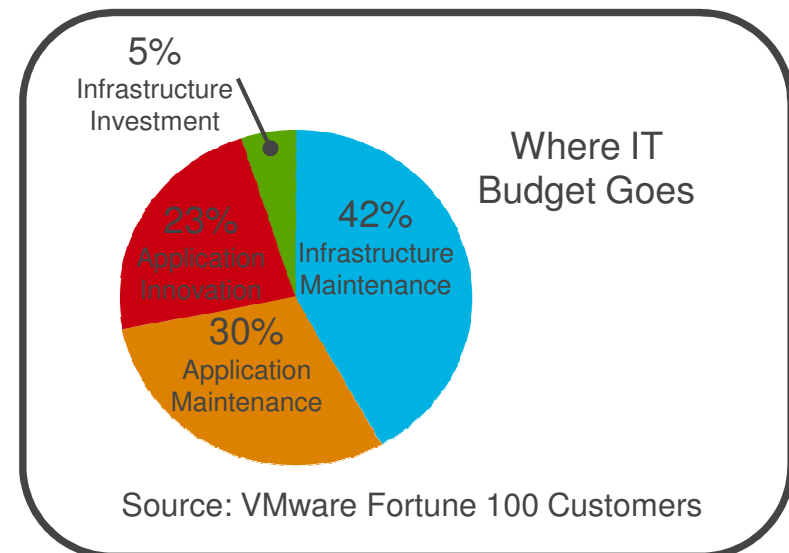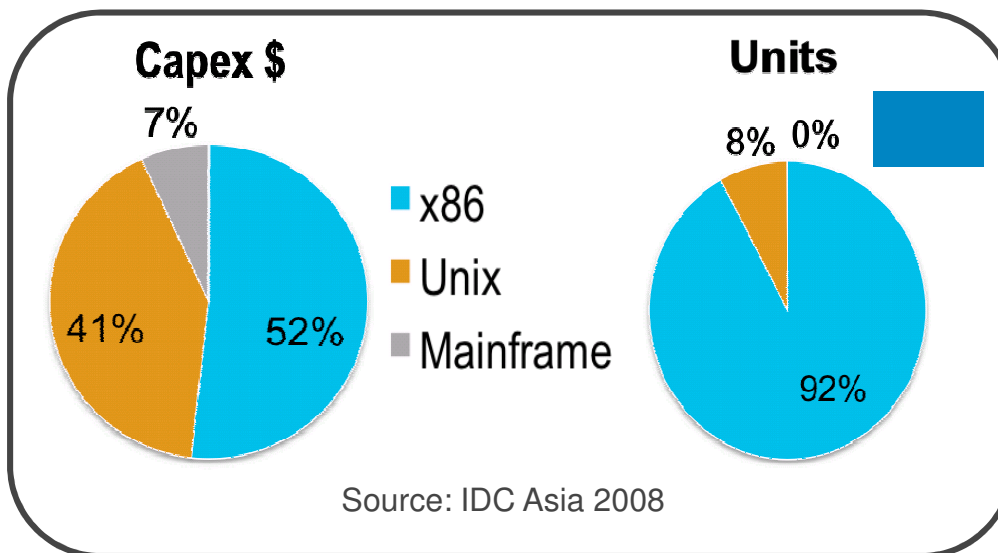# Data Center Virtualization

Next Generation Data Center

Kenny Lin 林健華
System Consultant
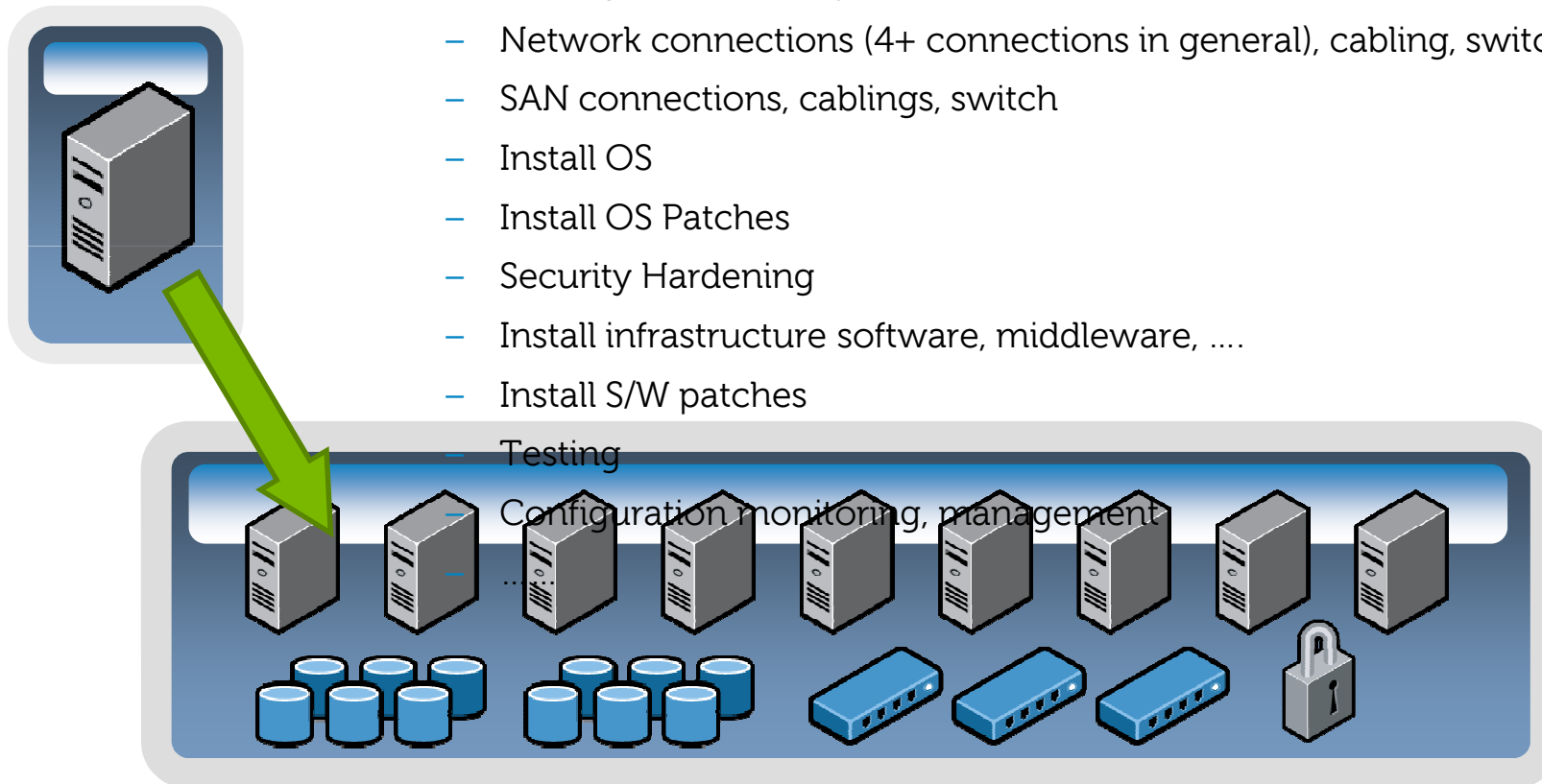
Data Center Pressures Today

