VERITAS OpForce™

Datacenter Automation

Jagadish Bandhole
Vice President, Datacenter Automation Products
Agenda

• VERITAS Utility Computing Strategy
  – Phase 1: Automated Resource Mgmt
  – Phase 2: Policy-based/Event-driven
• Problem Space
• VERITAS OpForce Solution
• Key Messages, Value Prop and Benefits
• Customer Use Case Scenarios
• Pricing and Licensing
• Competitive Landscape
• Demo
  – Phase 1
  – Phase 2
• Architecture – Scalability and Extensibility
• OpForce Enabled Solutions
Datacenter Automation?

Discover Inventory → Build Repurpose → Operate Change → Share Optimize → Integrate Extend

JXML – Standards-based Integration Language and Secure Communication Protocol for Automating IT

Why?
Better Utilization
Faster Operations
Greater Efficiency
Enhanced Quality
Lower TCO

Applications

Abstracted Resource Pool

Servers, Blades, Network, Storage

Cluster Monitor
Billing CRM
Enterprise Apps
Homegrown Apps

VERITAS™
VERITAS Utility Computing Strategy

APPLICATIONS

SERVERS

NETWORKS

STORAGE

VERITAS™
VERITAS Utility Computing Strategy

Phase 1

Automating Resource Management

APPLICATIONS

VCS

OpForce

Precise

SERVERS

NETWORKS

Storage Manager

STORAGE
VERITAS Utility Computing Strategy

Phase 2

Policy-based and Event-driven Automation

Service Manager

APPLICATIONS

APPLICAITONS

OpForce

Precise

VCS

SERVERS

Storage Manager

NETWORKS

STORAGE
Problem Space

- Common Questions
- TCO Drivers
- Challenges
Common Business Questions...

• Consolidate datacenters?
• Consolidate or migrate servers?
• Consolidate operations?
• Move away from just-in-case based provisioning?
• Rapidly deploy and provision new systems?
• Better utilize testing infrastructure?
• Implement utility-based computing?
• Improve utilization of existing infrastructure?...
Common Technical Questions...

• Install a new OS on a single server?
• Activate new servers to support peak loads?
• Deploy security patches, OS updates, config scripts...?
• Maintain build consistency across servers?
• Manage IP addresses and configuration?
• Create a new Virtual LAN or a Load balancer IP pool?
• Keep and update your data center asset inventory?
• Access and control remote servers and data centers?
• Manage different tools for different platforms?...

And, what is your administrator/server ratio?
TCO Drivers

Datacenter operational costs are escalating due to

- Greater heterogeneity
- More administrators
- Low service levels
- Low Utilization
- Geographic distribution
Operational Challenges

- Unevenly utilized IT infrastructure
- Leveled productivity of IT operations staff
- Dissimilarity of systems
- Maintaining and managing home grown scripts is not scalable
- Escalated costs of IT service delivery
- Geographically dispersed IT resources
VERITAS OpForce Solution

- Overview
- Platform Support
- Features
- Scalable and Secure Architecture
- Typical Deployment
- Product Roadmap
- VERITAS Integration Roadmap
VERITAS OpForce

Solving the major pain points in day-to-day operational management of IT infrastructure

What is OpForce?

- **Enterprise Infrastructure Automation Software**
  - Web-based management environment for System Administrators

- **Systems and Network Provisioning and Operation**
  - On-demand Provisioning, Configuration, Bare-metal Discovery, Inventory Tracking, System Recovery, Remote Access, Software Deployment…

- **Heterogeneous Datacenters**
  - Fully integrated, cross platform solution for systems (Windows, Linux, Solaris, AIX…) and IP networks (VLAN & non-VLAN)

<table>
<thead>
<tr>
<th>Discover</th>
<th>Inventory</th>
<th>Provision</th>
<th>Access</th>
<th>Operate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-discovers servers with or without OS (including blades)</td>
<td>Tracks server hardware components. Creates and profiles server snapshots</td>
<td>Automates server provisioning and deployment in a multi-tiered infrastructure</td>
<td>Secures remote access to servers across the network</td>
<td>Manages access policies, server snapshots, and software deployment</td>
</tr>
</tbody>
</table>
VERITAS OpForce Platform Support

• OpForce Management Server

Microsoft®

Sun microsystems

• OS

Microsoft®

Sun microsystems

• Servers and Network Devices

DELL™

Sun microsystems

HP

Cisco Systems

F5

intel.

IBM®

• Blades

DELL™

Sun microsystems

HP

intel.

