



Server Virtualization Success at Sandia National Laboratories

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Business Case for Virtualization

Why We Virtualized

Low Infrastructure Utilization

Typical x86 servers achieve 10% to 15% utilization of total capacity
Organizations typically run one application per server

Increasing Physical Infrastructure Costs

Central Computing Facility (CCF) running out of space and power
Operational costs rising for cooling, electrical, and space

Physical server refresh required every 3 to 4 years

Disposal/recycle of servers and its associated electronic components is costly and not good for the environment

Increasing IT Management Costs

Insufficient Failover and Disaster Protection with existing systems



Business Case for Virtualization cont.

Enhanced Capabilities with Virtualization

Server Consolidation and Infrastructure Optimization

40 VMs to 1 host server in the beginning, 100 VMs or more to 1 host possible now with some new hosts having 512GB of RAM

Reduction in physical Infrastructure Costs

Power, cooling, space, network

Increased Application Availability & Improved Business Continuity

HA and DRS provide the increased performance and up time

Improved Operational Flexibility & Responsiveness

Virtual servers can be deployed in minutes

Reduced System Administrator Labor

No hardware racking, maintenance, or future replacements



The Quest for Virtualization

Our virtualization journey began after seeing a VMware demo of ESX 2.5

Date	Progress Steps
January 2006	Soon after seeing a demo of VMware ESX2.5, built a virtualization proof of concept cluster
March 2006	First production VMware cluster
June-July 2006	Deployed first Symantec production virtual servers and upgraded to VMware ESX3.0
January 2007	Cost Model developed and began charging for virtual servers
September 2007	Enabled trunk mode to allow multiple VLANs on one port
March 2008	Sandia IT policy for new server-based systems becomes “virtual first”
April 2009	Upgraded to ESX 3.5 with boot to SAN hosts for the first time
September 2009	Upgraded to ESX 4.0 which gave us host profiles, FT, and vDS
November 2010	Rebuilt all hosts to ESXi 4.1 which gave us AD integration, boot to SAN for ESXi, vStorage APIs, and USB passthrough from host to VM
September 2011	Purchased Veeam backup software for all environments and eventually put into production
November 2011	Upgraded to vSphere 5.0 which gave us 32 CPUs and 1 TB of RAM per VM, DRS for storage, 64 TB LUN size, and 10Gb vmotion
March 2012	Upgraded to vSphere 5.0 Update 1
November 2012	Planning our next upgrade to vSphere 5.1 and vCloud Suite

Our current implementation spans 6 partitions and multiple SNL sites with a total of 54 ESXi hosts and 900 virtual servers.



Challenges We Faced

New Technology to Us (Early 2006)

Technology new to Sandia and not well understood
Little understanding/buy-in from management or other server admins

Lack of Funding

No grand plan
Purchased only a couple of servers at a time
Purchased storage as needed with no standard
Built slowly over time adding resources as needed

