Living in a Virtual World with Tangible Results
Virtualization Overview and Real World Case Study
Overview

• Business Justification
• Software Selection
• System Sizing
• Storage Hardware
• Storage Protocol Selection
• Backing Up
• Final Thoughts
Business Justification

• The start of an idea

   We need to replace some operator workstations, what about running virtual images?

• Taking the next step – virtualize servers

• Centralized management

• Dramatic improvement in disaster recovery capabilities

• Relocation of machines for ease of maintenance

• Pending BMS system upgrade
Software Selection

• Type 1 vs. Type 2

• VSPhere vs. Hyper-V vs. XenServer

System Sizing

- Cataloging the System Types – Current and Future

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Control Servers (Historians, I/O Servers, etc.)</td>
<td>5</td>
</tr>
<tr>
<td>Operator Workstations</td>
<td>8</td>
</tr>
<tr>
<td>IT Type Servers (Domain Controllers, Backup Servers, etc.)</td>
<td>5</td>
</tr>
</tbody>
</table>
## System Sizing

### Detailed Breakdown – Machine by Machine

<table>
<thead>
<tr>
<th>Machine</th>
<th>Service</th>
<th>Space Required (GB)</th>
<th>Memory Required (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server 1</td>
<td>Historian</td>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>Server 5</td>
<td>I/O Server, Tag Server, Alarm Server</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Workstation 1</td>
<td>Dedicated Operator Workstation</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Server 6</td>
<td>Backup Exec Server</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Workstation 8</td>
<td>Dedicated Operator Workstation</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Server 7</td>
<td>Existing Print Server</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Server 8</td>
<td>New Sharepoint Server</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td><strong>830</strong></td>
<td><strong>23</strong></td>
</tr>
</tbody>
</table>
System Sizing

• Planning for Growth – Machine by Machine

<table>
<thead>
<tr>
<th>Machine</th>
<th>Service</th>
<th>Growth Factor</th>
<th>Planned Space (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server 1</td>
<td>Historian</td>
<td>100%</td>
<td>400</td>
</tr>
<tr>
<td>Server 5</td>
<td>I/O Server, Tag Server, Alarm Server</td>
<td>100%</td>
<td>100</td>
</tr>
<tr>
<td>Workstation 1</td>
<td>Dedicated Operator Workstation</td>
<td>25%</td>
<td>25</td>
</tr>
<tr>
<td>Server 6</td>
<td>Backup Exec Server</td>
<td>50%</td>
<td>30</td>
</tr>
<tr>
<td>Workstation 8</td>
<td>Dedicated Operator Workstation</td>
<td>25%</td>
<td>25</td>
</tr>
<tr>
<td>Server 7</td>
<td>Existing Print Server</td>
<td>25%</td>
<td>12.5</td>
</tr>
<tr>
<td>Server 8</td>
<td>New Sharepoint Server</td>
<td>50%</td>
<td>75</td>
</tr>
<tr>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1433</strong></td>
</tr>
</tbody>
</table>
System Sizing

• Planning for Growth – System Level
• Add 50% factor to Memory and Storage
  • 35 GB of Memory
  • 2.1 TB of Primary Storage
• Safety Factor for underestimating machine requirements or machine count
Networking

• Dedicated Storage Network
  • Redundant gigabit switches
  • Redundant NIC connections to each switch

• VM Communications Network
  • Single gigabit switch – redundant later if necessary
  • Redundant NIC connections to switch

• Pay attention to separating redundant connections across adapters
Storage Hardware

• Most Critical Selection
  • Performance, Scalability, Reliability, Availability

• 4 Major Classes of Storage
  • Component Hardware, Redundancy, Availability
    1 – Single Controller, Commodity SATA Hard Drives
    2 – Redundant Controllers, SAS Hard Drives, Online Management
    3 – Snapshotting and Deduplication
    4 – Capacity to handle PB of data
Storage Hardware

• This project - Class 2
  • Phase 1: (4) 300 GB 15K SAS Drives (Primary)
    (3) 1 TB 7.2K SAS (Nearline/Backup)
  • Phase 2: +(5) 300 GB Drives
    Additional 1TB Drives
Storage Protocol Selection

• ISCSI vs NFS vs FCOE
• Scale and Performance need not drive selection
• FCOE ruled out due to complexity and cost
• ISCSI Slightly more complex
  • LUN Setup with VMFS
  • 2 TB LUN Limitation
• Ultimate choice driven by device selection
System Backup

• Best reason to virtualize (in my humble opinion)
  • Scares people away due to unfamiliarity
• Chose ESXPress from PHDVirtual over Veeam Backup
  • Familiarity
  • Small footprint (No Windows Install)
  • Appliances to perform backup
  • Deduplication
    • 15-20x reduction in space
Data Deduplication

11 Units

5 Units

11 Units
Backing up the Backups

• Deduplicated data stored as series of self describing data blocks in folders

• Use traditional backup methods to backup data blocks
  • Backup to tape once a week
  • Incrementals not necessary
    • Deduplication so efficient you can keep weeks of daily backups

• SAS Tape drive special challenge – utilized DirectPath
A Quick Word on Power

• Think about power planning and segregation
  • Redundant Power Supplies on UPS
  • Plan for Worst Case – All machines starting up together on common circuit.
System Layout

Phase 1 – Single Host, Single SAN Chassis
System Layout

Phase 2 – Redundant Hosts, Extra SAN Chassis
System Layout

Phase 3 – Dedicated PLC Network
Final Thoughts

• Virtualization is about more than just saving space, power, and money
  • Take credit for disaster recovery
• Plan to spend the most time and money on storage.
• Don’t overthink your backups, let the technology do the work for you
• Virtualization doesn’t reduce the TSLC (Total System Lifetime Complexity), it just shifts it to the design phase instead of operation and maintenance.
Questions, Comments, Thoughts