IBM®
OpForce Features

• Discovery
  – Bare metal discovery of servers, blades, chassis
  – Live server discovery of servers, blades, chassis, Ethernet switches (Cisco), IP load balancers (F5)

• Inventory
  – Track servers, images, OS configurations, IP, VLANs, VIPs, OS/application licenses
  – Custom reports using grouping and search filters
  – Exporting reports for post-processing and charting

• Security
  – Clients
    • SSL, Certificates
  – Network (Management Server, Agents, Devices)
    • MD5 Authentication, SEAL Encryption, SSH
OpForce Features (contd.)

- **Provisioning and Repurposing**
  - Automatic provisioning of servers
    - From first principles
    - From templates
  - Imaging
    - Fully baked OS+patches+apps images
    - Base OS image with add-on patch and application provisioning
    - Volume manager support (VxVM/VxFS on Solaris)
  - Snapshots
    - Server image snapshot save and restore
    - Full and Incremental imaging
    - View and edit file-mode images offline (in a dot release)
  - Software Distribution
    - Patch or application or utility packages that can be mass deployed to servers and executed
    - Pre-boot software distribution support for RAID, BIOS and Firmware updates
  - Multi-mode Support
    - Dedicated servers (with or without VLAN)
    - Shared pool of servers (with or without VLAN)
    - Best-fit analysis to verify compatibility between images and servers using image and server constraints
  - Network provisioning
    - Save / restore configuration snapshots of switches and load balancers
    - IP address space, VLAN, VIP management
    - Network topology creation, removal and modification
OpForce Features (contd.)

- Scripting and Extensibility
  - Integration
    - JXML, Perl and Java APIs enable client-side application development, integration with 3rd party apps and scripting
  - Customization
    - JXML Beanshell Framework APIs enable server-side extensions to OpForce (backend and UI) to support customized commands and workflow
- Scheduling
  - Time-based
    - Batch-processing of one or more commands at a specified time
    - Exception handling within jobs
  - Event-based
    - Batch-processing of one or more commands based on an internal event or on an external event
    - Mechanisms for defining and adding external events from 3rd party apps and converting it to a normalized OpForce event format
OpForce Features (contd.)

• Role Based Administration
  – Roles and Authentication
    • LDAP and AD support for users and roles
  – Access Control
    • Fine-grained ACLs for OpForce operations and resources

• Events
  – Logs
    • Detailed event logs of every OpForce operation (effected either through GUI or APIs or scripts)
  – Troubleshooting
    • Layman messages and additional attributes attached to every event enable effective troubleshooting
  – Auditing
    • Change or license or usage related events enable auditing
  – Chargeback
    • Time-stamped server, IP, VLAN, license usage events provide necessary substance for implementing chargebacks
  – Export
    • Exporting events for further post-processing enables feeding into billing or service management or trouble ticketing software
OpForce Architecture and Solutions
Typical Deployment

- OpForce Database, LDAP, AD Servers
- IP Switches
- VTP Domain
- Remote Power Controllers
- Production Network
- Computing On Demand for Performance
- Computing On Demand for Availability
- Serial / KVM Concentrators
- R&D Network
- Spare Servers
- VLAN 2
- VLAN 3
- VLAN 4
- Blades
- LB
- Computing On Demand for Availability
- Shared Pool Network
- OpForce Image and Configuration Storage Servers
- Internet
- Administrators
- Engineers
- Operators
OpForce Enterprise Edition 3.0
- Jobs & Scheduling
- Role-Based Administration
- Incremental Snapshots
- Inventory of “Live” Servers
- Server-side Scripting
- LDAP Support
- Advance Reporting
- Workload Management
- AIX 4.3 and 5.1 Support
- Windows 2003

OpForce Enterprise Edition 3.x
- Provisioning Templates
- SuSE Linux
- Server Pre-Deployment
- Intel and IBM Blades
- 64-bit Windows and RedHat Linux Support for Itanium Servers

OpForce Enterprise Edition 4.0
- SNMP-based Network Discovery
- Event Management
- Software Change Management
- Policy Manager
- HP UX, FreeBSD, United Linux
- Clustering Aware
- Virtual Machine Support
- Storage Provisioning
- FC Switch and HBA Support
- Built-in VLAN Switch Support in Dell, Intel, HP, Sun, IBM Blades

Q2 ‘03
Q4 ‘03
Q2 ‘04
VERITAS Integration Roadmap

OpForce Enterprise Edition 3.0

- VERITAS Volume Manager and File System Support (Solaris)

OpForce Enterprise Edition 4.0

- VERITAS Volume Manager and File System Support (Windows, Linux, AIX, HP-UX)
- VERITAS SanPoint Control Integration
- VERITAS Cluster Server Integration

