Working Smarter in 2011

How zEnterprise Drives Lower Cost for Workload Deployment

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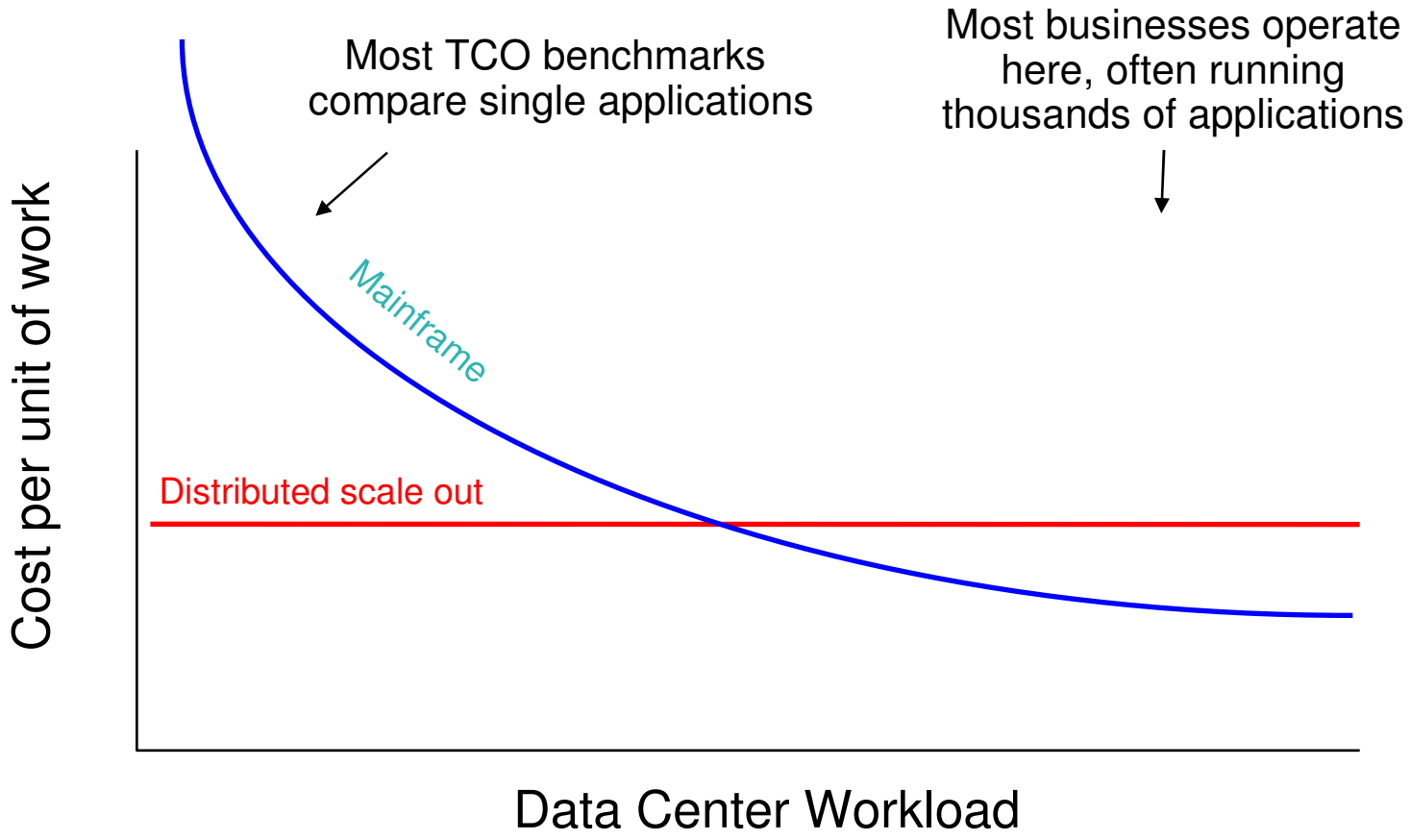
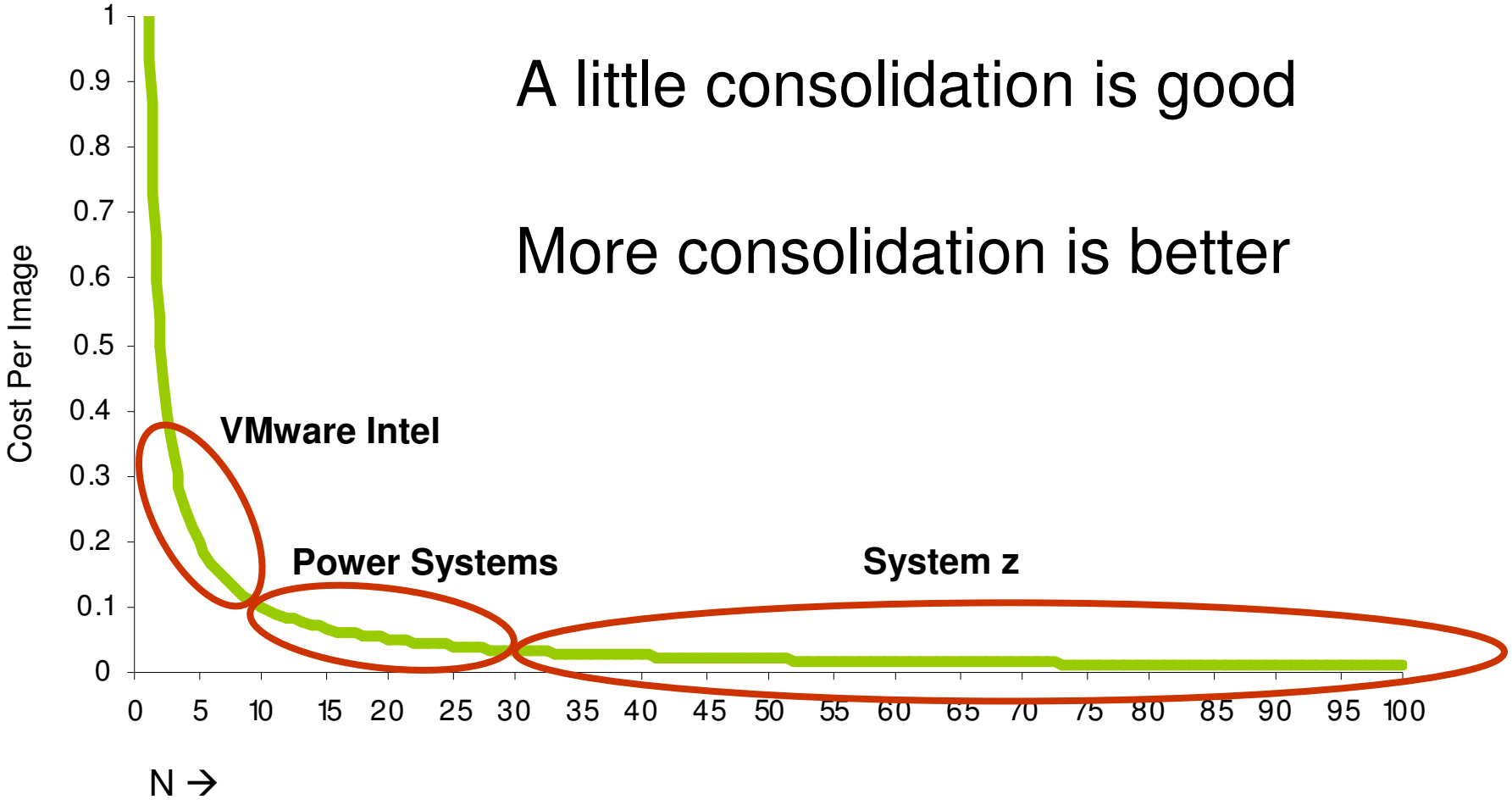
Mainframe Cost/Unit of Work Decreases as Workload Increases