- Data growth 40%-70% per year

- Provisioning applications takes 3-6 months

- Low system utilization raises Power & Cooling to 25%-30% of budget

- x86 and Unstructured Data responsible for largest costs, yet is invisible

Capex $

7%

41%   52%

Units

8%   0%

- x86
- Unix
- Mainframe

92%

Source: IDC Asia 2008

5%
Infrastructure Investment

Where IT Budget Goes

23%
Application Innovation

42%
Infrastructure Maintenance

30%
Application Maintenance
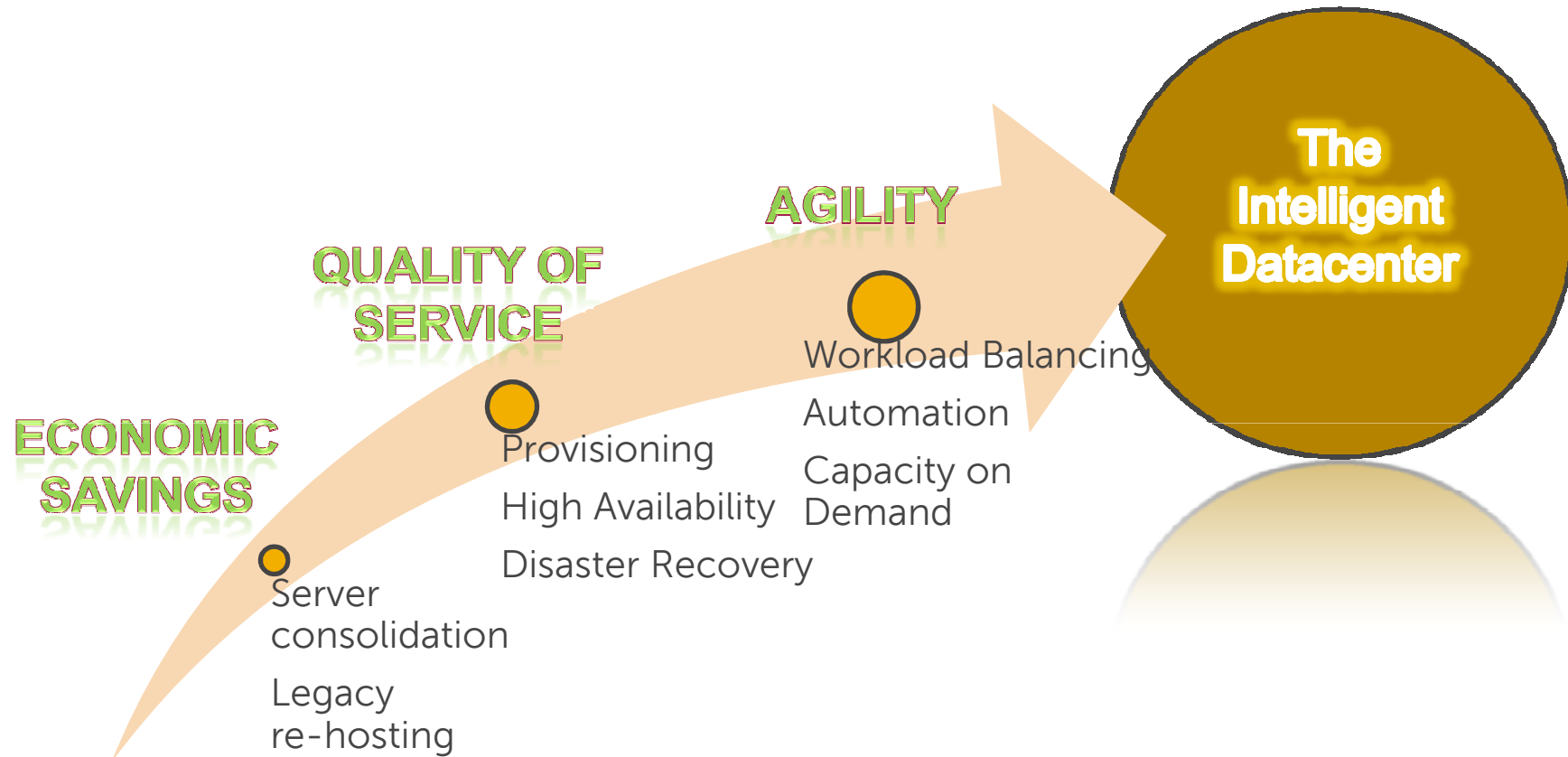
Source: VMware Fortune 100 Customers

Why Virtualization and Cloud?

Without virtualization you simply cannot offer <u>Infrastructure as a Service</u> because provisioning an application server requires:

- Finding rack space
- Getting power supply
- Network connections (4+ connections in general), cabling, switches ..
- SAN connections, cablings, switch
- Install OS
- Install OS Patches
- Security Hardening
- Install infrastructure software, middleware, ….
- Install S/W patches
- Testing
- Configuration monitoring, management
- …:.

VIRTUALIZATION IS THE CORE OF THE vision

The Intelligent Datacenter

AGILITY

QUALITY OF SERVICE

ECONOMIC SAVINGS

Workload Balancing

Automation

Capacity on Demand

Provisioning

High Availability

Disaster Recovery

Server consolidation

Legacy re-hosting

What service does the customer need?

