Strategies for Successful Server Consolidation

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Director of Product Marketing
VMware

October 19, 2005
Agenda

- Why Consolidate?
- The Vision: “100% Virtualized”
- The Challenge: How to Get There From Here?
- Common Consolidation Starting Points
  - Pilot projects
  - Server containment
- Summary
Datacenter Infrastructure Today

Increasing use of x86 servers – widespread “server sprawl”

- 91% of enterprise servers bought in 2004 were x86 (Gartner Dataquest)

But those servers are not utilized efficiently

- Typical x86-based server utilization: 5-15%
- Typical x86 use is one application per server
- Re-purposing servers is difficult and costly

Yet the need for servers continues to grow

- Disaster recovery requires duplication of systems
- Additional servers required for development and testing of new applications
- Servers required for staging, hardware refresh, etc.
Why Consolidate?

- Three key reasons:
  - To resolve datacenter management challenges
  - To act on management demands for increased IT efficiency
  - To maintain a competitive edge by optimizing IT resources

**consolidate (v):**
- To unite into one system or whole; combine:
- To make strong or secure; strengthen:
- To make firm or coherent; form into a compact mass.
Reason #1: To Resolve Datacenter Management Challenges

- Dynamic workloads difficult to forecast
- Application lifecycles outlast hardware lifecycle
- Workloads outgrow original platforms
- Hardware budget constraints
- Single applications per server
- Capacity planning challenges
NOW, THEREFORE, I, ARNOLD SCHWARZENEGGER, Governor of the State of California, by virtue of the power and authority vested in me by the Constitution and statutes of the State of California, do hereby issue this Executive Order to become effective immediately:

1. The goal of **data center consolidation** and information technology realignment is to substantially improve the performance of the Executive Branch in managing its information technology infrastructure.

2. . . .

**STATE OF CALIFORNIA – EXECUTIVE ORDER S-13-04**
Reason #3: To Maintain a Competitive Edge by Optimizing IT Resources

“Enterprises that do not leverage virtualization technologies will spend 25% more annually for hardware, software, labor, and space for x86-based servers”

Gartner Report – November, 2003
Why Use Virtualization to Consolidate?

• Virtualization offers a proven solution for fast and effective server consolidation, with minimal disruption to existing business processes.

• Server consolidation through virtualization capitalizes on the benefits of commoditized IT hardware

“We regard virtualization as the most disruptive technology the PC has faced in a decade. If adopted and deployed to its full potential, the PC's long journey to commodity status could finally be over.”

Gartner Group, December 2004
Degrees of Consolidation

- **Departmental consolidation**
  - Identify applications on underutilized servers
  - Group many virtual machines on a single physical system

- **Datacenter consolidation**
  - Extend virtual machines to single apps on dedicated servers
  - Aim for 100% virtual machines for better maintainability and disaster recovery support

- **Enterprise-wide consolidation**
  - Virtualize entire primary and recovery datacenters
VMware Customer Consolidation Ratios

- Conseco Finance: 8:1
- State of Montana: 8:1
- 7-Eleven: 10:1
- Antares IT: 10:1
- National Gypsum: 10:1
- Applied Innovation: 15:1
- AIG Technology: 20:1
- Qualcomm: 30:1
The Vision: Virtual Infrastructure

Provides the key to:

- Dynamically map computing resources to the business
- Lower IT costs through increased efficiency, flexibility and responsiveness
- Provision new services and adjust the resources dedicated to services
- Treat a datacenter as a utility, or a single pool of processing, storage and networking power

Virtual infrastructure brings uniformity to the datacenter
The Vision: “100% Virtualized”

- The ultimate goal of a server consolidation initiative:
  - Every possible x86-based server workload virtualized
  - All new projects provisioned within VMs
  - All remaining legacy applications migrated to VMs
  - All future hardware provisioned for virtualization support

- ... So how do we get there from here?
Implementing the Vision

- Assumption: The strategic decision has been made to consolidate server infrastructure

- Next Steps:
  - Determine overall datacenter priorities
  - Assess current infrastructure and workloads
  - Envision the future virtual infrastructure design
  - Use priorities to guide consolidation strategy
  - Communicate consolidation strategy to IT team
Determine Datacenter Priorities

- There are many compelling reasons to commence server consolidation, but how to go about it depends on a wide range of factors:
  - Environmental constraints
    - Data center space, rack space
    - Power, HVAC, network capacity
  - Financial constraints
    - IT infrastructure budgets
  - Operational constraints
    - Workload types
    - Business cycle
Determine Environmental Constraints

- Issues that often trigger or accelerate customer consolidation initiatives:
  - Running out of datacenter space, faced with cost of expansion or establishing an entirely new datacenter
  - Hitting physical limits of power supplies or HVAC equipment, leading to potentially expensive upgrades
  - Hitting physical limits of rack space, blade chassis capacity, network switches or other shared devices
Determine Financial Constraints