Q3 ‘03 - Q2 ‘04

Note – Current plan; Subject to change
OpForce
Key Messages,
Value Proposition
and Benefits
OpForce Objectives

• To deliver a significant ROI
  – *How?* By dramatically reducing the TCO
  – *Why?* HW and SW purchase only half the TCO of a server in a network

• To simplify IT infrastructure management
  – *How?* By automating labor-intensive operations
  – *Why?* Too many tasks remain manual, too many point solutions required

• To increase availability
  – *How?* By reducing downtime
  – *Why?* Server and network management should not impede operations

• To accelerate time-to-deployment
  – *How?* By speeding up the provisioning process
  – *Why?* New apps should generate business benefits faster
Key Messages

• First and only cross-platform server automation product
• First and only cross-platform blade management product
• First and only product to provide a holistic view of compute and network resources (add to it storage resources in the next version)
• Proven technology being shipped by Dell and Intel with every blade server
• Recognized by industry analysts as the strongest offering in its category
• Most extensible product in its category
• Installed base of customers
  – Telco (SBC)
  – eBusiness (WebEx)
  – Technology (Texas Instruments, BEA)
• Growing list of pilot implementations as part of strategic initiatives (typically mentioned only under NDA until they agree to being references)
  – Financial (CSFB, Morgan Stanley)
  – Service Providers (Datalex, LogicaCMG)
Key Business Benefits

Server automation delivered via resource provisioning

- Server Utilization
- Administrator Productivity
- Infrastructure Flexibility

Reduce Downtime
Who needs OpForce?
What is the value proposition?

- **Automate operations management** tasks for superior asset utilization, while freeing skilled staff for value-added tasks
- **Accelerate server and VLAN deployment** from days to hours or minutes
- **Reduce costs of software development process** through reduced administration and improved integrity of test and stage environments
- **Enhance disaster recovery** through rapid redeployment of complete system configuration and state at any site
- **Enable enterprise-wide utility computing** for superior asset utilization and workload management. Server or data center consolidation can be a first step
# Usage-based Customer Segmentation

<table>
<thead>
<tr>
<th></th>
<th>Build</th>
<th>Operate</th>
<th>Optimize</th>
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</thead>
<tbody>
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<td>Future Investment</td>
<td>Build</td>
<td>Operate</td>
<td>Build</td>
</tr>
<tr>
<td>Current Functionality</td>
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## Important OpForce Features

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<th>Build</th>
<th>Operate</th>
<th>Optimize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterogeneous, RAID/BIOS Updates, Intelligent Server Provisioning, Incremental Snapshots, Auto Discovery, Volume Manager</td>
<td>Network Provisioning, Integration with Layer 2 and Layer 7 Network Devices, Remote Access, Scripting and Scheduling, Software Distribution, Configuration and Change Management, Extensible Command Set, Standards Based Integration APIs</td>
<td>Heterogeneous, Event Driven Provisioning, Intelligent Workload Management, Shared Server Pool, Integration with VCS, Precise and Storage Manager, Standards Based Integration APIs</td>
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## Summary

<table>
<thead>
<tr>
<th>Revenue Potential</th>
<th>Margin</th>
<th>Opportunity Type</th>
<th>Sales Cycle</th>
<th>Organization</th>
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<tbody>
<tr>
<td>$$</td>
<td>Low</td>
<td>Tactical</td>
<td>Short</td>
<td>R&amp;D, Production, Support</td>
</tr>
<tr>
<td>$$$$$</td>
<td>Medium-High</td>
<td>Tactical</td>
<td>Medium-Long</td>
<td>Production</td>
</tr>
<tr>
<td>$</td>
<td>High</td>
<td>Strategic</td>
<td>Long</td>
<td>Utility Computing</td>
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</table>
OpForce: Before and After

- Component Centric
- Manual Processes
- Dedicated Hardware Silos
- Just-in Case Provisioning
- Specialized Skill
- Day and Weeks
- Many Point Tools
- Trial and Error

- Service Centric
- Automated Deployment
- Shared Resource Pool
- Just-in Time Provisioning
- Versatile Administration
- Hours and Minutes
- One Integrated System
- Consistent and Repeatable
Key Feature Differentiators

- Bare-metal and live-server discovery
- Just-in-time provisioning and on-demand computing services – interactive or event-driven
- True support for heterogeneous environments
- Holistic view of the data center – servers, IP networks and in the future, storage and applications
- Support for both utility-mode and dedicated-mode IT
- Extensible command interface for integration and creating custom commands
- Integration with VERITAS Applications
  - Foundation Suite
  - Cluster Server
  - Storage Manager
  - Application Performance Management
Common Customer Use Case Scenarios
Server Replication and Update