| Just starting out w/ virtualization and reviewing their options	Have justified virtualization, but need to take the next step	Has implemented some virtualization but needs to do more with the environment	Already has Virtualization and requires validation	Needs to speed up their migration-adoption rate
▪ Customer is not currently using Virtualization but knows it is a direction they want to go in ▪ Customer does not have a detailed plan, has not decided on hardware for their project ▪ Customer is not sure of how many servers they can virtualize and have not developed a business case	▪ Customer has had an assessment completed, or they already understand their potential ▪ Customer may (or may not) have a small VM environment but needs to know how to scale it larger, or use it in production ▪ Needs to plan how they will use it and get details on how it will be implemented	▪ Customer has some existing VM environment and needs to understand impact of virtualization on operational processes and / or remove barriers that slow deployments ▪ Customer wants to leverage the environment further and potentially review tools or changes that can help them gain efficiencies	▪ Customer has an existing VM environment ▪ Customer is fairly satisfied with their environment but want validation of their implementation or want to be proactive and identify potential issues ▪ Customer wishes to ensure their environment is both configured and being managed properly	▪ Customer has an existing VM environment ▪ Customer wants to accelerate their migration/adoption rate to realize benefits sooner. ▪ Internal processes and lack of integration of the VM environment is what is slowing the migrations down
Virtualization Assessment VRA	**Virtualization Design and Plan**	**Operational Readiness VORA and VORA-Lite**	**Virtualization Health Check**	**Streamlined Migrations**
▪ Performs non-invasive discovery in the environment ▪ Gathers inventory and performance data on x86 servers ▪ Identify and prioritize the servers that can be virtualized ▪ Develop an ROI model that will validate the move to virtualization and project ROI in the short and long term	▪ Dell consultants work WITH the customer to develop their Design and Plan (Roadmap) ▪ Will document a design including, software, hardware, monitoring, storage, all items required in the virtual environment for long-term production use ▪ Develop a detailed plan to migrate to the new environment to show both how , and what resources are needed to complete the project	▪ Operational Readiness engagements are meant for customers that wish to further integrate their VM environment into their management and business processes ▪ Dell will work with the customer to review their existing operational processes and identify process changes, and tools to gain more efficiencies in the environment.	▪ Dell consultants will review the existing implementation with special focus on the customer's use of the environment ▪ Configurations and uses will be reviewed and compared to best practices ▪ Discrepancies in configuration or risk in the environment will be documents and resolutions will be recommended ▪ This is often used prior to expansion of the environment or upgrades	▪ Dell consultants will work with customer (Via the VORA and Planning sessions as needed) to accelerate the migration pace and adoption rate ▪ Process and procedure review and optimization ▪ Designing review and modification for rapid expansion and deployment ▪ Detailed planning of migrations ▪ Customized tools to manage and report on the migration

虛擬化平臺導入
Methodology

Workshop   **Assessment**   **Design**   **Implementation**   **Manage/Support**
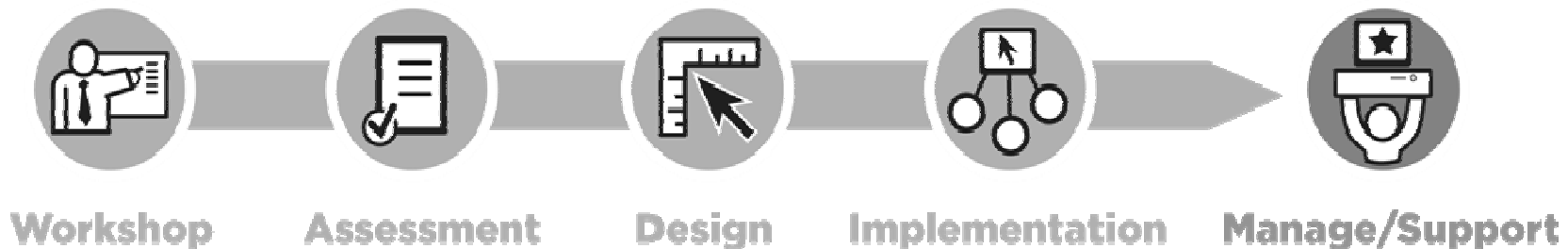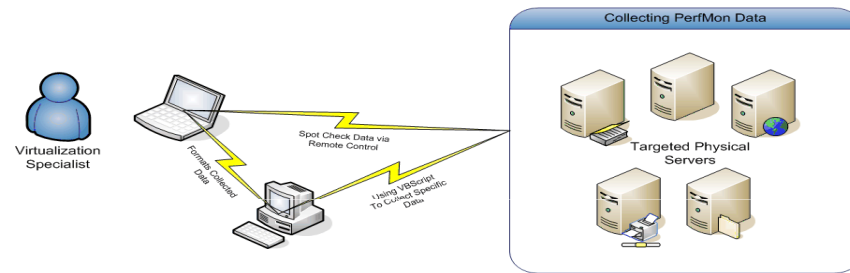
- **Virtual Readiness Assessment**
  - 採用 Tool 進行 Virtualization 與 Consolidation 需求評估與模擬
  - 評估資料取樣日期
  - 標的系統

- **Design 策略**
  - 沿用現有可用 Server 以保護與運用既有投資, 採用新購系統做 Mission Critical 系統虛擬化, 以提供最佳服務
  - 建立 Virtualization Pool , 包含 Hyper-V 與 VMware 兩類, 以提供 Mission Critical 與 Daily Operations 系統
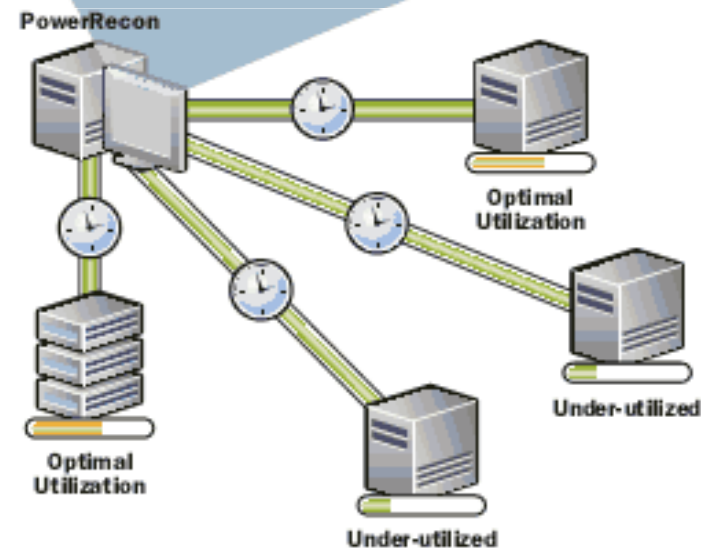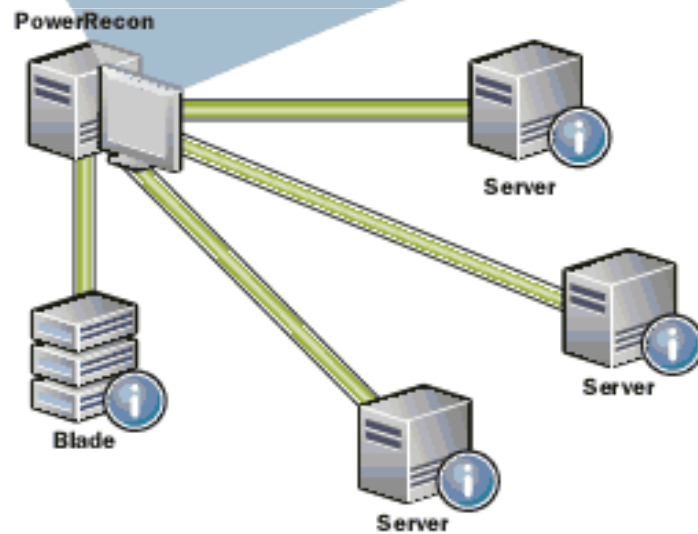
ASSESSMENT METHODOLOGY

- Data Collection: 30 days of unattended data collection on servers

Analysis of application performance metrics and comparison against industry performance benchmarks

