy costs.
  - Low utilization of servers and storage.
- Proliferation of geographically dispersed, small, department-level data centers.



# What is IaaS ?

- A virtualized data center
  - Public IaaS : Off Premise, shared infrastructure.
  - Private IaaS: On premise or off premise; not shared
- Compliant with Federal security requirements
  - FISMA C&A, FedRAMP.
  - Typically FISMA Moderate.
- Specialized IaaS
  - Storage.
  - High performance compute resources.
- Bundled services
  - Virtual machines (servers, clients).
  - Storage.
  - Internet connectivity/bandwidth.
  - Typical features
    - Access portal to manage ordered services and provision VMs.
    - Choice of Operating Systems per VM (user provisions VMs with Applications).
    - Dynamic user provisioning of VMs in near real-time.
    - Resource burst capability
      - Exceed service parameters for short periods.
    - Provider management of network, storage, server and virtualization.
    - High availability (99.5 % +).
    - Help desk and technical support for contracted services.
    - Patch management for VM Operating Systems.
    - Security for data at rest and in transit.
    - Periodic Backup.
    - Disaster Recovery & Continuity of Operations plan.



# Deployment Models

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- Public Cloud
  - Multi tenant
    - Data isolation may be offered.
- Private Cloud
  - On premise or off premise.
  - Solutions
    - Build your own
      - Use your own hardware.
      - License software for virtualization, cloud management.
    - Integrated hardware-software solution.
  - Burst to public cloud for additional resources.



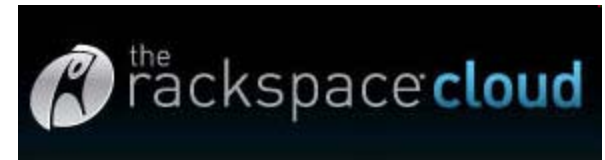


# Example: Storage

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- Amazon Simple Storage Service (Amazon S3)
  - Pricing: \$0.14 to 0.05 /GB/Mo. (volume discount).
  - Bandwidth: \$0.10/GB (In); \$0.15-0.08/GB/Mo (Out).
  - No charge for data transfer within an Amazon region.
  - Support plan available but not included in pricing.



- Rackspace Cloud Files
  - Pricing: \$0.15/GB/Mo. (no volume discount).
  - Bandwidth: \$0.08/GB (In); \$0.18/GB/Mo. (Out).
  - Integrated with the Akamai Content Delivery Network.
  - Support plan included in pricing.

# Example: Compute Resources

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*Applications: Life Sciences Bioinformatics, Weather research and forecasting, Computational fluid dynamics, Finite element analysis, Data analytics, Statistics*

- Amazon Elastic Compute Cloud (EC2)



- Functionality

- Launch one or more VM instances with OS of choice.
    - Load instances with custom app created from Amazon Machine Image.

- High Performance Computing (HPC)

- Cluster Compute and Cluster GPU.
    - Linux OS.
    - Supports 128 instances with 10 Gbps bandwidth between instances.

- Penguin Computing

- High Performance Computing as a Service

- Red Hat Linux HPC cluster systems

- Direct attached high-speed storage

- File transfer via Internet or overnight disk caddy w/ 2 TB disks



# Example: VMs – Storage - Connectivity

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- Amazon Web Services
  - Massive infrastructure resources.
  - Strong portfolio of Cloud services.
  - Branded software applications available as Amazon Machine Images (AMI).
  - Access to infrastructure through APIs supported by a range of third party monitoring tools.
- Microsoft
  - Microsoft Hyper-V Private Cloud.
  - Windows Azure Public Cloud.
  - Limited to Windows server; no Linux.



# Examples: VMs/Storage/Connectivity

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- Terremark (Verizon)
  - Strong public sector provider; civil & defense.
  - Comfortable with FISMA C&A.
  - Strong VMware and NetApp partner.
- Carpathia
  - Public sector specialist.
  - Comfortable with FISMA C&A.
  - Public, Private (off-premise), Community IaaS.
  - Strong partnership with Citrix.
  - API for Infrastructure monitoring
    - Unique, not widely supported by third party tools.