- Bare Metal Auto-Discovery
- Full System Personalization
- BIOS, RAID and Firmware Update
- Centralized Image Management
- Automated Deployment and SW Updates
- Remote Access
- Role-based Administration
- Authentication via Network Directories
- Reporting

Internet

OpForce™

Router

Switch

Web Servers

Application Servers

Database Servers
Dynamic Server Provisioning

- Resource Pooling
- Network Personalization
- Snapshot Save and Restore
- Image-based Server Save/Restore with Deltas (Incrementals)
- Backup/Recovery of Network Devices
- Server Repurposing
- Scripted Tasks, Job Scheduling, Policy Management for Dynamic Provisioning

OpForce™

Router

Switch

Internet

Web Servers
Application Servers
Database Servers
Resource Pool

VERITAS™
Workload Management

- VIP Pool Creation
- Add & Remove Servers to a Pool
- Backup and Restore Device Configurations
- VLAN Management

Diagram:
- Internet
- Router
- VLAN 1
- VLAN 2
- VLAN 3
- VLAN 4
Manual Provisioning vs. OpForce

1. Acquire IP Address
2. Acquire Network Settings
   ✓ Subnet Mask, DNS, Gateway, Switch Port #
3. Acquire VLAN Settings
4. Plug the server to the switch
5. Power on the server
6. Install the OS and Patches
7. Reboot the server when applicable
8. Install and configure Volume Manager
9. Install and configure File System
10. Install & configure Clustering software
11. Enter the network settings
12. Install Applications
13. Reboot the server when applicable
14. Test network connectivity
15. Configure and personalize the applications
16. Make sure applications are up and running

1. Plug the server to the assigned switch port
2. Power on the server
3. Accept the newly discovered server
4. Choose the destination network
5. Provision the server with an existing Snapshot
6. Restart the server from OpForce console
   ✓ Automatically acquires the destination networks settings
7. Access the server remotely
Point Tools vs. OpForce

1. Acquire IP Address
2. Acquire Network Settings
   ✓ Subnet Mask, DNS, Gateway, Switch Port #
3. Acquire VLAN Settings
4. Plug the server to the switch
5. Power on the server
6. Edit the appropriate scripts
7. Choose the base OS image
8. Select the patches
9. Install Base OS image and post boot patches
10. Install and configure Volume Manager
11. Install and configure File System
12. Install & configure Clustering software
13. Edit the network settings
14. Telnet to the switch and modify VLAN Settings
15. Run Scripts to Install Applications packages
16. Configure and personalize the applications
17. Make sure applications are up and running

1. Plug the server to the assigned switch port
2. Power on the server
3. Accept the newly discovered server
4. Choose the destination network
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7. Access the server remotely
Pricing and Licensing

• Structure and Fee
OpForce Pricing and Licensing

• OpForce Server
  – One Server Needed
    • Intel $7,500
    • Non-Intel $15,000

• OpForce Managed Server
  – Per CPU
    • Intel CPU $500
    • Non-Intel CPU $750

Example:

• Customer has Linux server designated for the OpForce Server
• Customer would also like to use product for deployment of 20 Intel-based servers (1 CPU each) to support web server farm

<table>
<thead>
<tr>
<th>Server</th>
<th>$7,500</th>
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</thead>
<tbody>
<tr>
<td>Managed Server</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

Total Price $17,500
Competition

- Landscape
- Differentiation
## Competitive Landscape

<table>
<thead>
<tr>
<th>Scope</th>
<th>Server</th>
<th>Server, Application</th>
<th>Server, Network, Storage, Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>R&amp;D Labs, Support Labs, Production Datacenters</td>
<td>Production Datacenters</td>
<td>Utility Computing, Next Generation Datacenter</td>
</tr>
</tbody>
</table>

### Build

#### Operate

#### Optimize

### Competitors

<table>
<thead>
<tr>
<th>Competitors</th>
<th>Altiris, Ghost, Jumpstart</th>
<th>Opsware</th>
<th>HP UDC, Sun N1, IBM Tivoli, CA Unicenter</th>
</tr>
</thead>
</table>

### Competitor Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Platform-Specific Point Tools, Server Only, Storage Unaware</th>
<th>Patch and Configuration Management, Weak Architecture, Native Inflexible Server Provisioning, Service Delivery Focused, Large Service-Oriented Deals</th>
<th>Large Bundled HW+SW+Services Solution, Vendor Lock-in, Native Inflexible Server Provisioning, Monitoring and Service Delivery Focused, Old Architecture</th>
</tr>
</thead>
</table>