Capacity Planning
VRA – CPU, Memory, Disk, Network
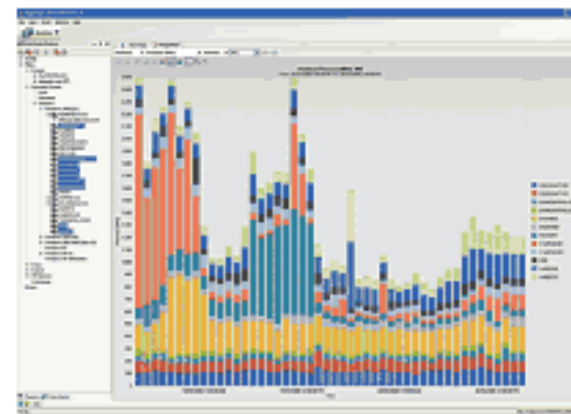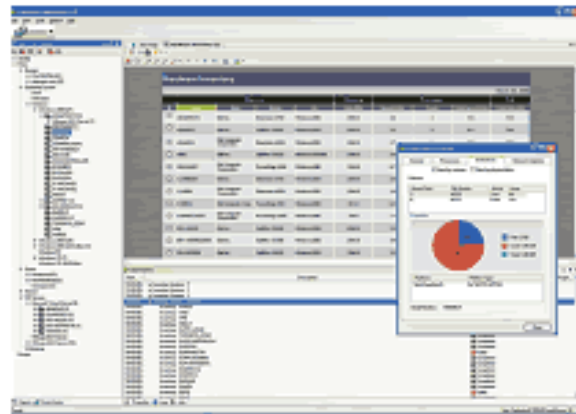
Processor Utilization in Mhz
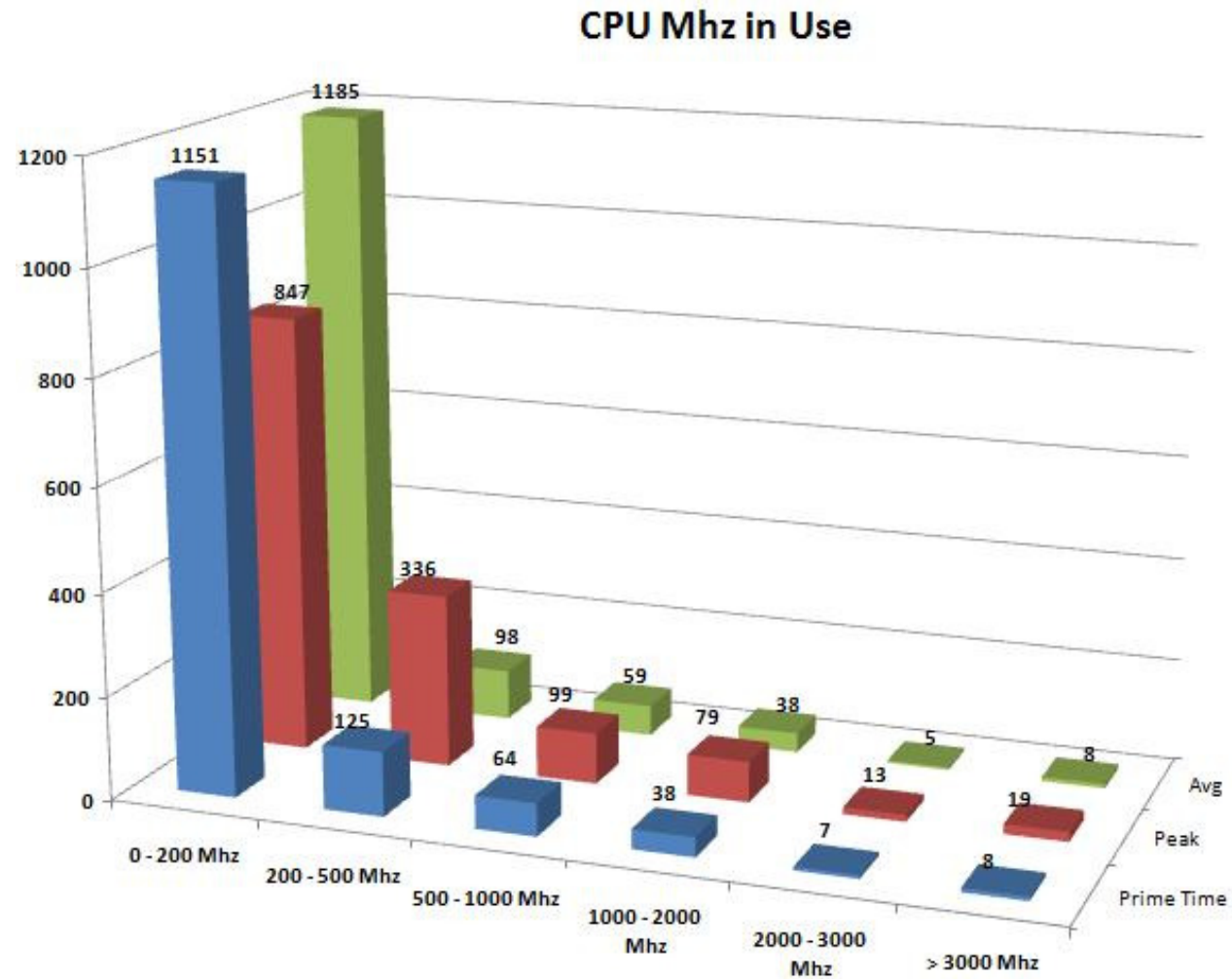
Processor Peak Hours

