

Virtualization for Business Advantage: IT at the Speed of Business

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“Decouple Applications/Users from underlying Infrastructure Requirements”

Agenda:

- Evolving Goals of Virtualization
- PCLN Virtualization Ecosystem
- Virtual Attained Benefits
- Virtualization Environmental Benefits
- Virtualization Challenges
- Virtualization 2012

Evolving Goals of Virtualization

- 2004 – Goal of Virtualization
 - Attain Consolidation ROI's to reduce Data Center costs (power, heat, server, storage, etc.)
- 2009 – Continue Consolidation and also attain:
 - Increase the nimbleness/velocity (a.k.a. “nimbleocity”) of Application Development
 - Improve Environmental Impact
 - Improve Provisioning Speed
 - Increase User Mobility and Productivity
 - Increase DR recovery speed

Case Study – Finance Project

- Problem: Upgrading performance of the QA environment will save significant project time on a high profile business project.
- Details: The project manager calls and asks for an upgrade to QA. Production is already partially built. There are no replacement servers for the database, which runs on Solaris. The application server is a Linux VM. Data is on shared SATA drives.
- Reality: Fast procurement of hardware is impossible. Moving the application is extremely difficult, and downtime is a detriment to the project!
- Using virtualization tools, we solved this problem!

Case Study – Finance Project

- Solution: With a few hours notice, the problem was solved.
 - Our production database was being built. We created a Solaris Zone on top of our production database to support the QA database.
 - During a two hour window, we transferred our disk volumes to the new zone.
 - The database was restored on the new high performance hardware.
 - Prior to production, the production database server can still be built, tested.
 - QA can be cut back to the original database before launch, after tuning is complete.
 - We performed a virtual to physical (V2P) migration of our application server to boost performance. This procedure uses native Linux commands and we use it routinely.
 - Portability of the operating system means that we can fit performance to need.
 - Total down time was less than two hours for 200GB. Application build was preserved perfectly with no changes to procedure.
 - We optimized our QA database volume onto fast fiber channel disks. This was performed live, with no impact to the project.

Case Study – Finance Project

RESULTS

	<u>BEFORE</u>	<u>AFTER</u>
Procurement Cycle	5 days	0 hours
Hardware Build	2 days	2 hours
Database Build	2 days	2 hours
Software configuration	<u>1 day</u>	<u>0 hours</u>
<i>Total Duration</i>	<i>10 days</i>	<i>4 hours</i>

In less than two hours downtime, we upgraded total performance by over 2x. Total down time was two hours and no changes for the app teams.

Priceline Virtualization Ecosystem

- Virtualization Software
 - Enables the business to think about software and hardware as two separate entities. This simplifies decisions and allows for provisioning “just enough”.
- Provisioning Software
 - Increases the flexibility and speed of provisioning
 - Reduces configuration variability (a major cause of problems)
 - Increases productivity and morale of programmers
- Storage Virtualization
 - Storage virtualization decreases cost, provides instant on demand storage provisioning for the business, reduces complexity and uses less power than traditional approaches. Highly flexible and robust storage is a MUST for effective virtualization.

Virtualization Software + Provisioning Software + Storage Virtualization
FAR more than the sum of its parts

Priceline Virtualization Ecosystem

Virtualization Ecosystem - Servers

- Priceline uses a mixture of Virtual Iron, VMWare products, Microsoft Virtual Server and Solaris Zones.
- VM's are provisioned on either a distributed farm or isolated physical servers depending upon business need.
- We created a shared Solaris Zones farm with central storage and movable zones.
- 70% of our development and QA servers are VM's.

Priceline Virtualization Ecosystem

Virtualization Ecosystem – Storage

- We use storage that virtualizes our disks at the block level.
- Our goal is to operate storage as a utility. This means:
 - It is always on. It is highly robust and cannot go down even for maintenance.
 - Unreliable shared components are the enemy of density.
 - Is designed through the complete storage lifecycle from initialization to decommissioning. All reclaimed space can be used flexibly. All maintenance is live.
 - Capacity can be provisioned instantly.
 - Volumes can be reorganized at will in any fashion.
 - Complex provisioning decisions are eliminated.
 - Performance is predictable and well instrumented.
 - It can grow or shrink non-disruptively.
 - Monitoring is comprehensive and proactive.

Flexible storage is a must when supporting highly dynamic environments.