### VERITAS Differentiation

<table>
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<tr>
<th>Veritas</th>
<th>Heterogeneous, RAID/BIOS Updates, Incremental Snapshots, Auto Discovery, Remote Access, Volume Manager</th>
<th>Deeper &amp; Intelligent Server Provisioning, Integration Layer 2 and Layer 7 Network Devices, Extensible Command Set, Standards Based Integration APIs</th>
<th>Heterogeneous, Event Driven Provisioning, Intelligent Workload Management, Standards Based Integration APIs</th>
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**VERITAS**
Competitive Landscape

Source: Forrester Research '03
Competitor Segmentation

• Build, Operate, Optimize – Utility Computing
  – Sun N1 Provisioning Server
  – Opsware
  – IBM Autonomic Computing (Think Dynamics)
  – HP UDC

• Build – Vendor Specific Server Management
  – Sun JumpStart (Solaris)
  – IBM NIM (AIX)
  – HP Ignite (HP-UX)
  – IBM RDM/IBM Director (Windows & Linux)
  – HP Smart Start (Windows & Linux)
  – Windows ADS (Windows)

• Build – Server Imaging Tools
  – Altiris
  – Symantec Ghost
## OpForce vs. Utility Computing Offerings

<table>
<thead>
<tr>
<th>Feature</th>
<th>VERITAS OpForce</th>
<th>IBM Think Dynamics</th>
<th>Sun N1</th>
<th>HP UDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Metal Server Discovery</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>In-Context Provisioning</td>
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<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Image-based Server Provisioning</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Resource Pooling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Service Provisioning</td>
<td>X</td>
<td>Limited</td>
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<tr>
<td>Rule-based, Event-driven Provisioning</td>
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<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Operation Abstraction</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Software Deployment</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Role-based Administration</td>
<td>✓</td>
<td>Limited</td>
<td>Limited</td>
<td>Limited</td>
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<tr>
<td>Network Directory Authentication</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>OS Support</td>
<td>Win/Linux/Solaris/AIX</td>
<td>Win/Linux/Solaris/AIX/HP-UX</td>
<td>Solaris</td>
<td>HP-UX</td>
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## OpForce vs. Altiris/Ghost

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<td>Win/Limited Linux</td>
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</table>
Demo

• Automated Resource Management
• Event-driven Provisioning
Competition

- Details and Differentiation
Sun N1 Provisioning Server

• Details
  – Generic N1 provisioning product is based on acquired technology from TerraSpring
    • Utilizes EMC boot-over-SAN mechanism
  – Blade provisioning server is based on Sun Jumpstart point tool

• Limitations
  – All Jumpstart limitations apply (covered in a separate slide)
  – Boot-over-SAN is unreliable on Windows due to remote pagefile I/O issues
  – Post-acquisition, it is completely Sun Solaris centric
    • No announced support for other operating systems
  – Support for Sun blade servers only (as of today)
  – No auto-discovery of servers and inventory tracking
  – No auto-discovery of VLANs or layer-2 switches or SLBs
  – No knowledge of cross-platform volume management and file systems
  – Requires rewiring of the data center
    • Must manually map the server/switch/switch port physical connectivity
  – Basic client-side Scheduling and Scripting
  – No extensible command interface to integrate home-grown applications and create custom commands
  – No integrated Remote Access
  – No integrated Software Deployment
HP UDC

• Details
  – Based on the Source Level licensing from TerraSpring
  – Recent partnership with Opsware (6/1/03)

• Limitations
  – HP hardware and services centric
  – More of an initiative filled with 3rd party tools rather than an integrated, enterprise software
  – No auto-discovery of servers
  – No auto-discovery of VLANs
  – Requires rewiring of the data center
    • Must manually map the server/switch/switch port physical connectivity
  – Scheduling and scripting
  – Remote Access
  – Software Deployment
IBM/Think Dynamics

• Details
  – Focused on “Service Provisioning” using resource pools
  – Predictive modeling, using SNMP, to match resources to application requirements.