Observed Consolidation Ratios



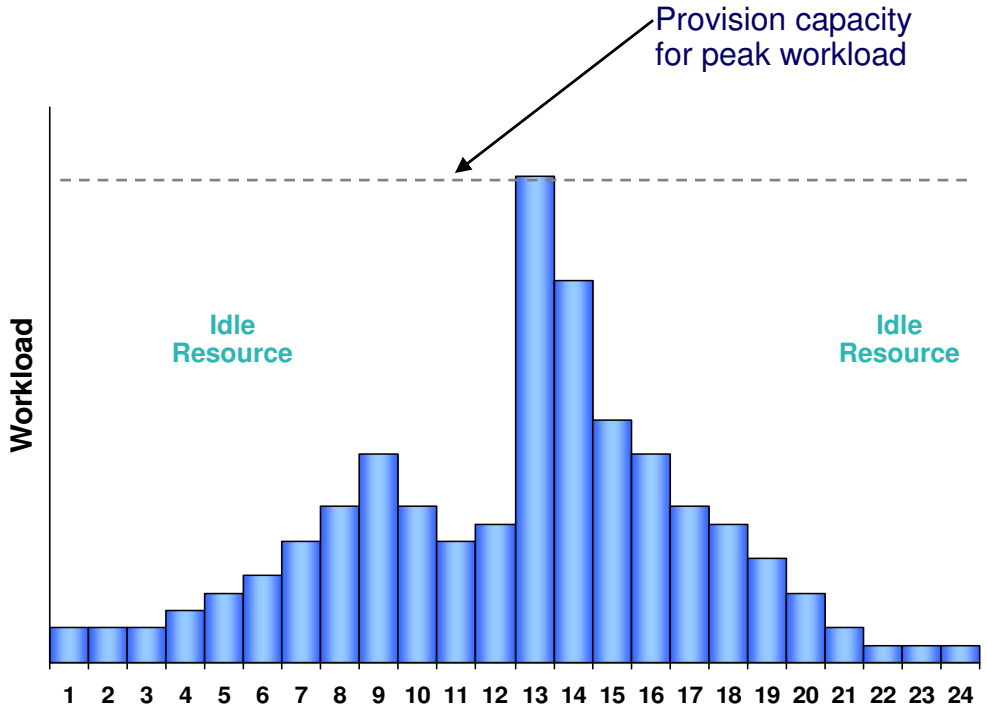
Utilization of Distributed Servers & Storage

Typical utilization of:

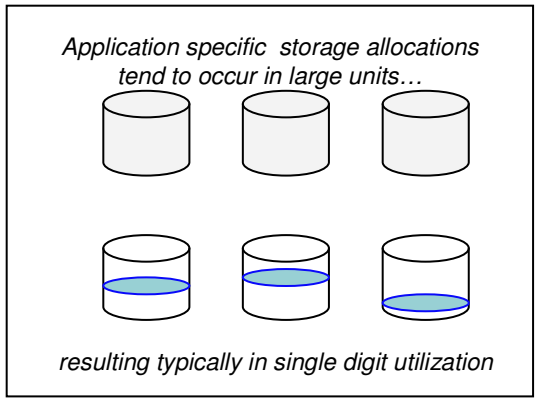
Windows Servers	5-10%
UNIX Servers	10-20%
System z Servers	85-100%

Server dedicated to one application

The cost of storage is typically three times more in distributed environments



- **Storage Allocation**
  - Application-specific resulting in over-allocations
  - Fine grained storage allocation mechanisms characteristic of mainframe storage are uncommon in distributed environments.
- **Storage Utilization**
  - Single digit utilization for distributed environments is not uncommon
  - Storage utilization of 80% + is typical for mainframe
- **Storage Management**
  - Data disaster recovery, synchronization, and transfer requirements add complexity and cost



What Is A Typical Value Of Sigma?

IBM Survey Of Workload Variability In 3200 Servers

Type Of Workload	Average Utilization	Peak Utilization	Sigma
Infrastructure	**6%**	**35%**	**2.5 * Mean**
Web Server	**4%**	**24%**	**2.5 * Mean**
Application	**4%**	**34%**	**3.75 * Mean**
Database	**5%**	**37%**	**3.25 * Mean**
Terminal	**6%**	**45%**	**3.25 * Mean**
E-Mail	**4%**	**34%**	**3.75 * Mean**

IBM System x™ Servers and VMware Virtual Machine Sizing Guide

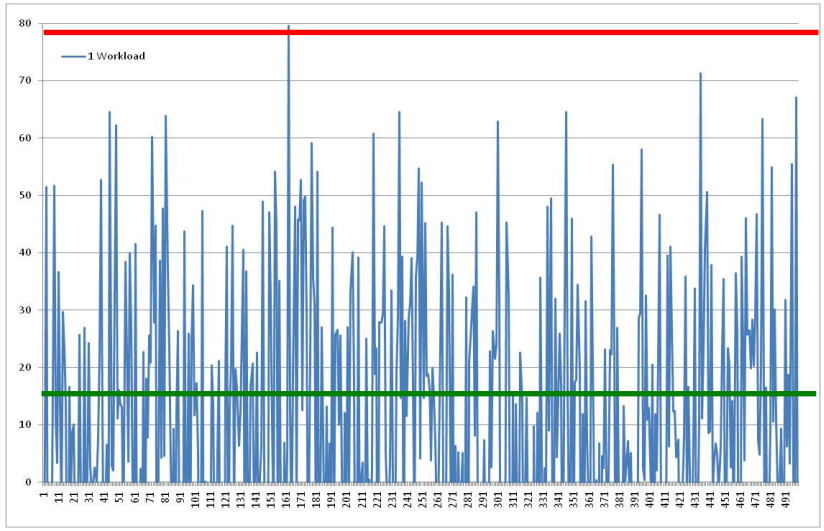
Legacy workloads on XEON 2.5-2.8GHz Servers