# Examples: VMs/Storage/Connectivity

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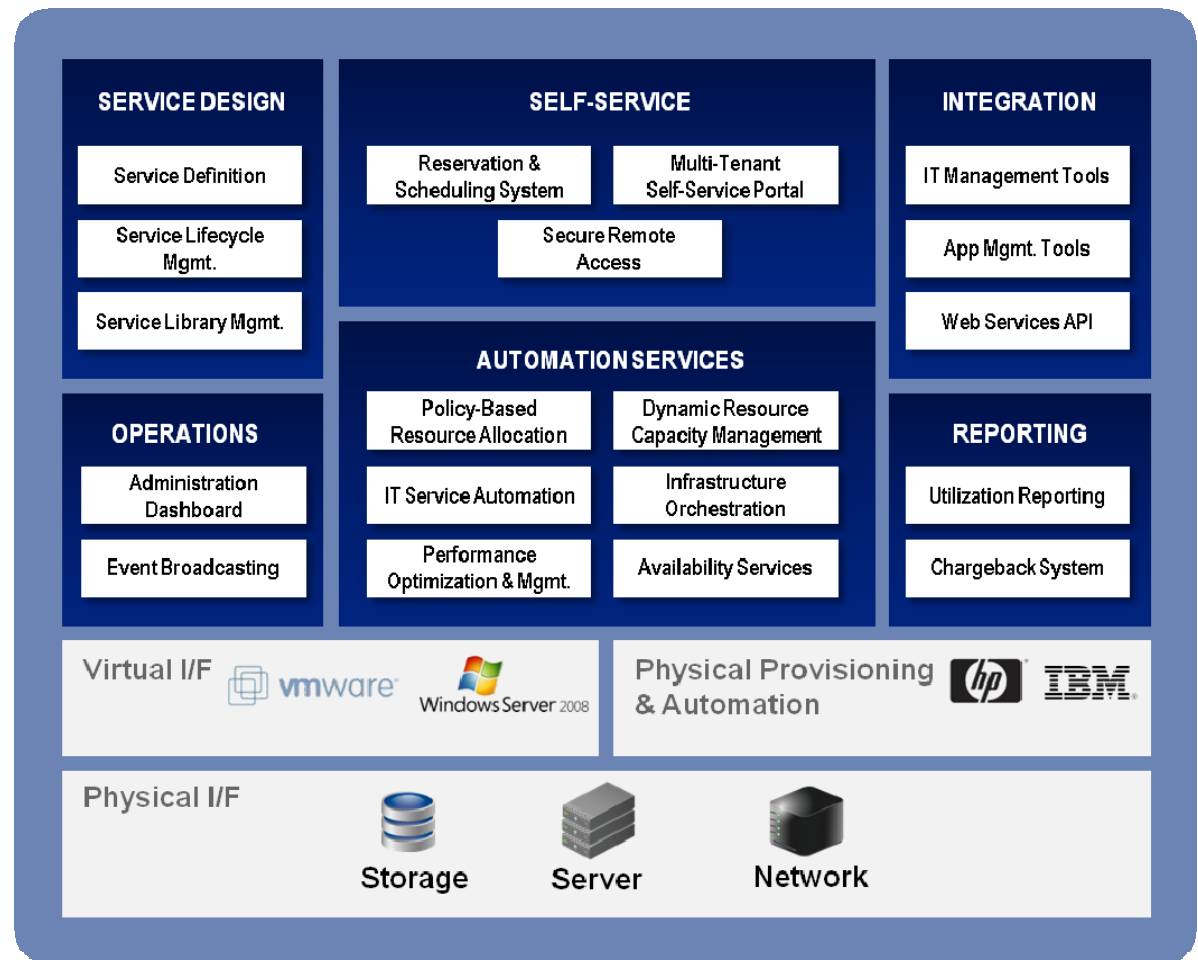
- Rackspace
  - Industry best practices in customer service.
  - Cloud based on the OpenStack project, developed in cooperation with NASA.
- Softlayer
  - Automated, highly standardized.
  - Does not support nonstandard configurations.



# Example: Private Cloud (software only)

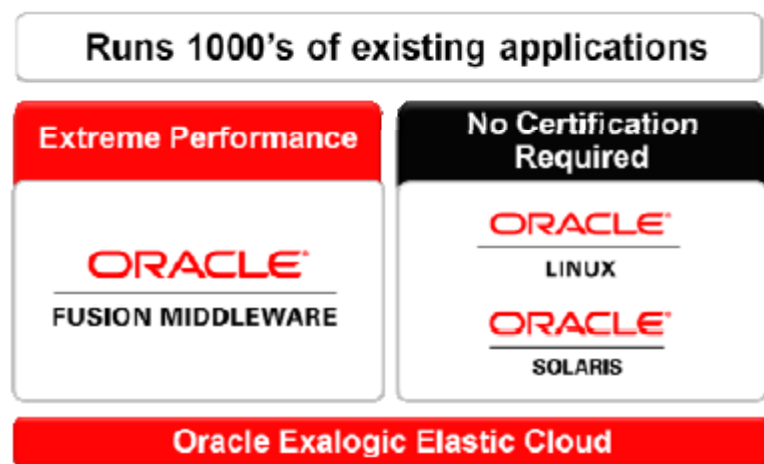
- Quest Software
- Leverage your
  - Hardware
  - Virtualization

