



Server Consolidation without Virtualization

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Agenda

- What a Server Costs You
- Server Consolidation
 - Requirements
 - Choices
- Server Virtualization
- Container Virtualization / Workload Management
- Side-by-Side
- Summary

Cost of a ~\$2500 Server (3 Year Life)

Category	Life time	Yearly		Amazon/yr paid hourly	Amazon/yr reserved
Acquisition					
Server HW	\$2500	\$833			
Other HW	\$200 ¹⁾	\$67			
SW (OS, other)	\$500 ¹⁾	\$167			
Maintenance & Administration					
Initial set-up	\$100 ¹⁾	\$33			
Support contracts	\$900 ¹⁾	\$300			
In-house labor	\$900 ¹⁾	\$300			
Facilities					
Power & cooling	\$1200	\$400 ²⁾			
Floor space	\$1500	\$500 ³⁾			
Site operations	\$1200	\$400 ³⁾			
Total	\$9000	\$3000		\$7000	\$4700

¹⁾ Will vary

²⁾ 400W at full load, \$0.10/kwh

³⁾ Tier II data center at 55% utilization (single path power/cooling, n+1 redundancy)

Server Consolidation ROI – Business Rationale

- Yearly costs of a sever
 - 1/3: Server OpEx (maintenance, admin, power/cooling)
 - 1/3: Depreciation (HW & SW)
 - 1/3: Facilities
- Owned data center
 - Server OpEx: Immediate saving
 - Delay acquisition of new servers
 - Delay data center expansion
 - Data center consolidation
 - Sell off superfluous servers
- Cloud or hosted data center: All costs are variable

Server Consolidation ROI – The Investments

- SW acquisition & support / subscription
- Deployment
 - Training
 - Preparation / pre-production
 - Installation in production environment
- Yearly maintenance / administration
- Impact on existing infrastructure
 - Networking
 - Storage
 - HA/DR
 - Backup
 - Systems management tools & procedures

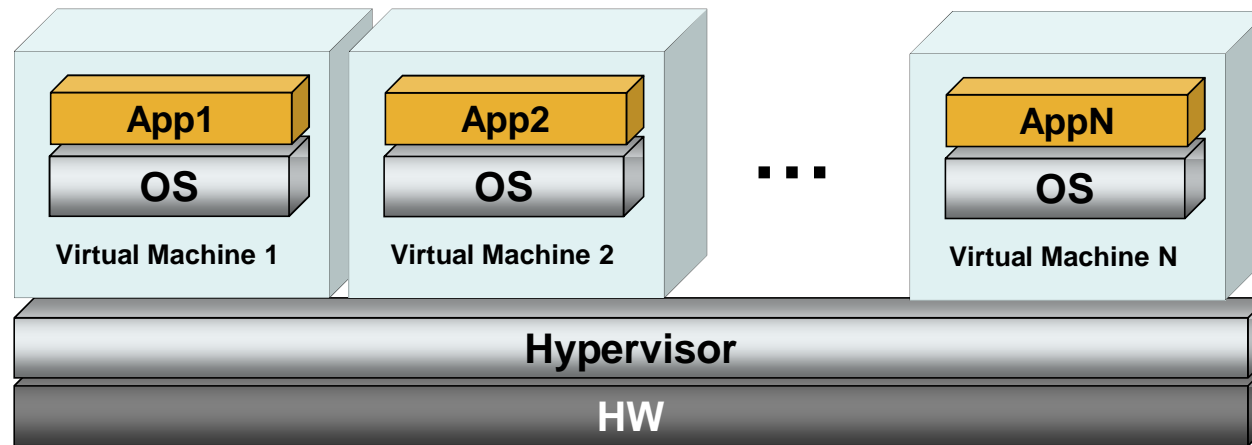
Server Consolidation Requirements

- Resource management
 - Resource limits & guarantees
 - Maximum utilization (Dynamic rebalancing)
 - All server resources
- Other requirements
 - Live application migration
 - Namespace isolation
 - Multiple OS images per server

Server Consolidation Approaches

- Run more applications “natively” on Operating System
 - OS schedulers deal with tasks rather than workloads
 - Unpredictable performance
 - Not possible to manage SLA’s
- Server Virtualization
 - Used in many data centers for Windows, Linux
- Container Virtualization / Workload Management
 - Used in many data centers for UNIX
 - Used by Google