Lack of Manpower

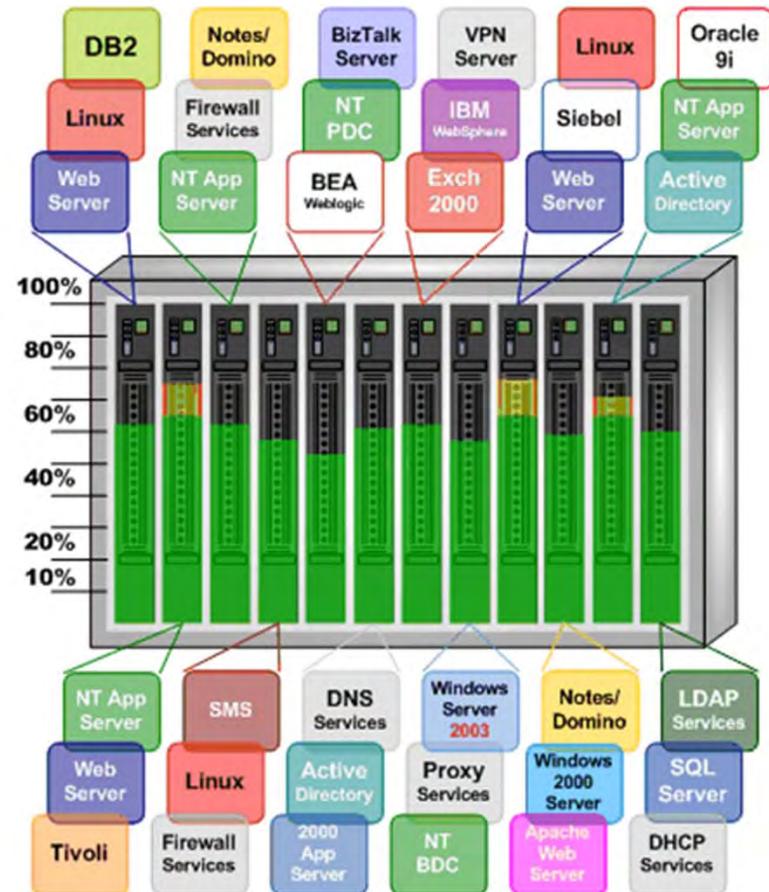
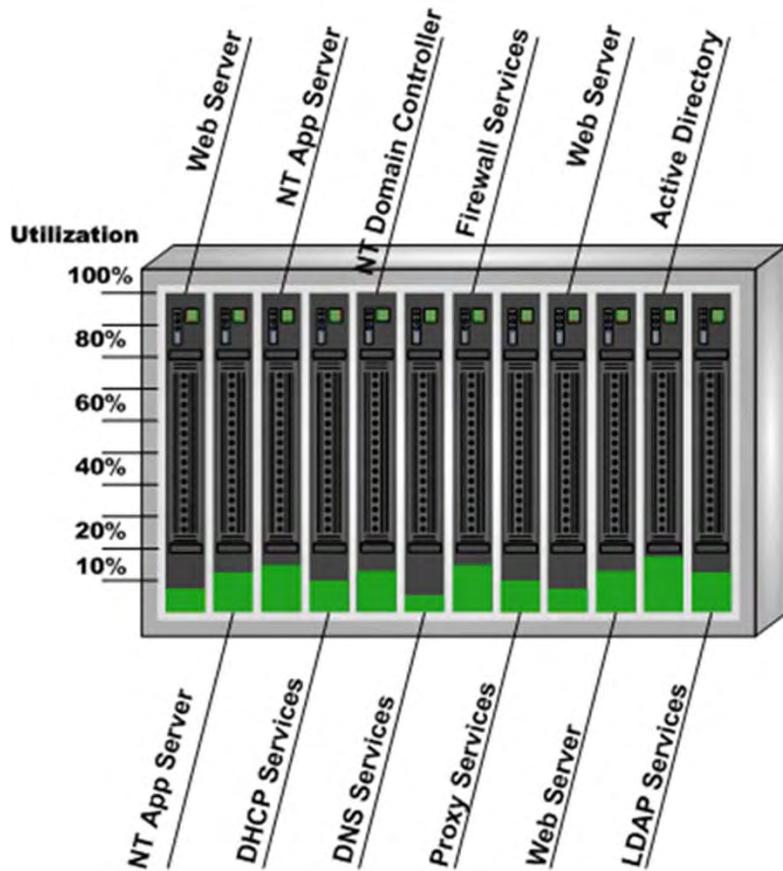
Manpower budgets are constrained, yet infrastructure continues to grow
Staffing model is yet undetermined

New Hardware Vendor Introduced

New hardware purchased without full evaluation/understanding
Virtual networking/other components are complex
Minimal vendor support and problematic



Server Consolidation





Applications Running Virtually

SQL Database

BMC Remedy Ticket System

EIMS Library System

IBM Maximo

Bentley ProjectWise

Business Objects Xlr2

IBM FileNet

Savvion BPM

Forio

Process Dashboard

TEDS – CBM LMS

WFS - Document Library (Stellent)

Reliasoft (reliability tracking) software

Oracle Weblogic General Purpose Java environment

Sharepoint

RSA DLP

Perseus (survey generator software)

ARM – asset risk management

Medical apps

Fleet management applications

Symantec

Blackberry Servers

Dropzone

Capp Servers

Web Servers

Terminal Servers

Cyber Scanning servers

Primavera

and many more



SNL Cost Savings as of 12/06/12

- Energy Savings**

Servers (kWh/yr)	900 Virtual Servers kWh	54 Physical Hosts kWh	Energy Savings kWh/y	Cost Savings Per Year
Direct (Power)	2,365,200	189,216	2,175,984	\$195,839
Indirect (Cooling)	886,950	70,956	815,994	\$73,459
Total	3,252,150	260,172	2,991,978	\$269,298

- Hardware Savings to Date**

- **\$4,411,556**

- ~900 virtual servers @ ~\$6K each = \$5,400,000

- minus the cost of 54 hosts currently in use = \$973,000

- (VMware licenses included)

- minus the cost of ~900 virtual servers using 30GB system partition = 27 TB

- 27 TB * \$572/TB/Year is \$15,444 per year