Normal probability distribution

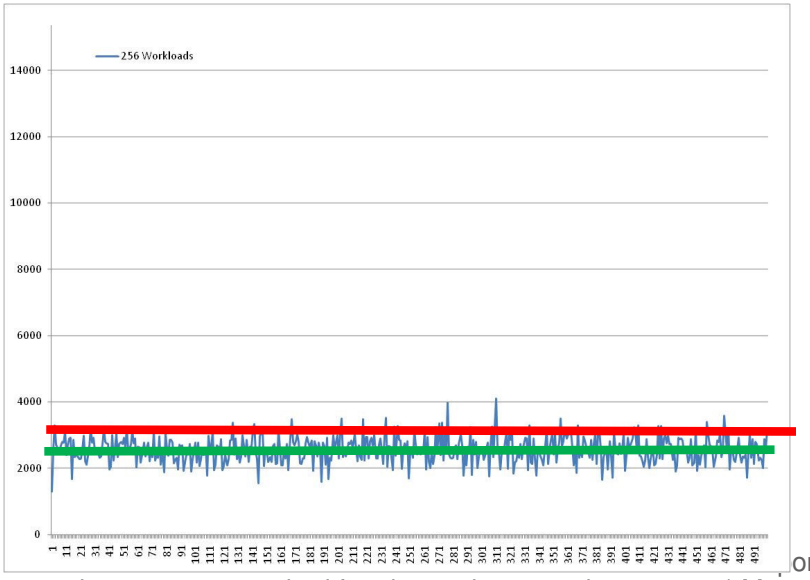
New Workload Scenarios – Beware Benchmarks

- **Stress test benchmarks have no variability!**
  - They drive the system under test to100% utilization with no variation
  - Comparing mean throughputs at 100% utilization doesn't give a realistic view of the resources required for deployment

Running a new workload with variability Sigma=2.5*Mean requires processing capacity equal to **6 times the Mean** workload demand



Adding a new workload to a pool of 256 existing workloads will require incremental processing capacity equal* to the **Mean** workload demand