Server Virtualization

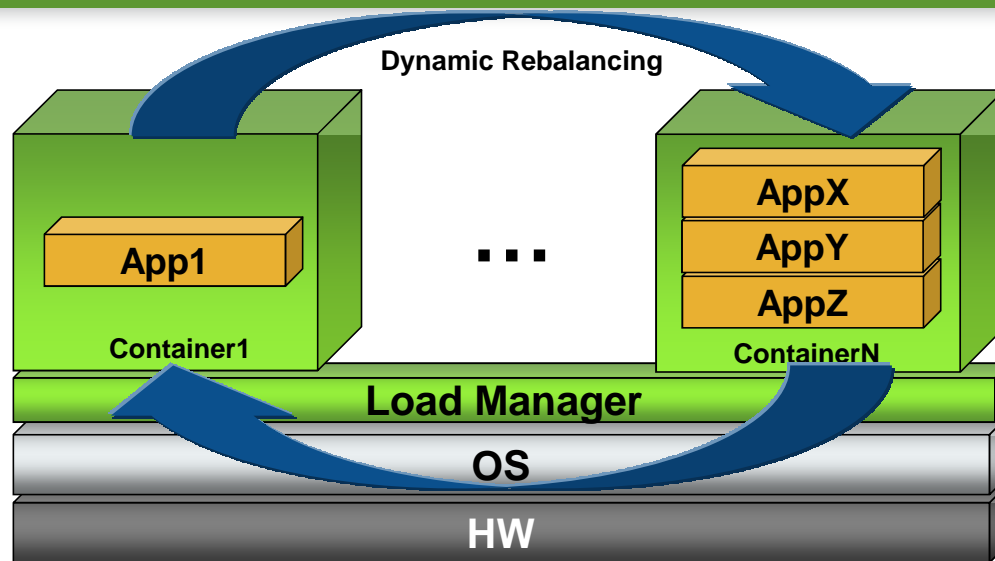


- Full complement of server consolidation features
 - Resource management
 - Namespace isolation
 - Live application migration
 - Multiple OS instances per server

Server Virtualization Deployment

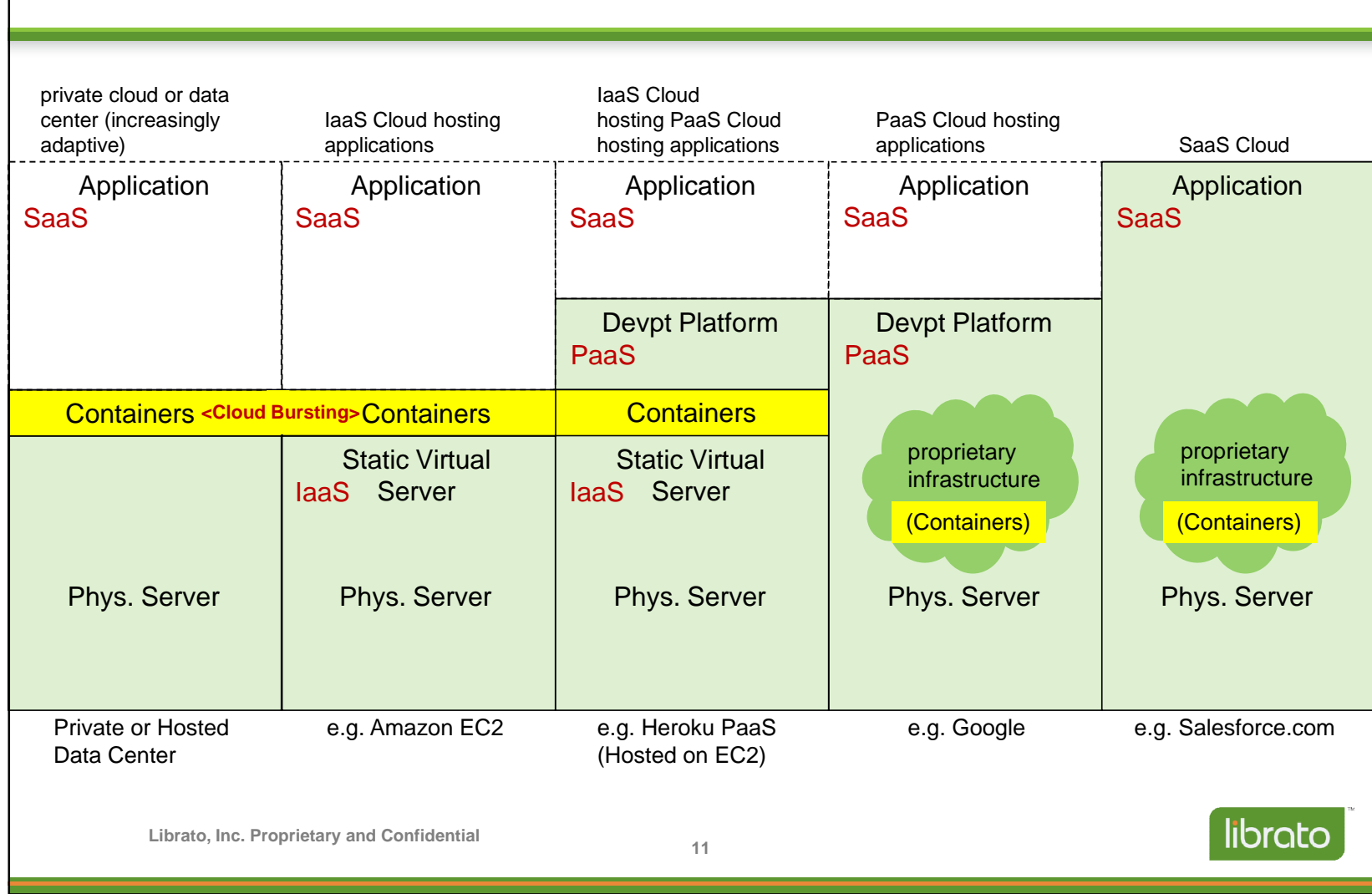
- Costs
 - Impact on existing infrastructure
 - Networking, storage, backup, HA/DR, management tools
 - Software license costs (function of # virtual servers)
 - Management costs
 - Management of Virtual Servers, Operating System Instances
- Performance overhead for I/O intensive workloads (e.g. database)
- Do the math