## Quest's Cloud Automation Platform



Source: Quest Software

# Example: Private Cloud (HW-SW stack)



Oracle Exalogic Elastic Cloud  
for Mission-Critical private clouds

## Integrated Hardware-Software Stack

- Hardware/Software Engineered together
- Ready to Run

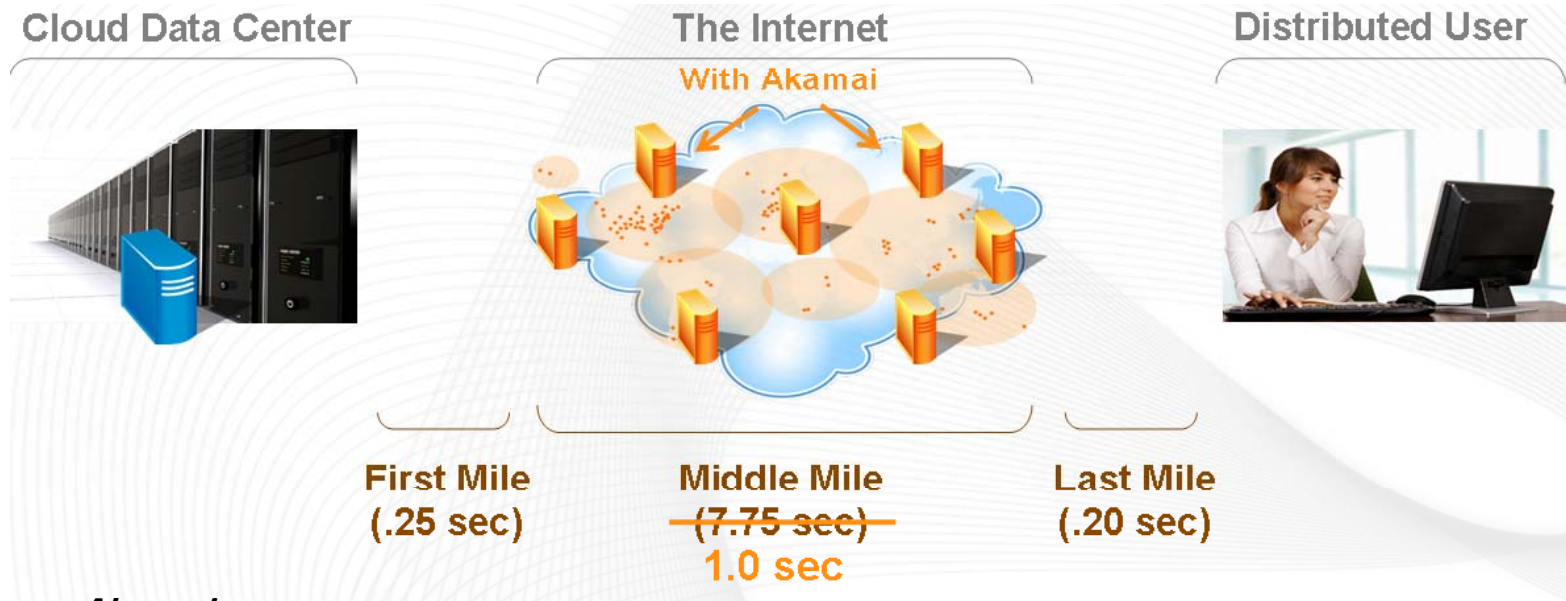
*Source: Oracle*



	Quarter Rack	Half Rack	Full Rack	2 - 8 Racks
2.93 GHz Xeon Cores	96	192	360	720 - 2880
1333 MHz RAM	768 GB	1.5 TB	2.8 TB	5.6 – 22.4 TB
FlashFire SSD	256 GB	512 GB	960 GB	1.9 – 7.7 TB
SAS Disk Storage	40TB	40TB	40TB	80 – 320 TB

# Example: Cloud Acceleration Services

- Akamai : Improve end user experience
  - Reduce apparent network latency.