• Limitations
  – No bare-metal server discovery
  – No image-based server provisioning
  – No in-context provisioning
  – No support for on-the fly personalization (NICs, and VLANs)
  – No infrastructure level operational scheduling and scripting
  – No integrated remote access
  – No software distribution capabilities
  – No knowledge of cross-platform volume managers and file systems
  – Top-down architectural approach
Opsware

• Details
  – Previously Loud Cloud
  – Productized version of what Loud Cloud offered as a service
  – Primary focus on patch and application configuration management
  – Partnerships with EDS and HP
  – Primarily focused on large price points
  – Yet to generate any profits

• Limitations
  – Focused solely on unattended install of OS and applications
  – Customer must create the unattended install packages
  – Not architected as a shrink-wrapped enterprise software
  – Heavy reliance on implementation and customization services to work
  – No server or VLAN discovery
  – No server imaging capabilities
  – No knowledge of cross-platform volume managers and file systems
  – Not capable of rapid deployment of servers
    • Must reinstall operating system and applications in a piece meal fashion
  – Targeted at companies with environments that are static, not dynamic
  – Top down architectural approach
Sun JumpStart, IBM NIM, HP Ignite

• Details
  – Point tools for configuring Sun Solaris, IBM AIX, HP-UX

• Limitations
  – Does not have any discovery and inventory capabilities
  – Does not have any remote access capabilities
  – No scheduling or jobs
  – Cannot redeploy or repurpose servers
  – Cannot configure multiple NICs
  – Cannot provision servers in the context of networks, VLANs or SLBs
    • Switches and Server Load Balancers must be configured manually
  – No server imaging capabilities (incremental saves etc.)
  – Requires a lot of custom scripting
IBM RDMS

• Details
  – Point tools for provisioning IBM and HP x86 platforms

• Limitations
  – First time server deployment tool
  – Linux and Windows only support
  – Lack of security measures
    • Role-based Administration
    • Network Directory Authentication
  – No Software deployment
  – No Network or VLAN awareness
    • Can not configure NICs
    Switches and Server Load Balancers must be configured manually
  – $100 - $150 per CPU
Microsoft ADS

• Details
  – Part of Microsoft Dynamic Systems Initiative (DSI)
  – Basic tool to PXE boot ADS

• Limitations
  – Only sector mode (block mode) support – no file-mode support yet
  – Windows only – further restricted to only server editions
  – No discovery, inventory functions
  – No network understanding
  – No storage support or integration
  – No remote access support or integration
  – Point tool as opposed to extensible product (no APIs)
  – No VERITAS integration
Altiris and Symantec Ghost

• Details
  – Requires Windows Console
  – Popular in setting up new windows desktops or laptops

• Limitations
  – Windows Based
  – Mainly a disk imaging tool
  – Little Support for Linux
  – No software deployment
  – Lack of security measures
    • Role-based Administration
    • Network Directory Authentication
  – No support for UNIX
  – No notable network awareness
HP SmartStart / Proliant RDP

- Limitations compared to VERITAS OpForce
  - Point tools for provisioning HP x86 platforms
  - First time server deployment tool
  - Linux and Windows only support
  - Lack of security measures
    - Role-based Administration
    - Network Directory Authentication
    - Encryption of communication
  - No Software deployment
  - No Network or VLAN awareness
    - Can not configure NICs
    - Switches and Server Load Balancers must be configured manually
    - Cannot manage IP address space
  - No best-fit-analysis of image-hardware
  - No in-context intelligent provisioning of network of servers
  - No integrated remote desktop access or shell access
  - No extensibility features that enables creation of compound custom commands
  - No in-built advanced scheduling, job control and event-driven operations
  - Limited logging capabilities – not very useful for extensive troubleshooting or auditing or chargeback
  - No integration capabilities with homegrown tools with APIs
  - No VERITAS volume manager or filesystem support
  - No RAID, BIOS, Firmware remote update capabilities
  - Requires many manual steps and creation of DOS-based boot disks
  - No repurposing or shared pool capabilities
OpForce Enabled Solutions
OpForce Solutions

- Computing-On-Demand
- Continuous Performance w/ JIT Provisioning
- High Availability (Dynamic System Failover - Clustered or Un-clustered)
- Dynamic Workload Management (Clustered or Un-clustered)
- Disaster Recovery
- Consolidation
- Continuous Server Utilization w/ JIT Provisioning
- Rapid Infrastructure Deployment
- Testing Infrastructure Lifecycle Management
Computing-On-Demand

Step #1 – Server Discovery
- A new server taken out of the cardboard box, plugged into an IP network and booted
- OpForce Server automatically discovers the new server at boot time, interrogates it, and captures information about it’s hardware assets
- Server hardware assets captured in the OpForce Server database

Step #2 – Registering a Golden Build
- A Golden build is registered with the OpForce Server
- Golden Build Image is downloaded to the OpForce Server
- Description of hardware assets of the Golden Build Server are also captured

Step #3 – Server and Network Personalities
- The OpForce Server holds a number of entities which are used when a new server is provisioned to give it a unique identity. Examples are:
  - Hostname
  - IP address, Subnet Mask
  - COMPUTER_NAME (Windows 2000), SID
  - VLAN, DNS, Gateway, Routes