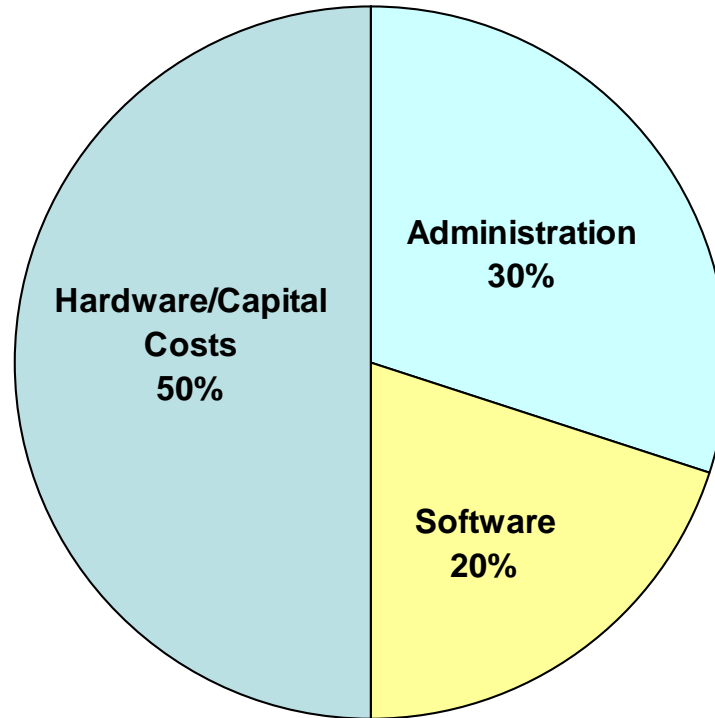
Virtualization Attained Benefits

Attain Consolidation ROI's to Reduce Data Center Costs

- Data Center Impact – Reduced servers
 - 43% of physical corporate servers
 - 50% by EOY 2009
- Total Costs include:
 - Network Ports
 - Power
 - Data Center Space
 - D&A of Data Center Capital
 - Man-days implications
- Trade-off's between greater density increasing utilization versus management issues.

How Does Virtualization Reduce Your TCO

Virtualization directly and dramatically reduces capital costs as much as 83% per server



Reductions in Administration can average 30-40% per virtual server

Costs for virtualization software can add to your TCO.

Estimated TCO for a Physical Server

* Adjusted for VM Sprawl

Virtualization Attained Benefits

Attain Consolidation ROI's to Reduce Datacenter Costs

- ROI Calculation

- 43% Corporate Servers Reduced x \$5,000 TCO/year
- Server Capital Cost \$6,000 x number Servers Reduced
- Capital for Data Center Expansion and Communication Infrastructure = \$800K

Virtualization Attained Benefits

Increase Velocity/Nimbleness of Application Development

- Improved Development Velocity
 - Parallel Development Environments
 - High Availability – one silo can be offline
 - Faster transition from Dev to QA
 - Mean time to repair/debug issues reduced because apps are not shared across cells
 - Fast configuration and deployment of new dev instances
 - Reduced man-days for hardware, wiring, etc. for physical deployment
 - Calendar days reduced from 7 to 1 on average for provisioning.
- Doubled QA Parallelism
 - Multiple QA silos allow more than one project to be tested concurrently

NOTE: The increase in speed of Application Development and testing can surpass the Server Consolidation ROI's and may be the most important aspect of Virtualization for some types of companies.

Virtualization Attained Benefits

Priceline's Environmental Impact Thus Far

- 504k KWH/year
- 390 tons of carbon dioxide/year
- 70 automobiles removed
- 106 acres of trees
- 46 households

Based on "Virtualization Impact on x86 Server Shipments, March 2008 Update" – Gartner, Inc. March 2008
Based on "Windows Vista Energy Conservation" - Microsoft Corporation, October 2006

Virtualization Potential Benefits

Improved Environmental Impact – Per Million Servers

- 2.2b KWH/year
- 1.7m tons of carbon dioxide/year
- 304k automobiles removed
- 463k acres of trees
- 201k households

Based on “Virtualization Impact on x86 Server Shipments, March 2008 Update” – Gartner, Inc. March 2008
Based on “Windows Vista Energy Conservation” - Microsoft Corporation, October 2006

Virtualization Attained Benefits

Improve Provisioning Speed

- ROI met in less than one year
- Eliminated 179 potential security holes on 700+ servers
- Deployed over 5,000 Production enhancements in 24 months consisting of more than a quarter million moving parts altered on the production servers.
 - More than 5-fold this number in Development and QA
- No increase in support staff despite doubling the number of Product types and increasing the number of servers 40%.

