Exploiting Virtual Technology for Army Mapper Application Development

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Virtualization Defined

• Software that is running on a virtual foundation
  – virtualization software manages virtual machine’s access to local hardware

• Versus a physical hardware platform
  – a single operating system controlling and interacting with the computer’s hardware

• Similar to the way the “old mainframe” ran with each user or process getting a slice of the environment

• So… how many of us are using virtual technology and to what extent?....
Current Vendors

- VMware
- Oracle
- Microsoft
- Red Hat
- Novell
Army Mapper

• The Army’s enterprise application for geospatial data management, viewing, mapping, and analysis

• BETA Version Available at: https://gisdev.hqda.pentagon.mil/

• Suite of custom and commercial GIS applications and tools
  – Web Map Viewer
  – Desktop Tools (via Citrix)
  – Data Repository (compliant with SDSFIE & metadata standards)

• Permission-based (AKO or CAC) access

• Replaces the legacy Geographic Information System Repository (GISR)

• Platform for migration of existing IMCOM GIS systems and tools
Architectural Objectives

- Provide a centralized data repository and a Global View of all installation data
- Standardize Desktop GIS / CADD Application Software
- Centralize licenses and take advantage of license pooling
- Identify and ensure sufficient network bandwidth
- Comply with SECARMSY mandate of 80% reduction of redundant IT investments
- Design and build High Availability, Load Balancing, Web Acceleration and COOP into the architecture
- Design solution to handle low bandwidth communications but be able to manage data repository from a remote installation/location
- Build solution using standard industry programming languages and technologies
- Standardize infrastructure components
Drivers for Virtual Application Development Environment

• Stand up quickly the core COTS packages

• Start development and leverage existing code or functionality from other Army GIS applications such as GISR or KORO application

• Quickly spin up developers’ exposure to core COTS packages such as ArcGIS Web mapping services and ArcSDE
VMware Selection Factors

• Booz Allen already had VMware ESX Servers w/ virtual environment established
• Deployment & Provisioning: Traditional vs. VMware

<table>
<thead>
<tr>
<th>Key Task</th>
<th>Traditional Approach</th>
<th>Virtual Center Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision a new server</td>
<td>3 - 10 days hardware procurement</td>
<td>5 - 10 minutes provisioning new VM</td>
</tr>
<tr>
<td></td>
<td>1 - 4 hours for each server</td>
<td></td>
</tr>
</tbody>
</table>
| Move an application to a new server | 4 - 6 hours for migration                              | 2 - 5 minutes using VMotion™  
(no service interruption)        |
| Repurpose a server           | Service interrupted for duration of maintenance window    | 10 - 30 minutes without VMotion™                              |
|                              | Requires days/weeks of change management preparation      |                                                               |
| Hardware maintenance         | Requires 1 - 3 hours maintenance window                   | Zero downtime hardware upgrades with VMotion™                |
|                              | Requires days/weeks of change management preparation      | Dynamically allocate additional resources on an as need basis|

**VMotion™** is a trademark of VMware, Inc.
# Total VMware Deployment

## Hardware Platform

**Server Specifications:**
- 10 Dell PowerEdge 1855 (Host Blade Servers)
- 4 Dell PowerEdge 2650 (Domain Controller & Management Server)
- 1 Dell PowerVault 775N (NAS Server)

**SAN Specifications**
- 3.5 TB allocated space out of a 27 TB HITACHI SAN
- Brocade Switches and Qlogic HBA

## Software Platform:

**Server Specifications**
- VMware ESX Server 3.0.1

**Modules**
- VMware Storage VMotion
- VMware VMotion
- VMware Converter
- VMware High Availability

## Current environment supports:

- 31 Projects across Booz Allen departments
- 160 virtual servers (Army Mapper 21 servers = 13%)
VMware Physical and Logical Deployment

Physical Servers

Logical Servers
VMware Management Console

Can view live or historical system performance such as CPU, Memory, Disk or Network counters.