CPU Peak hours
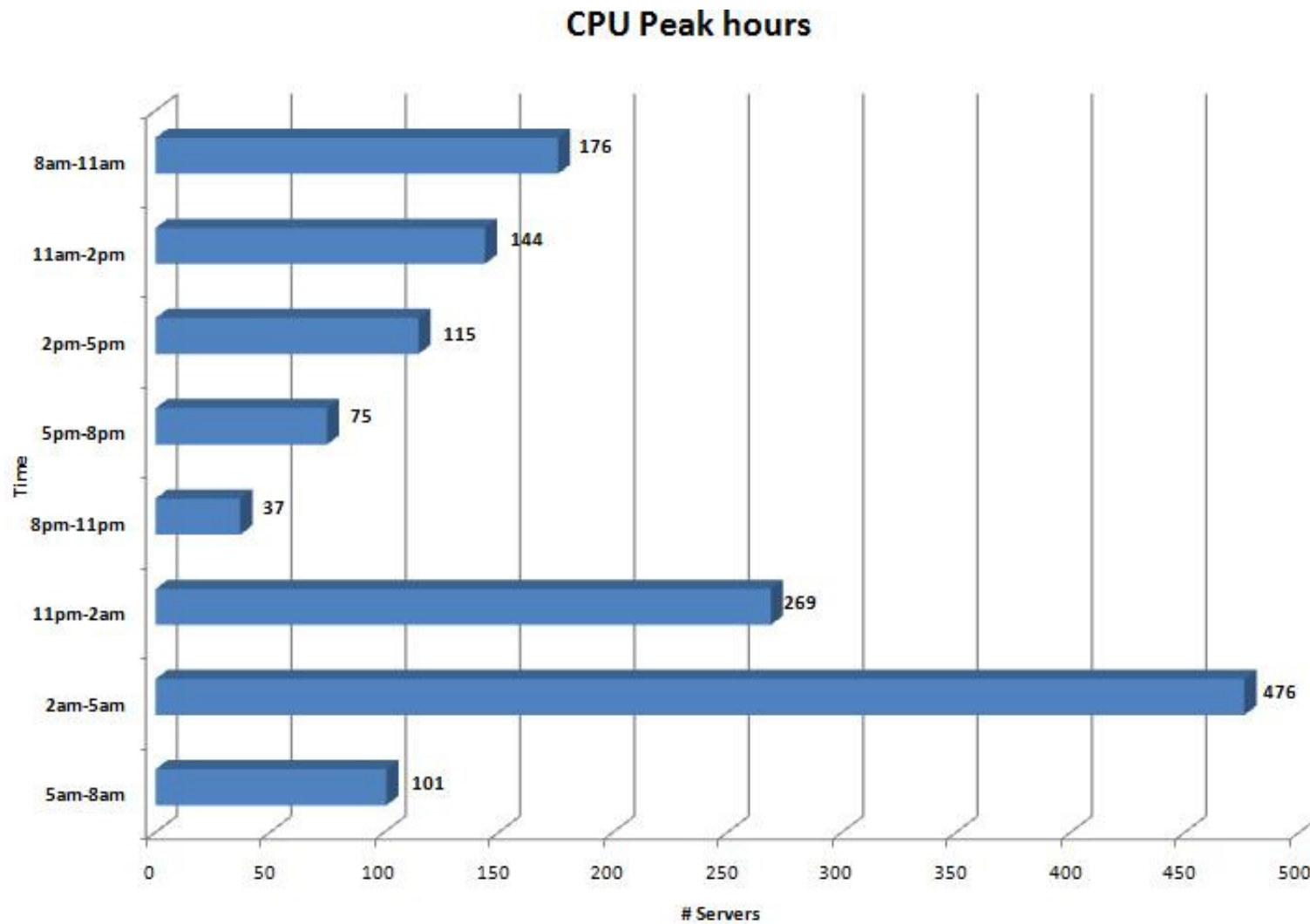
Memory Utilization

Phys. Mem in Use

RAM in Use MB
1536 - 2048
135
10%

RAM in Use MB
> 2048
160
11%

RAM in Use MB
0 - 512
89
6%

RAM in Use MB
1024 - 1536
289
21%

RAM in Use MB
512 - 1024
720
52%
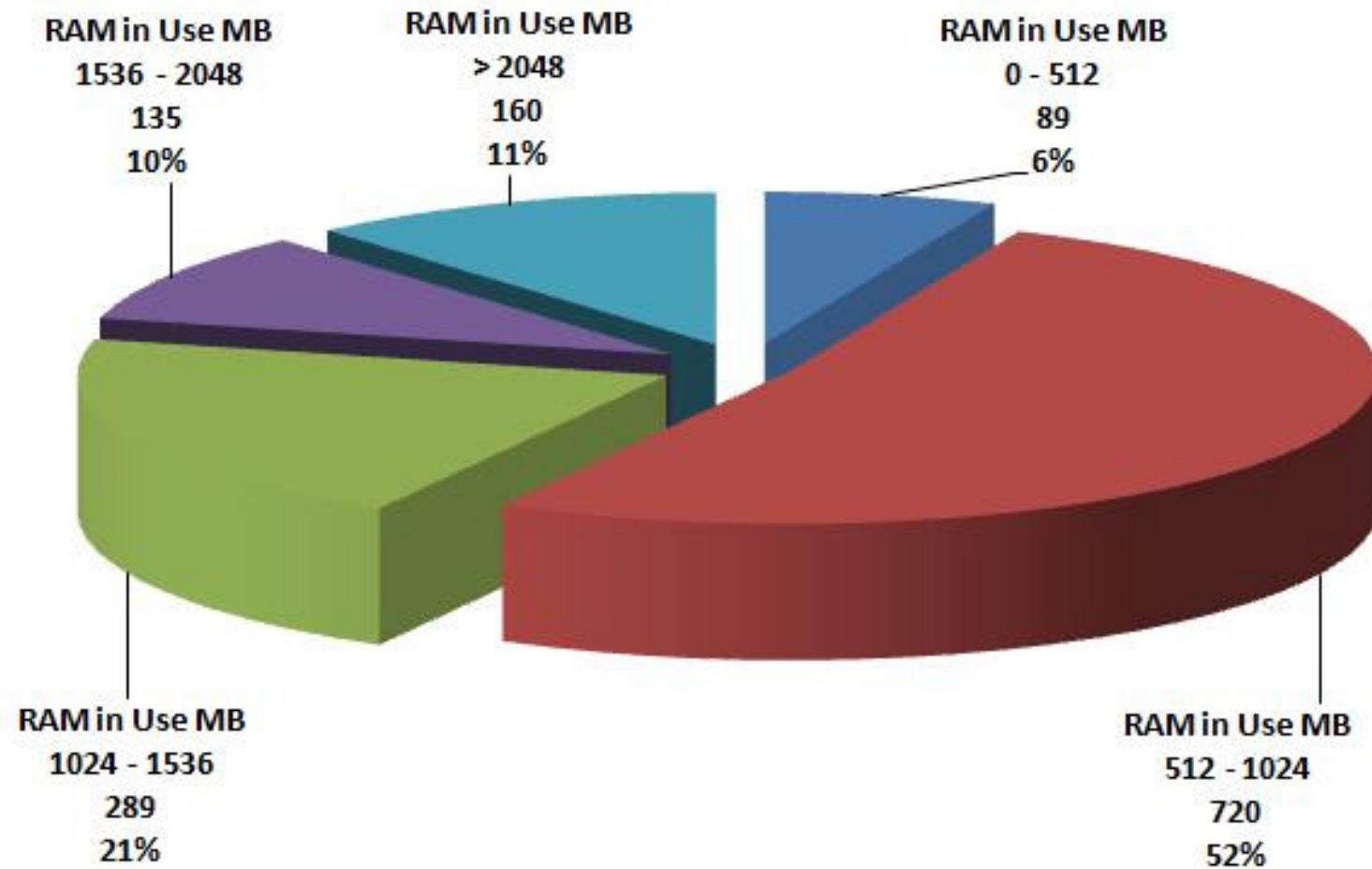
Logical Disk Avg. (assigned vs in use)

Avg. Logical Drive in use: Top 3Drives

Logical Drive Letter (vertical axis): E:, D:, C:

Space in Use In GB (horizontal axis): 0, 10, 20, 30, 40, 50, 60, 70

Legend:
- In Use
- Allocated
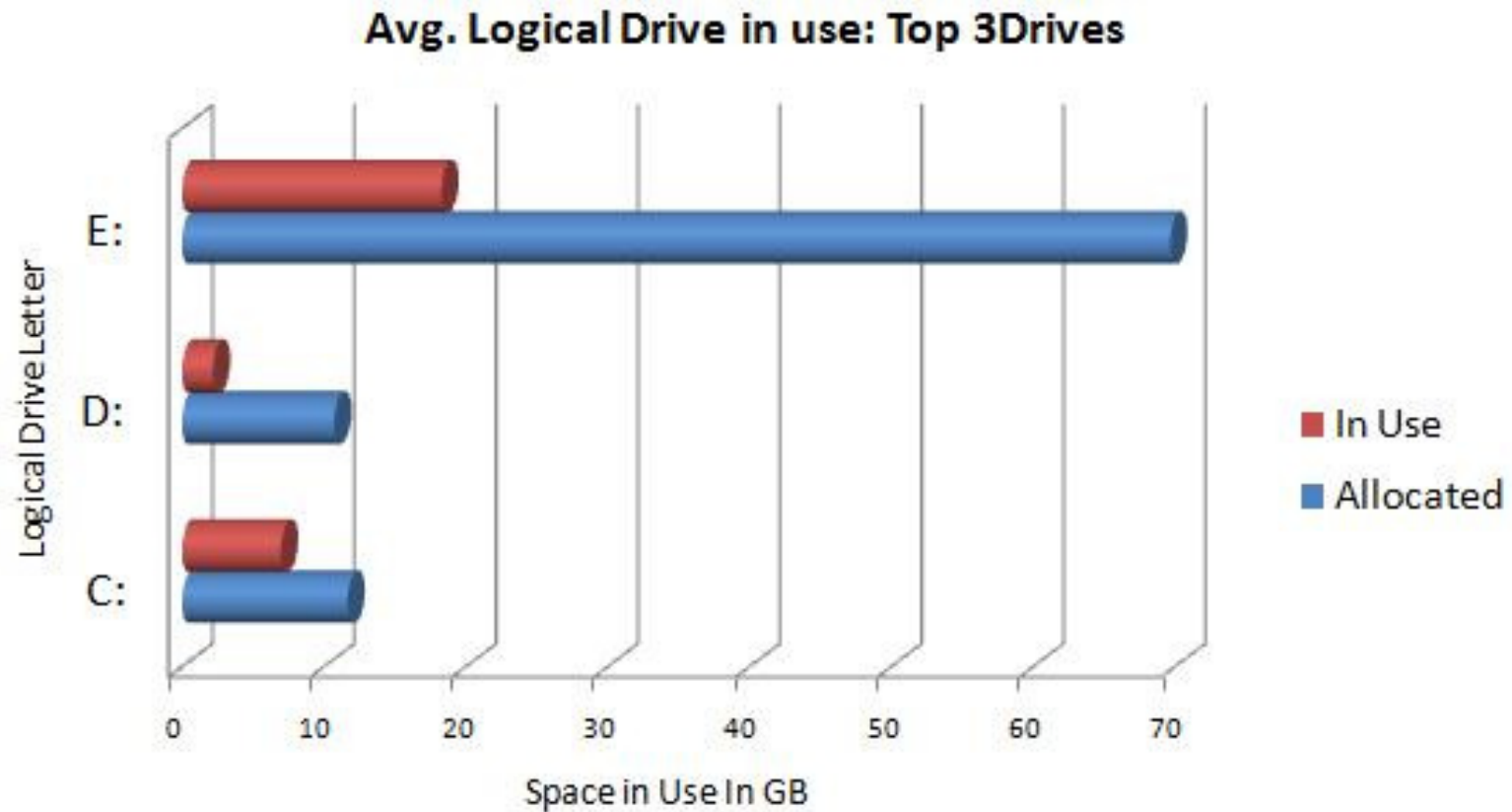
Servers by operating system

Servers by OS

- Windows NT Server — 2 — 0%
- Windows 2003 Ent. — 51 — 4%
- Other/not reported — 31 — 2%
- Windows 2000 Std — 538 — 39%
- Windows 2000 Adv. — 20 — 1%
- Windows 2003 Std — 751 — 54%
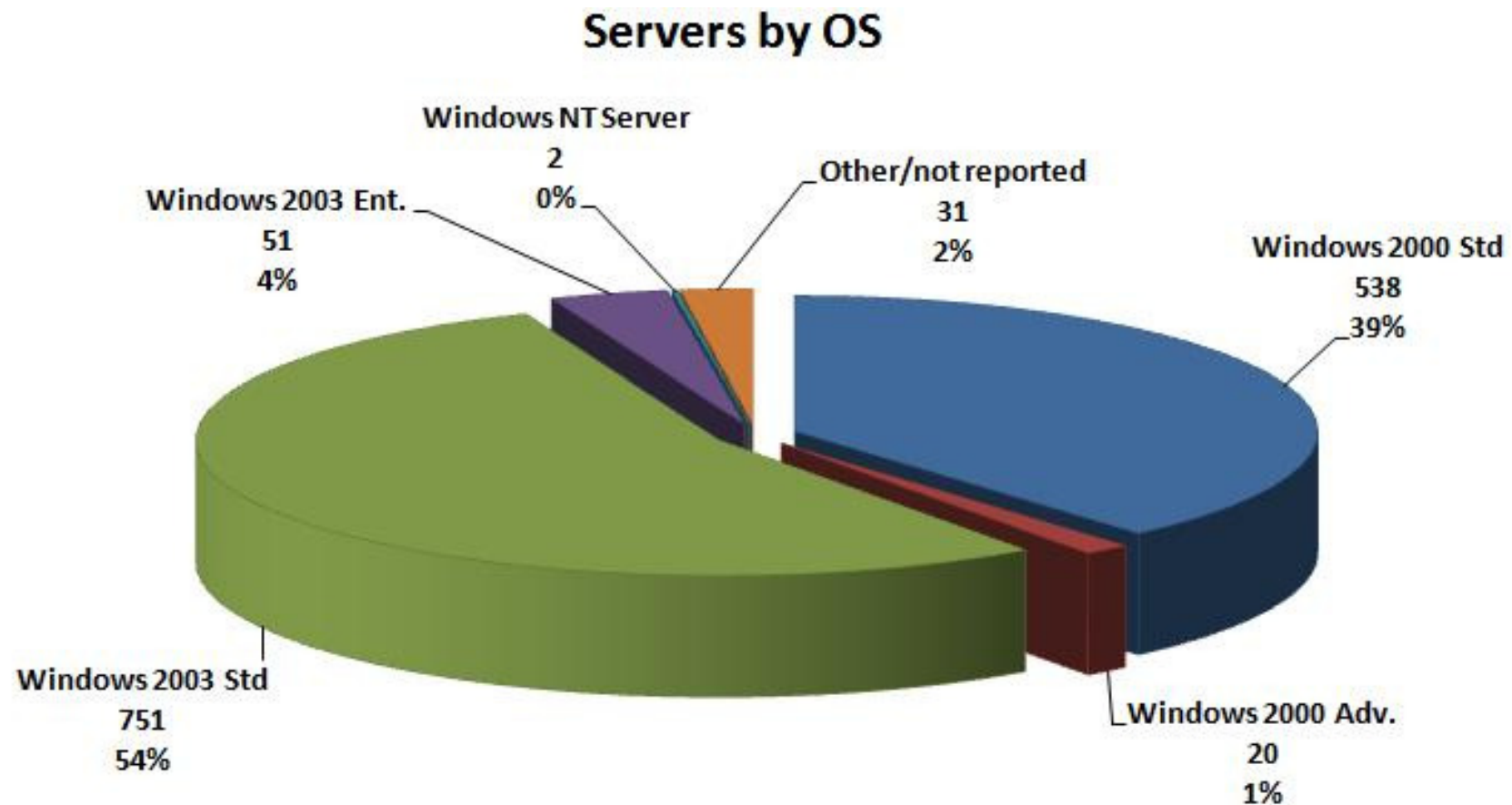
Virtualization Candidates