Step #4 – New Server and Network Provisioning
- Either driven by the administrator, or by an external initiator, a provisioning request is made
- Hardware assets are matched between registered servers in the bare-spare pool, and the requested Golden Build
- Golden Build image is downloaded to one or more servers
- New server moved into production by VLAN switch
Continuous Performance

Load Balancer Bandwidth Smoothing

- Response Time
- Load Balancer
- Web Servers
- Pre-staged Pool
High Availability
Clustered or Un-clustered Node Failover

• On server fault, VCS make a Provisioning Request for a replacement server from the Pre-Staged Server Pool
High Availability

Case study: VCS & automated provisioning

**VCS without Provisioning**
- 6,000 total nodes
  - 4,500 active servers in 4 node (3 active/1 standby) clusters
  - 1,500 standby servers

**VCS with Provisioning**
- 4,650 total nodes
  - 4,500 active servers in 4 node (4 active) clusters
  - 150 standby servers in unprovisioned pool

- Estimated hardware and HA software cost: $114 million

- Estimated hardware and HA software cost: $89 million
Workload Management

Clustered or Un-clustered Dynamic Provisioning

- In a resource constrained cluster, new system resources can be added dynamically by provisioning.

- Database: CPU = 80%
- CRM: CPU = 85%
- HR System: CPU = 20%
- Pre-staged Pool
Disaster Recovery
Cost-optimized Shared Systems and Re-purposing

• **Detection:** VERITAS Global Cluster Manager detects there’s been a datacenter failure

• **Identification:** Admin approves “red-button” event, and kicks-off DR plan

• **Solution:** Reconfigure DR Datacenter to look like Primary Datacenter prior to disaster, then move databases to DR Datacenter

• **Automated Correction:** OpForce re-images HR servers at DR datacenter to look like DB servers from Primary Datacenter, then VERITAS Global Cluster Manager moves databases to DR Datacenter
Consolidation *(datacenters)*

*Part I – Physical Consolidation*

**Steps**
1. Save Server Snapshot
2. Shutdown Servers
3. Move Server
4. Personalize
5. Consistency Checks
6. Bring Servers Up

Datacenter 1: 101.1.0
Datacenter 2: 202.253.0.0
Datacenter: 15.1.1.1
Consolidation (servers)
Part II – Rack / Pedestal Servers ➔ Protection Domains

Steps
1. One Server ➔ LPAR
2. Save Server Snapshot
3. Restore Snapshot
4. Personalize
Consolidation (servers)

Part III – Rack / Pedestal Servers ➔ Blade Servers

Steps
1. One Server ➔ Blade
2. Save Server Snapshot
3. Restore Snapshot
4. Personalize

1U/2U Rack Servers or Pedestal Servers

Blade Servers
Consolidation (servers)
Part IV - Rack / Pedestal Servers ➔ Virtual Machines

Steps
1. One Server ➔ VM
2. Save Server Snapshot
3. Restore Snapshot
4. Personalize

1U/2U Rack Servers or Pedestal Servers

Virtual Machines
Virtual Machines
Virtual Machines
Consolidation (operations)
Part V – Operational Consolidation

Steps
1. Discover
2. Inventory
3. Provision
4. Configure
5. Access
6. Troubleshoot

Diagram:
- OpForce Database, LDAP, AD Servers
- IP Switches
- VTP Domain
- Remote Power Controllers
- Blades
- VLANs 2, 3, 4
- LBs
- Computing On Demand for Performance
- Computing On Demand for Availability
- Shared Pool Network
- Spare Servers
- Serial / KVM Concentrators
- R&D Network
Continuous Server Utilization
With JIT Provisioning

Steps
1. Identify Systems in “Cold” Spots
2. Save Server Snapshot
3. Repurpose w/ New Snapshot
4. Personalize
5. Deploy to “Hot” Spots
6. Reclaim to Original

50-60% Average System Utilization

# of Servers vs Time
Rapid Infrastructure Deployment

Steps
1. Discover New Servers
2. Provision w/ a New Snapshot
3. Personalize
4. Deploy to appropriate Tier
Testing Infrastructure Lifecycle Management

Steps
1. Test Application with
   • IIS
   • Window 2000
   • HP Blades
2. Test Application with
   • Web Sphere
   • Linux
   • HP Proliant
   • Test Application ...