Desktop Virtualization Attained Benefits

VDI/SBC – Increase User Mobility, Productivity,
and DR Capability

- Desktop machine complexity reduced by 29 %
- Machines per person supported in IT Helpdesk increased by 37% thus far, 50% eventually.
- Remote and Mobile workers have increased flexibility.
- Greater controls are enabled for remote access
- Reduced virus and malware exposures by 90%
- Reduced litigation discovery costs
- Increased speed/flexibility of application upgrades

Virtualization Attained Benefits

Increase Availability and DR recovery speed

- Virtualization and Bare Metal Restore reduces DR Rebuild and Recovery time by 75%
- Virtualization and BMR enable real testing of DR capabilities and timelines.
- Can reduce Cold-Standby capital and expenses by 50% to 80%.
- Can avoid outages by increasing redundancy and (using “Tridundancy”) where you couldn’t afford to before.

Virtualization Challenges and Mitigation Techniques

- VM Sprawl
 - **Challenge:** Increased risk of building servers with minimal ROI
 - **Mitigation:** Use VM TCO/ROI Analysis to assess costs. Education and Communication about ROI quantification.
- Added complexity
 - **Challenge:** VM architectures require specific S/W, O/S, patching, etc. skills.
 - **Mitigation:** Discipline in VM environment design. Administrator training for enhanced skills. Seek help from experienced vendors.
- Cultural Issues
 - **Challenge:** Resistance to change, e.g. “server huggers”. Increasing expectation that everything can get done in 8 hours. Unrealistic assumption about performance degradation.
 - **Mitigation:** Education and communication on benefits and timing implications.

Virtualization Challenges and Mitigation Techniques

- Management Issues
 - **Challenge:** 24*7 requirements
 - **Mitigation:** Diversify load across VM architectures.
 - **Challenge:** Increased Instrumentation required, and live migration impairs manual thresholding.
 - **Mitigation:** Increase precision and number of monitors points. Expand tools that are used to help application level monitoring. New instrumentation approaches based upon statistical trending.
 - **Challenge:** Scheduling service levels
 - **Mitigation:** Diversity load across VM architectures.

Virtualization Challenges and Mitigation Techniques

- User training requirements
 - **Challenge:** Admin complexity increases
 - **Mitigation:** Budget training into virtualization projects
- Greater dependence upon good infrastructure (reliable fast communications, etc.)
 - **Challenge:** SPOF's now have 6x (density) impact
 - **Mitigation:** Make sure all SPOF's are known/eliminated
- Security
 - **Challenge:** Additional Security techniques and are needed
 - **Mitigation:** Set ground rules in advance and enforce security best practices. This is especially important on the physical host.

Security Best Practices

- Good security starts with a consistent and repeatable operating system and application build.
- Set security ground rules in advance and get buy in before implementation.
- Use more aggressive security on the software or operating system supporting your VM's.
 - Restrict logins only to administrators with need for access.
 - This is especially true since these administrators will have virtual console access on each VM.
 - Resist the urge to install extra applications or functions on the physical host OS.
- Consider putting the management address of your physical servers on a protected network segment.

Attained Benefits Summary

- Effective Consolidation. This lowers data center/capital resource costs.
- Reduced Environment Impact. Reduction of power usage, hardware, and real estate is a benefit for our environment.
- Flexibility. An OS consumer need not upgrade or care if hardware changes, or is upgraded.
- On Demand Service. IT can provide OS instances on demand, with little or no planning.
- Instant Upgrades. Memory, storage, or processing power can be increased upon demand.
- Administration Reductions. Lower administration for both operations and application users.

But most of all:

5% greater application development speed

Priceline & Industry Virtualization in 2012

Priceline Virtualization

- 75% corporate servers virtualized
- 50% production servers virtualized
- Up to 80% of desktops are virtualized or are a hybrid of virtualized and local

Industry Virtualization

- Virtualization configuration becomes more standardized
 - Standardized integration of VM servers and Virtualized Storage
 - More seamless integration of Provisioning capabilities
 - More seamless integration of Instrumentation capabilities
- Monitoring becomes more statistically based
- Monitoring becomes better for monitoring the whole virtual ecosystem
- Build and provisioning becomes turnkey and unified

Virtualization Attained Benefits

2015 Environmental Impact – with 7 Million Servers Avoided

- 17.5b KWH/year
- 13.5m tons of carbon dioxide/year
- 2.4m automobiles removed
- 3.8m acres of trees
- 1.6m households

Based on “Virtualization Impact on x86 Server Shipments, March 2008 Update” – Gartner, Inc. March 2008
Based on “Windows Vista Energy Conservation” - Microsoft Corporation, October 2006

In Summary

Virtualization + Provisioning + Storage
= Greater ROI

Q & A