Candidate Selection

Potential Candidate
Resource Concerns
126
9%

Potential Candidate
216
16%

Prime Candidate
743
53%

High Priority
Virtualization
Targets

Candidate
308
22%
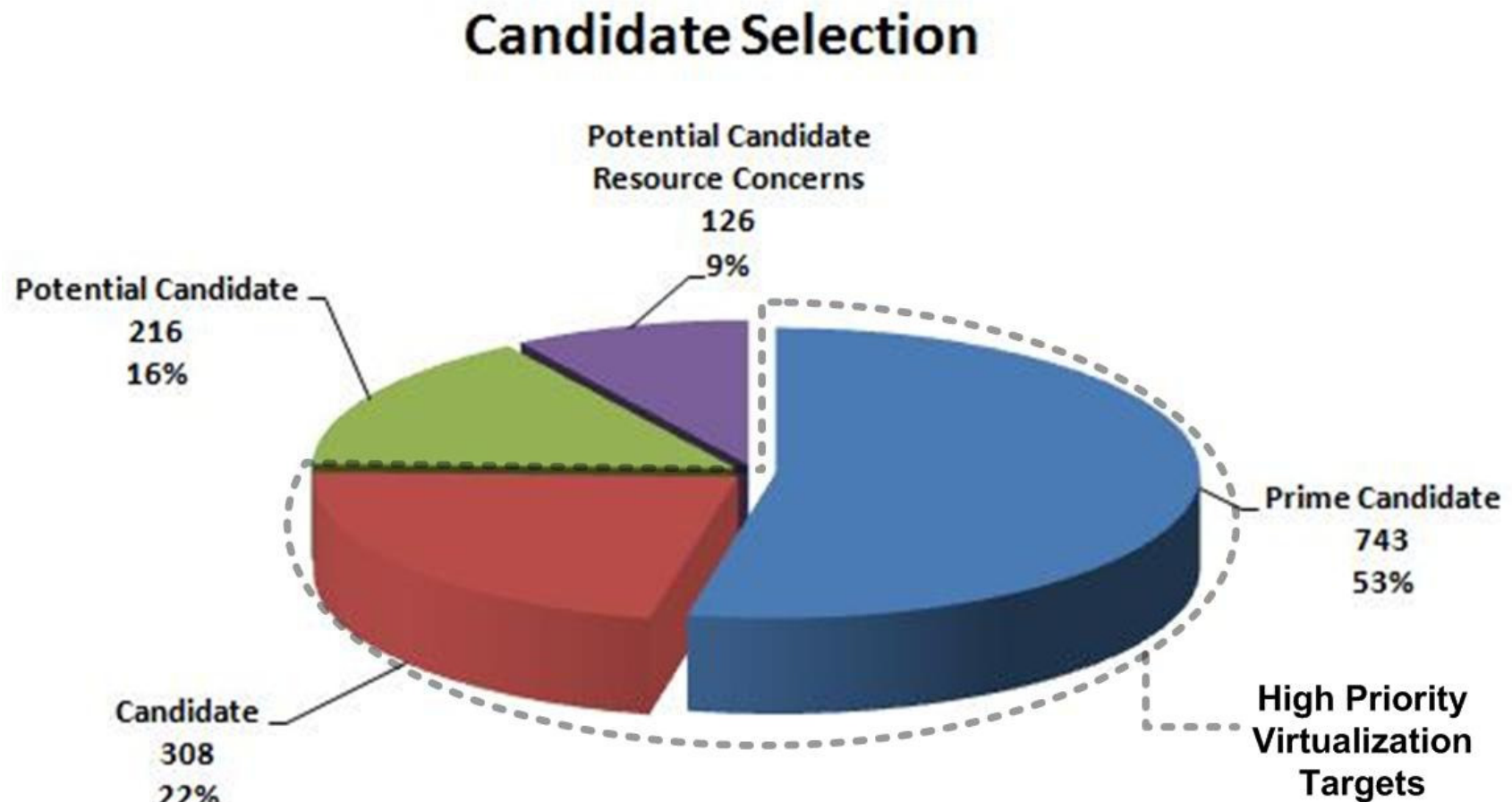
5 Year analysis
(w/ proposed solution)

- Migration 500+ end of life servers to VMs instead of new physical servers – some of these servers are 6 or 7 years old

- Get back on track with lifecycle replacement

- Utilize Virtual Machines for 75+% of new servers deployed

Server and VM Count	Year 1	Year 2	Year 3	Year 4	Year 5
Total number of logical servers (physical and VM)	1800	2142	2549	3033	3610
Number of physical servers in the environment	1500	1001	915	864	846
Number of Virtual Machines in the environment	300	1142	1634	2169	2763
Number of VMs used for physical server refresh	585	188	171	162	159
Number of VMs used for new growth	257	305	363	432	514
Total number of VMs	842	493	535	594	673

Assumptions	Value	Notes
Starting Number Of Servers	1500	assumes 1500 physical x86 servers
% of all servers that are Tier 1 and 2 candidates	75	75% of all servers are vm candidates based on data
Starting % of servers that are end of life and a VM candidate	39	Year 1, % of server due for refresh and VM candidates
Growth rate per year (in %)	19	Based on Lilly's 19% growth in new servers per year