- Issues that often trigger or accelerate customer consolidation initiatives:
  - Limited budgets for new x86-based hardware constrain the number of new projects that can be implemented
  - System administration overhead costs limit the number of new servers that can be provisioned
  - Budget constraints limit the ability to deploy effective high availability and disaster recovery infrastructure
Determine Operational Constraints

- Issues that often trigger or accelerate customer consolidation initiatives:
  - Legacy applications running on obsolete hardware suffer performance limitations and represent high risk
  - New projects built on development lab systems are incompatible with production environments
  - Hardware incompatibilities limit the scope of disaster recovery infrastructure
Consider Consolidation Options

- Using the datacenter priorities as a guide, consider the most effective approach to get started on a consolidation initiative:
  - Approach #1: Start with a pilot consolidation project
    - Identify a simple subset of the IT infrastructure
  - Approach #2: Adopt a ‘containment’ approach
    - Forward containment
    - Backward containment
Benefits of Pilot Project Approach

- Seek opportunities for some early ‘wins’
  - Aimed at overcoming internal resistance
- Identify groups of poorly-utilized servers
  - Domain controllers
  - File/print servers
  - Internal Web portals
- Complete the pilot project and promote results
  - Immediate cost savings
  - No disruption to end users
  - Gain experience deploying virtual infrastructure
Server Containment – Stopping the Sprawl

- Virtual infrastructure provides a managed approach to regain control over x86-based server sprawl:
Forward Containment

- Virtual infrastructure provides a managed approach to regain control over x86-based server sprawl:
  - Forward containment
    - Provision new projects with virtual infrastructure
    - Defer acquisition of new physical hardware
Virtual infrastructure provides a managed approach to regain control over x86-based server sprawl:

- **Forward containment**
  - Provision new projects with virtual infrastructure
  - Defer acquisition of new physical hardware

- **Backward containment**
  - Enable support for older applications on new hardware
  - Retire legacy hardware from the data center
Benefits of Forward Containment

- Forward containment is a suitable approach when coping with hardware budget constraints is a top datacenter priority:
  - Virtual infrastructure costs can be recovered very rapidly – typically after provisioning 2-3 new servers in VMs rather than on physical hardware
  - In addition to the one-time hardware cost savings, considerable ROI benefits can be gained from lower ongoing administrative costs
  - Over time, the hardware cost savings can be leveraged to implement new IT projects that would otherwise be postponed or shelved
Backward containment is an ideal approach in situations where a top datacenter priority is minimizing risk:

- Up to 25% of Windows servers in datacenters run Windows NT – which is no longer supported
- Most of these systems run on outdated hardware, with risks that include:
  - Lack of replacement or upgrade parts
  - Out of warranty, no more support
  - Limited performance characteristics
  - Diminishing admin/configuration skills
A combination of forward and backward containment is ideal when environmental constraints (e.g. no more datacenter space) are a top datacenter priority:

- Reallocate budget for next x86-based hardware toward virtual infrastructure software instead
- Provision new projects in VMs rather than hardware
- Incrementally retire legacy servers at the same time
- Defer future hardware purchases until necessary
Which Workloads to Consolidate First?

- Assess current datacenter workloads
  - Monitor resource utilization
  - Identify workloads with minimal utilization
- Plan virtualized workload combinations
  - Consider optimal mix of workloads per host
### Server Expenditure by Workload Type

<table>
<thead>
<tr>
<th>Workload Type</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Infrastructure (file/print, DHCP, etc)</td>
<td>25%</td>
</tr>
<tr>
<td>Collaborative (E-mail, Workgroup)</td>
<td>23%</td>
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<tr>
<td>Business Processing (ERP, CRM, OLTP)</td>
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</tr>
<tr>
<td>Decision Support (Data warehouse, etc)</td>
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<tr>
<td>Application Development</td>
<td>9%</td>
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<tr>
<td>Web Infrastructure</td>
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<td>Technical/Scientific</td>
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<td>Other</td>
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*Source: IDC Research, November 2003*
## Workload Performance Characteristics

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<thead>
<tr>
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<th>CPU</th>
<th>RAM</th>
<th>Disk</th>
<th>Net I/O</th>
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<tr>
<td>Technical/Scientific</td>
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<td>High</td>
<td>Medium</td>
<td>Low</td>
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</table>
Typical ESX Server Workloads

- Tier 2 Apps (Web/Non-web)
- Infrastructure
- Collaborative
- Tier 1 Web/J2EE
- Mid-Large DBs
- Bus Apps (ERP)

Resource and Availability Requirements
Aim for Optimal Workload Mix

- Measure average and peak utilization (CPU, memory, disk I/O and network bandwidth)
- Optimize resources by balancing workloads
- Re-balance periodically, as workloads evolve
Inventory Current IT Infrastructure

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<tr>
<th>Servers</th>
<th>OS</th>
<th>CPUs</th>
<th>CPU Speed</th>
<th>Total Mhz</th>
<th>RAM (MB)</th>
<th>Disk Size (GB)</th>
<th>NIC (Mbs)</th>
<th>Apps</th>
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## Evaluate Individual Workload Profiles