Container Virtualization / Workload Management



- Resource management
 - All server resources
 - Resource guarantees: Predictable performance
 - Dynamic Rebalancing: Maximum utilization
 - Guarantee allocation of assigned quota when needed
 - Rapidly reassign resources based on actual needs and demand
- Available for Linux and Windows

Containers in Clouds / Data Centers

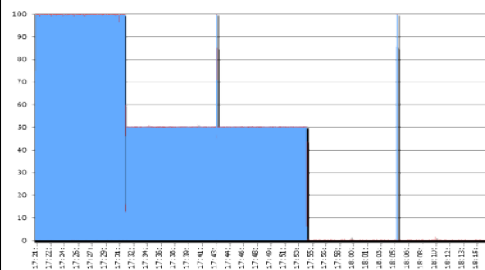


Container Virtualization Solutions

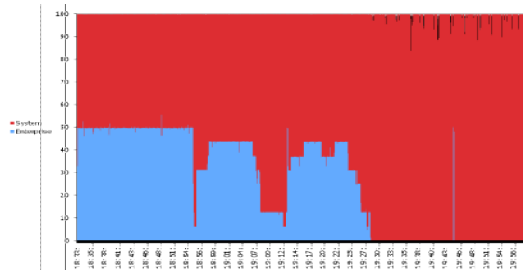
- IBM AIX6 WPARs (Workload Partitions)
- Solaris 10 Containers/Zones
- Parallels Virtuozzo Containers (Linux & Windows)
 - Kernel implementation
 - Resource Management
 - Namespaces, Migration
- Librato Load Manager (Linux & Windows)
 - User space implementation
 - Resource Management
 - Migration (4Q09), DLL isolation on Windows
- Microsoft Windows WSRM
- Linux Containers
 - Resource management (Control Groups) & Namespaces (RHEL 6?)
 - Migration (RHEL 7?)

Workload Management vs. the Operating System

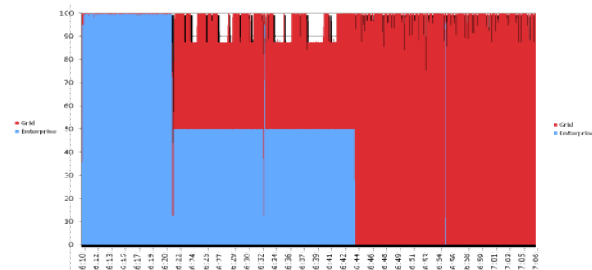
- Test case: “sponge” spare cycles
 - Run background/grid workload together with interactive workload
 - Interactive workload needs hard resource guarantees
- Results
 - Operating System scheduler: no resource guarantees
 - Workload Management: enterprise/interactive workload not impacted
- Opportunity to harvest >80% capacity of typical server running interactive workload



primary workload only



unmanaged primary +
grid workload



managed primary +
grid workload

Managing Cloud Resources for a PaaS supplier

- PaaS vendor hosting its service on an Infrastructure Cloud
 - Multi-tenant application
 - Multiple users serviced by single application instance
 - EC2 machines are “static” virtual machines
 - Fixed in size, paid by the hour, independent on utilization
 - Fully variable costs
 - Not possible to manage workload using server virtualization
- Container Virtualization value proposition:
 - Manage service levels within a server / application instance (e.g. for free vs. paid service)
 - Maximize server utilization
 - Detailed chargeback reports
 - Dynamically manage scale-out based on resource usage/demand

Container Virtualization: Questions to ask

- Which operating systems are supported?
- Standard or proprietary OS distribution?
- Application transparent?
- Granularity of resource scheduling?
 - Varies from seconds to msec
- Other features?
 - Live application migration
 - Namespace isolation

Server Virtualization & Container Virtualization Side-by-Side

	Server Virtualization	Container Virtualization
Consolidation Approach	Multiple Virtual Machines per server	Multiple Containers per server
Server Resource Mgt.	Yes	Yes
Namespace Isolation	Yes	Yes
Live Migration	Yes	Yes
OS Images	One per application	One per physical server
OS failure isolation	Yes	No
Impact on Existing Infrastructure	Networking, Storage, Backup, HA/DR	Deploy in existing environment
Performance Overhead	Can be significant in I/O intensive environments	<1%
Costs	<ul style="list-style-type: none"> • License & admin costs for virtualization • Manage more OS instances • OS / Application license costs • Changes in other parts of infrastructure 	License & admin costs for Workload Management

Summary

- Server Consolidation with Container Virtualization
 - Rapid deployment in existing infrastructure
 - Low cost / high ROI, rapid payback
- Additional features under way
 - Live application migration
 - Namespace isolation
- Attractive solution for many environments
 - Unless you need multiple OS instances per server

Thank You