5 Year ROI

Item	YEAR					
	0	1	2	3	4	5
Virtual Environment Capacity						
Capacity Costs						
Number of Virtual Machines	0	842	493	535	594	673
Servers that had to be purchased new	0	842	493	535	594	673
P2V of non-depreciated servers	0	0	0	0	0	0
Hdw and SW Costs to Provide Capacity for Net New VMs	$0.00	$3,744,617.78	$2,193,054.43	$2,379,497.72	$2,644,534.68	$2,995,003.85
Hardware Refresh costs (5 Year Intreval) cost avoidance						$3,744,617.78
Support Costs						
Annual Pwr and Cooling Costs to Support Hdw VM Capacity		$0.00	$44,604.28	$70,727.00	$99,070.56	$130,571.12
Project Costs						
Total Consulting Man hours cost to implement year 1	$1,400,000.00					
Total Project Cost and Virtual Machine costs	$1,400,000.00	$3,744,617.78	$2,237,658.70	$2,450,224.72	$2,743,605.24	$6,870,192.74
Physical Environment						
Capacity Costs						
HDW Cost to Provide Physical Capacity (net new)	$0.00	$9,584,685.00	$5,613,319.46	$6,090,537.79	$6,768,923.67	$7,665,980.92
Hardware Refresh costs (5 Year Intreval)						$9,584,685.00
Support Costs						
Annual Pwr and Cooling costs to support Phys. Hdw Capacity	$0.00	$0.00	$571,849.74	$906,756.45	$1,270,135.36	$1,673,988.72
Total Costs Physical Model	$0.00	$9,584,685.00	$6,185,169.20	$6,997,294.23	$8,039,059.03	$18,924,654.64
SAVINGS						
Total Savings	-$1,400,000.00	$5,840,067.22	$3,947,510.50	$4,547,069.51	$5,295,453.79	$12,054,461.90

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Flow	($1,400,000)	$5,840,067	$3,947,510	$4,547,070	$5,295,454	$12,054,462
Present Value of Cash Flows	(1,400,000)	5,214,000	3,147,000	3,237,000	3,365,000	6,840,000
Cumulative PV of Cash Flows	(1,400,000)	3,814,000	6,961,000	10,198,000	13,563,000	20,403,000
Payback Period	-	0.27	-	-	-	-

Three year NPV	$10,198,000.00
Five Year NPV	$20,403,000.00
Payback Period (Yrs)	0.27
3 Year ROI	1024%
5 year ROI	2263%
3 Year IRR	376%
5Year IRR	392%

Cost Avoidance Model – average VM vs Phys Price

Project Cost Avoidance and VM : Phys Cost Comparison

Item	Physical Environment	Costs		Mixed Phys and Virtual Env.	Costs	
Hardware						
Traditional Physical Servers	250	$	2,125,000	0	$	-
ESX Host Servers	0	$	-	13	$	494,000
Network ports	500	$	300,000	104	$	62,400
Rack Space and UPS	250	$	106,250	26	$	11,050
SAN Ports Required	0	$	-	26	$	39,598
SAN Disk Required (in GB)	0	$	-	7500	$	277,500
Hardware Totals		**$**	**2,531,250**		**$**	**884,548**
Software						
ESX Virtual Infrastructure Node	0	$	-	13	$	117,000
ESX Support and Subscription (1yr)	0	$	-	13	$	25,740
Software Totals		**$**	**-**		**$**	**142,740**
Procurment and Setup Labor						
Cost / Man Hours required for Phys Srvrs	250	$	316,250	13	$	16,445
Cost / Man Hours required for VM Setup	0		-	250		68,750.0
Man Hour Totals			**316,250.0**			**85,195.0**
Totals		**$**	**2,847,500**		**$**	**1,112,483**
				Cost Savings	**$**	**1,735,017**

Cost Comparison		
Avg Cost per Physical Srvr	$	11,390
Avg Cost per Virtual Srvr	$	4,450

Ongoing power and cooling savings

Three Year Energy Costs in Thousands
Phys Vs. Virtual for Migrated Servers

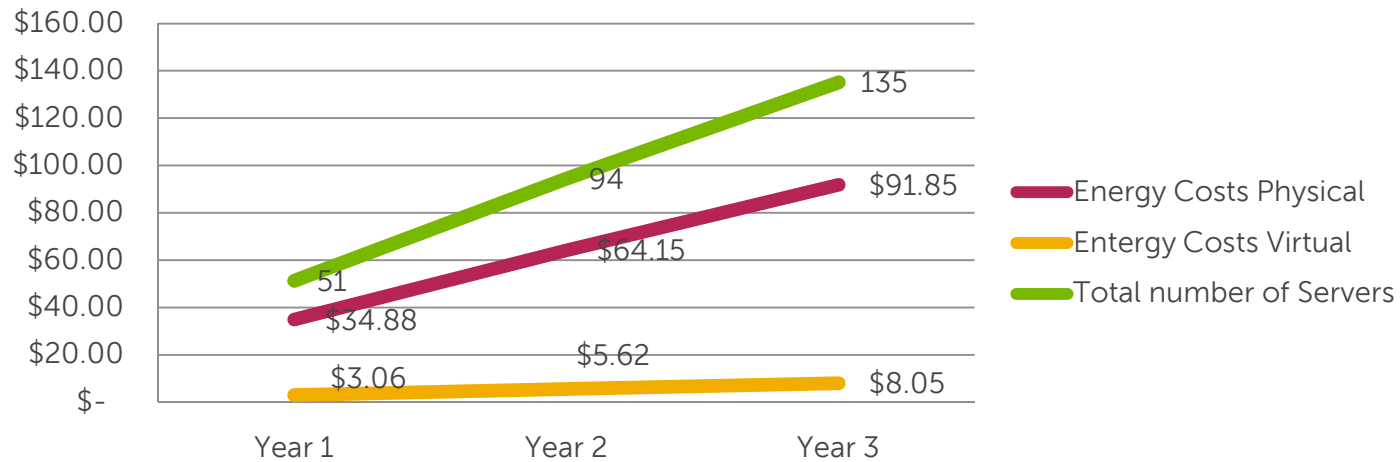|	Year 1	Year 2	Year 3
Energy Costs Physical	$34.88	$64.15	$91.85
Entergy Costs Virtual	$3.06	$5.62	$8.05
Total number of Servers	51	94	135

Chart Shows 100 Physical Servers as compared to costs to support hardware for 100 Virtual machines

Item	Physical Environment Num Required	Annual Costs	Virtual Consolidation	Annual Costs
Power per server	51	$14,611	3	$1,281
Cooling per server	51	$20,271	3	$1,777
Hardware Support / Srvr	51	$0	3	$0
Total per year:		$34,882		$3,058
			Savings:	$31,824

Cost Comparison	
Avg Cost per Physical Srvr /yr	679.56
Avg Cost per Virtual Srvr /yr	59.58

ACHIEVE MAJOR **COST SAVINGS** AND **OPERATIONAL IMPROVEMENTS** FROM VIRTUALIZATION

Cost savings

➤ Major reductions in total cost of ownership by about $4.5 million over 3 years

    ➤ 4x return on investment and payback in about than 6 months

Faster systems deployment

➤ More than a 99% reduction in time to deploy new servers and server software by cutting the time to provision them using templates

Higher system availability

➤ Significant improvement in system availability by reducing maintenance downtime as well as increasing disaster recovery capabilities