### Application Profiles

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<th>Application</th>
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<th>RAM MB Used</th>
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<th>Disk Busy</th>
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Evaluate Performance of Server Groups

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<tr>
<th>Group</th>
<th>% CPU</th>
<th>Available MBytes</th>
<th>Pages/sec</th>
<th>PageFile % Av.</th>
<th>PDsk % Busy</th>
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Workload Consolidation Options

- Optimize for Functionality
  - Group VMs based on function
  - Ease of management and security benefits

- Optimize for Performance
  - Group VMs to maximize resource utilization
  - Re-group VMs as workloads evolve
Optimize for Functionality: ‘DMZ in a Box’

- Low-cost (one server)
- Multiple firewalls
- Fully isolated
- High security
Optimize for Performance: Web+Mail

**Traditional Configuration**
- Apache Web server on Linux
  - 1U, 2-way Rackmount
- Sendmail Gateway on Linux
  - 1U, 2-way Rackmount
- Exchange/IIS on Windows 2000
  - 1U, 2-way Rackmount

**Consolidated Configuration**
- 3U, 4-way Rackmount

- Multiple applications
- OS-independent
- Simplified administration
- Frees up hardware
- Smarter resource use
Identical Workloads on a Physical Host?

- Advantages
  - Common files leverage memory oversubscription
  - Possible savings on Windows 2003 server licenses

- Disadvantages
  - Higher risk – all your eggs in one basket?
  - Similar resource utilization pattern not optimal
## Optimal Consolidation Strategies, Based on Primary Datacenter Priorities

<table>
<thead>
<tr>
<th>Environmental Constraints</th>
<th>Financial Constraints</th>
<th>Operational Constraints</th>
</tr>
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<tbody>
<tr>
<td>- Immediately stop server sprawl through forward containment</td>
<td>- Adopt incremental forward containment one project at a time</td>
<td>- Plan pilot consolidation project, by identifying “low-hanging fruit”</td>
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<td>- Defer new hardware purchases</td>
<td>- Cover costs after 2-3 servers virtualized</td>
<td>- Virtualize specific workloads and deploy in production prior to taking next steps</td>
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<td>- Follow up with selective backward containment to remove old hardware from datacenter</td>
<td>- Determine boost to operational efficiency, assign more servers to system admins</td>
<td>- Leverage hardware independence to enhance disaster recovery infrastructure</td>
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<td>- Plan future hardware purchases to support further consolidation</td>
<td>- Over time, apply cost savings to more efficient hardware</td>
<td>- Virtualize dev/test</td>
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## Consolidation Helps to Raise IT Business Value

<table>
<thead>
<tr>
<th>Level</th>
<th>IT Asset Management Process Maturity Model</th>
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<tbody>
<tr>
<td>Value</td>
<td>IT/Business metric linkage</td>
</tr>
<tr>
<td>Service</td>
<td>Capacity planning</td>
</tr>
<tr>
<td></td>
<td>Service-level management</td>
</tr>
<tr>
<td>Proactive</td>
<td>Performance and change management</td>
</tr>
<tr>
<td></td>
<td>Automation</td>
</tr>
<tr>
<td></td>
<td>Job scheduling</td>
</tr>
<tr>
<td>Reactive</td>
<td>Event up/down, alarms, notification, consoles</td>
</tr>
<tr>
<td></td>
<td>Trouble ticket</td>
</tr>
<tr>
<td></td>
<td>Backup</td>
</tr>
<tr>
<td></td>
<td>Systems topology and inventory</td>
</tr>
<tr>
<td>Chaotic</td>
<td>Multiple help desks</td>
</tr>
<tr>
<td></td>
<td>Non-existent IT operations</td>
</tr>
<tr>
<td></td>
<td>User call notification</td>
</tr>
</tbody>
</table>

*Source: Gartner Group*
## Benefits of Server Consolidation With Virtual Infrastructure

<table>
<thead>
<tr>
<th>Reduced TCO</th>
<th>Enhanced Manageability</th>
<th>Increased Flexibility and Responsiveness</th>
</tr>
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<tbody>
<tr>
<td>Lower hardware costs through higher utilization</td>
<td>SLA management capabilities</td>
<td>Instant provisioning using VirtualCenter</td>
</tr>
<tr>
<td>Lower administrative costs</td>
<td>Better management of capacity planning</td>
<td>Easy to repurpose physical servers</td>
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<tr>
<td>Lower overhead costs for datacenter</td>
<td>Centralized management of virtual machines</td>
<td>Online workload management</td>
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</tbody>
</table>
Summary

- Once an executive decision has been made to consolidate servers with virtual infrastructure, there are a variety of strategies to choose from.

- Select a consolidation strategy that is appropriate to your situation.

- Determine the high-level datacenter priorities, and use them as your guide.
Thank You!

- Questions?