Your Application

- DB2
- AIX 5.x
- IBM P690
- BEA WebLogic 5.x
- Solaris 7.x
- Sun E220
- Tom CAT 5.x
- RH Linux 7.x
- DELL 2650

Database Tier  App Tier  Web Tier
Architecture – Extensibility and Scalability

- Standards Compliance
- Scalable Architecture
- Extensible Architecture
- JXML API
## OpForce – Standards Compliance

<table>
<thead>
<tr>
<th>Technology</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN</td>
<td>VLANs allows customers to segment their flat networks and contain broadcasts without having to install routers on every segment. OpForce offers support for VLAN-based networks where the customer intends to group servers and segment their network traffic.</td>
</tr>
<tr>
<td>LDAP</td>
<td>The Lightweight Directory Access Protocol, most commonly known as LDAP, has emerged as the preferred Internet Protocol for accessing directory information. OpForce offers added access security via directory-based user authentication.</td>
</tr>
<tr>
<td>SSL/SSH</td>
<td>OpForce Secure Shell support solves the most important threat to network integrity: the stealing device passwords through eavesdropping on IP connections. OpForce SSL support guarantees secure access to OpForce Web-based Console.</td>
</tr>
<tr>
<td>SNMP</td>
<td>SNMP is the standard protocol for managing and monitoring network devices. OpForce enables customers to trigger policies based on SNMP events, or send SNMP Alarms to enterprise consoles such as HP OpenView.</td>
</tr>
<tr>
<td>Network-Boot Protocols</td>
<td>Network Boot protocols, such as PXE, allow servers to be booted from the network. OpForce is able to intercept network boot broadcasts in order to discover bare-mental servers which do not have any pre-installed OS.</td>
</tr>
<tr>
<td>APIs</td>
<td>OpForce a rich set of Java and Perl-based APIs to allow customers and 3rd party developers to extend its functionality.</td>
</tr>
<tr>
<td>XML</td>
<td>XML is the preferred interchange format between unlike systems. OpForce provides XML support for communication with other business-critical applications such as Billing and Metering.</td>
</tr>
<tr>
<td>Multi-Threaded and Throttling</td>
<td>OpForce optimal performance by Multi-Threaded processes to provide parallel execution of operational tasks. It uses Network Throttling techniques to conserve network resources.</td>
</tr>
</tbody>
</table>
Scalable Architecture

VERITAS OpForce UI, Java/Perl SDKs, Other Apps, Custom Scripts

JXML (Intermediate Language)

Presentation Layer

Services Layer

Abstraction Layer

Kernel

Resource Drivers

Physical Resources

Session Manager

Events and Logging Manager

User Manager

Account Manager

Asset Manager

License Manager

Administrative Services Manager

Configuration Manager

Consistency Manager

Storage Manager

VLAN Manager

CPU Manager

Boot Manager

Power Manager

Elemental Server

Distributed Services

JVM

ITAP Agents

TCP/IP Network Fabric

Storage

Switch

Server

Physical Resources
Extensible Architecture

1. Application APIs
   - “Build your own customized infrastructure rollout tool”
   - “Build application deployment into your application”

2. Resource driver API for device integration
   - Servers
   - NICs
   - Switches
   - Load balancers
   - HBAs
   - Storage
   - etc.

OpForce Server

Resource Driver API

Component Plug-ins

Java API
JXML API
JXML Protocol

• XML API (JXML)
  – Datacenter resources description data format
  – Remote procedure call APIs for Elemental platform
  – Commit and rollback for consistency
  – Fully encrypted communication

• JXML Development SDK (JavaTea)
  – Java APIs for building applications on top of Elemental platform
  – Easy to write different user interfaces

• JXML Scripting Module (PerlTea)
  – Perl scripting with easy to use module and pre-defined APIs
  – Enables implementation of point-tool adaptors
  – Easy to integrate into existing custom processes
Example of JXML code for a software configuration description...

<jxml:config-data>
  <jxml:config-pk>
    <jxml:account-name>MyAccount</jxml:account-name>
    <jxml:workspace-name>MyWorkspace</jxml:workspace-name>
    <jxml:config-id>60</jxml:config-id>
  </jxml:config-pk>
  <jxml:config-name>MyConfig</jxml:config-name>
  <jxml:config-scope>WorkSpace</jxml:config-scope>
  <jxml:server-profile-pk>
    <jxml:server-profile-name>DellOptiplex</jxml:server-profile-name>
  </jxml:server-profile-pk>
  <jxml:base-os-pk>
    <jxml:base-os-name>Win2000</jxml:base-os-name>
  </jxml:base-os-pk>
  <jxml:is-gateway>false</jxml:is-gateway>
  <jxml:licenses>win2000;oracle8i</jxml:licenses>
</jxml:config-data>
JXML
Infrastructure Management Operations

- Discovery
- Inventory
- Provisioning
- Configuration
- Change
- Access
- Maintenance
- Troubleshoot
- Audit
- Chargeback
- Recovery