Source: Akamai

Typical number of round trips for an application = ~~31~~ 5

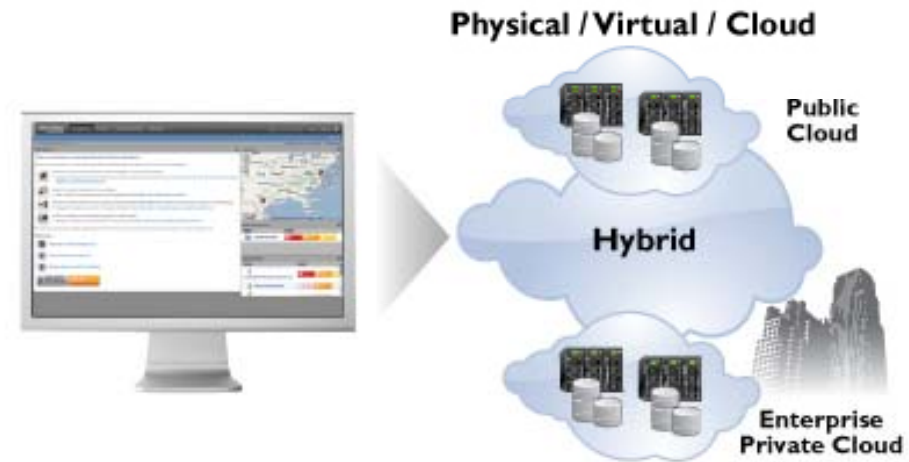
Total response time = ~~8.2 sec~~ 1.45 sec



# Example: Infrastructure Monitoring

## Zenoss

- Commercial Open Source.
- Agentless.
- Unified monitoring solution.
- Global event management.
  - Event integration
    - VMware vCloud Director.
    - Cisco UCS Manager.
- Unified Analytics and Reporting.



# Pros – Public IaaS

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- Avoid direct facility infrastructure, hardware and energy costs.
- Reduce IT staffing for O&M.
- Eliminate facility management costs.
- Elasticity enables rapid response to changes in demand.
- Avoid need to architect for peak loads.
- Access from any Internet connection.
- Better resource cost awareness by allocation to end user cost centers through charge-back of metered usage.
- Eleven Pre-screened providers available through GSA's IaaS Blanket Purchasing Agreement.
  - Requires certification to FISMA Moderate.



# GSA IaaS BPA awardees

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- Apptis Inc. partnered with Amazon Web Services
- AT&T partnered with Carpathia, Enomaly, and Dell
- Autonomic Resources
- CGI Federal Inc.
- Computer Literacy World partnered with Electrosoft, **XO Communications** and Secure Networks
- Computer Technologies Consultants, Inc., partnered with Softlayer, Inc.
- Eyak Tech LLC
- General Dynamics Information Technology partnered with Carpathia
- Insight Public Sector partnered with Microsoft
- Savvis Federal Systems
- Verizon Federal Inc.



## Pros – Private IaaS

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- Virtualize and pool resources to increase utilization.
- Reduce facility footprint.
- Better resource cost awareness by allocation to end user cost centers through charge-back of metered usage.



# Cons – Public IaaS

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- End users require Internet connectivity
  - Be prepared for higher bandwidth costs.
  - Absence of connectivity = end user downtime.
- Lack of total control
  - Uptime is the responsibility of the service provider.
- Public vs. on-premise may be unsuitable
  - Where excessive bandwidth costs are inherent
    - Example: Image processing.
  - Applications that require low latency
    - Example: 3D Graphics simulations.



## Cons – Private IaaS

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- Requires specialized IT skills for O&M.
- VM sprawl may become a management challenge.



# Cautions & Considerations

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- IaaS is a very dynamic market
  - Providers are continually releasing new platform features.
  - Services and support vary significantly among major players.
- One-sided Service Level Agreements (SLAs)
  - Some service providers will negotiate custom SLAs for premium pricing.
- Change of service provider
  - Plan for portability in case you decide to change to another service.
- Virtualization adds a layer of complexity
  - Data recovery is more complex.
  - Deploy in minutes, recover in hours.
- Performance monitoring is your responsibility
  - Monitor end user experience, not just application uptime.
- Integration issues
  - With existing Identity and Access Management system.
  - With other enterprise services (data and applications).
- Moving to IaaS without optimizing IT Management architecture
  - Consolidating infrastructure will bring disparate IT organizations together.
  - Standardization of tools (monitoring, diagnostics) becomes possible and desirable.
- Change management
  - Engage line of business customers and ensure their support.
  - Plan for changes in IT staff scope of responsibility.



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