Can view or edit virtual machine’s hardware settings such as RAM, Disks, Memory or even CD-ROMs.
Army Mapper Development & Test Configuration

• **Typical Server Configuration** (Total Servers = 21)
  – Development Environment (10 servers)
    • 2 hard disks: 5 or 10 GB OS drive / 10 to 35 GB App & Data Drive
    • RAM: 512 MB web servers / 2 GB database and ArcGIS Server
    • Processors: single processors except EarthWhere Server dual processors
  – Test Environment (11 servers)
    • 2 to 3 hard disks: 10 GB OS drive / 10 to 60 GB App & Data Drive
    • RAM: 1 GB to 3.5 GB web servers / 2 GB database server
    • Processors: single processors except EarthWhere Server dual processors

• **Deployed Software Applications**
  – Microsoft’s IIS & JBoss 4.05GA
  – Citrix Presentation Server 4.51
  – ESRI Desktop Tools 9.2 sp #4
  – EarthWhere Image Server
  – ESRI ArcGIS and ArcSDE 9.2 sp#4
  – Oracle 10g R2 patch 2

• **Average Resource Usage & Load**

<table>
<thead>
<tr>
<th>Test Server</th>
<th>Processor</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIS/JBoss</td>
<td>115.86 MHz</td>
<td>9% of 1 GB</td>
</tr>
<tr>
<td>Citrix</td>
<td>158.65 MHz</td>
<td>5% of 2 GB</td>
</tr>
<tr>
<td>ArcGIS/ArcSDE</td>
<td>63.54 MHz</td>
<td>9% of 1 GB</td>
</tr>
<tr>
<td>Oracle DB</td>
<td>101.42 MHz</td>
<td>7% of 2 GB</td>
</tr>
</tbody>
</table>

* Resource usages are for the past 30 days
Current Development & Test Layout
Lessons Learned

• Resource Utilization
  – Disk space
    • Never underestimate OS drive partition and temp directory free space
  – Processor
    • ArcGIS and EarthWhere servers need extra processors
  – RAM
    • ArcGIS, Database, EarthWhere and Citrix servers get as much as you can
    • Be careful in acquiring too much RAM for virtual machines may exceed physical host server’s RAM

• Windows domain or LDAP structure strongly recommended
• Red Hat Linux ES v4 Database servers
  – VMware tools had compatibility issues with virtual machines
• VMware Snapshots and VMware VMotion
• VMware vs ESRI’s license key
  – Still need a physical server
Future Requirements

Increase in Resources:

<table>
<thead>
<tr>
<th>Army Mapper Virtual Environments</th>
<th>Current Development &amp; Test Usage</th>
<th>Projected Future Development &amp; Test Needs</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers (EA)</td>
<td>14</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td>Disk Space (GB)</td>
<td>502</td>
<td>10,450</td>
<td>9,948</td>
</tr>
<tr>
<td>RAM (GB)</td>
<td>24</td>
<td>54</td>
<td>30</td>
</tr>
<tr>
<td>Processors (EA)</td>
<td>18</td>
<td>40</td>
<td>22</td>
</tr>
</tbody>
</table>

• Core Factors for Increase:
  – Storage for Snapshots
  – Storage for Database Refreshes
  – Servers for Load Balancing
Future Goals

• Support Clustering
  – Oracle Real Application Clustering (RAC)
  – Microsoft Cluster

• Support Network Load Balancing
  – Cisco Application Control Engine (ACE) or Big-IP F5

• Support Larger Database Storage Requirements

• Re-implement Snapshots
Virtual Technology Resources

• VMware Products:
  http://www.vmware.com/products

• Microsoft Products:
  http://www.microsoft.com/windowsserversystem/virtualserver

• Oracle Products:
  http://www.oracle.com/technologies/virtualization

• Open Source Products:
  Xen built into Red Hat (http://www.redhat.com) & Novell’s Suse Linux Enterprise Server (http://novell.com)

• c|net Technology Review:
  http://www.news.com/FAQ-Detangling-virtualization/2100-7339_3-6177477
Questions?

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