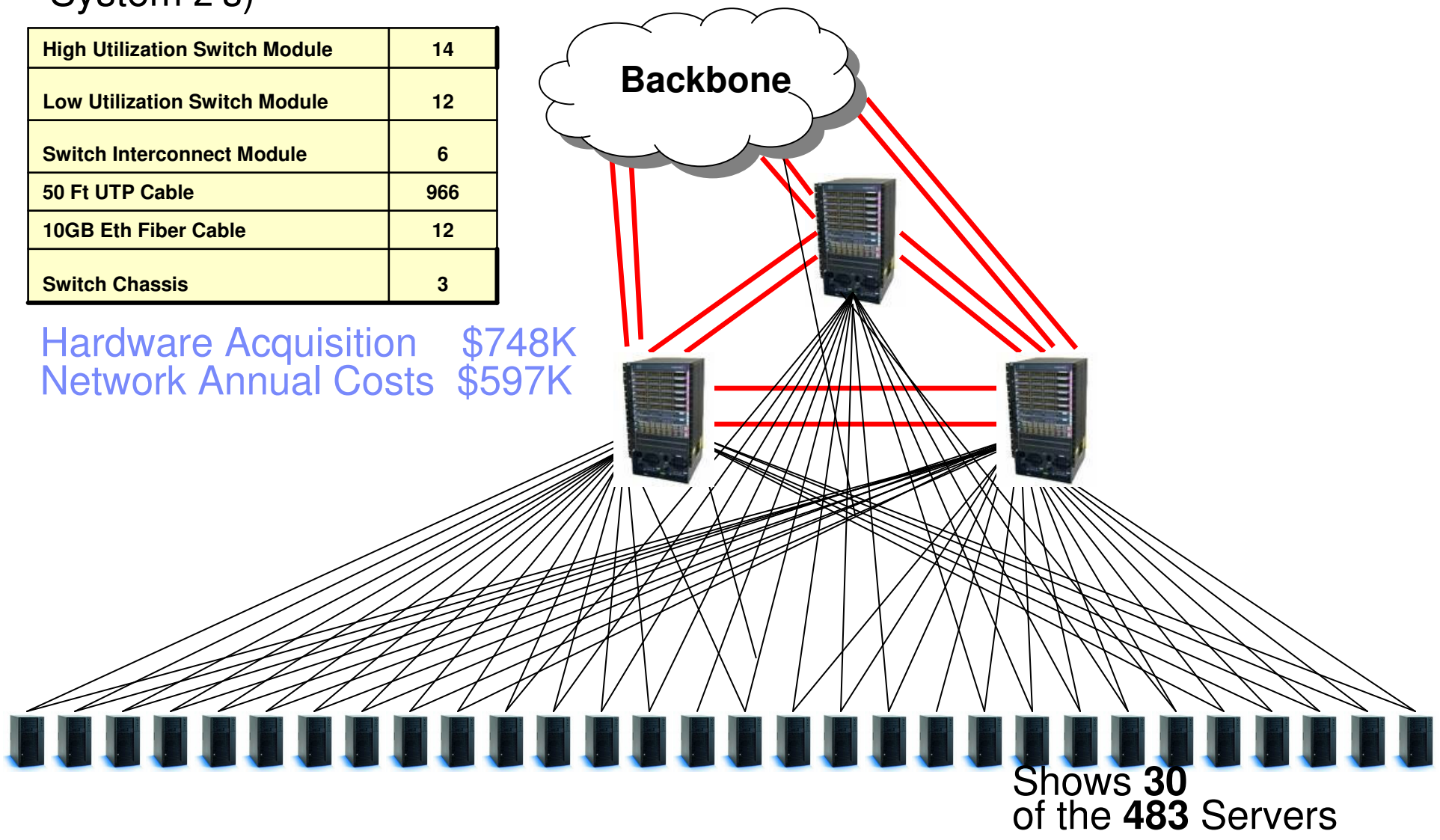


* If we add one more workload to a pool of 256 consolidated workloads the computing resource required for the pool goes up by 1.00047 * Mean

Case Study: Network Costs –Before Consolidation (483 Servers to 2 System z's)

High Utilization Switch Module	14
Low Utilization Switch Module	12
Switch Interconnect Module	6
50 Ft UTP Cable	966
10GB Eth Fiber Cable	12
Switch Chassis	3

Hardware Acquisition $748K
Network Annual Costs $597K

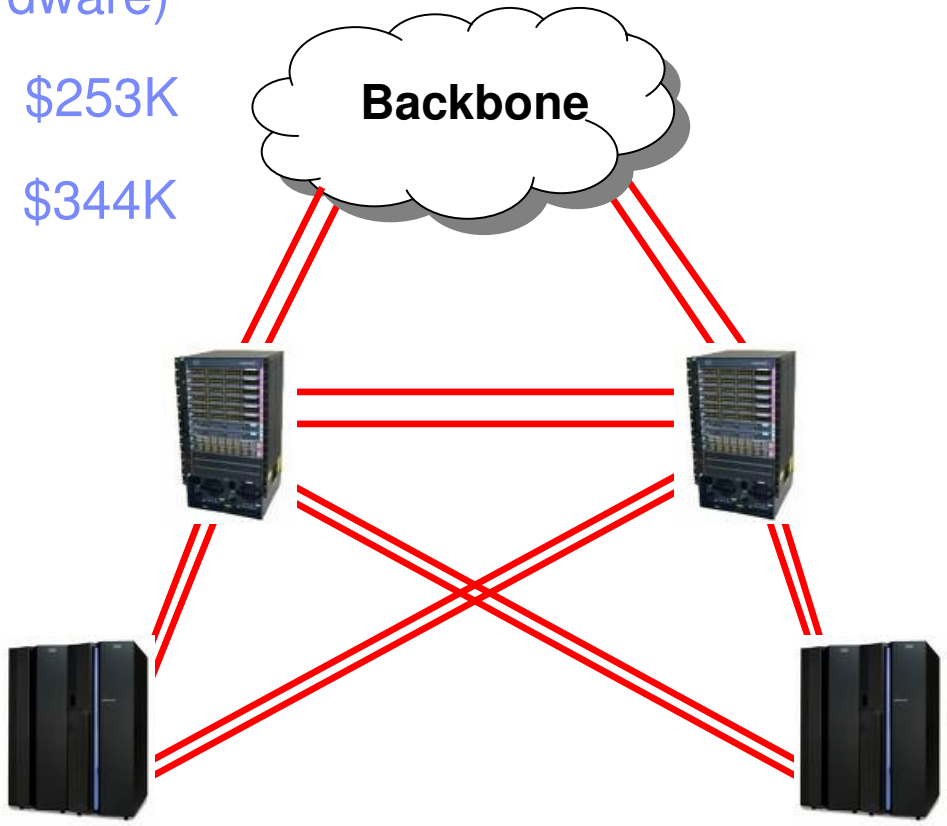


Case Study: Network Costs – After Consolidation (483 Servers to 2 System z's)

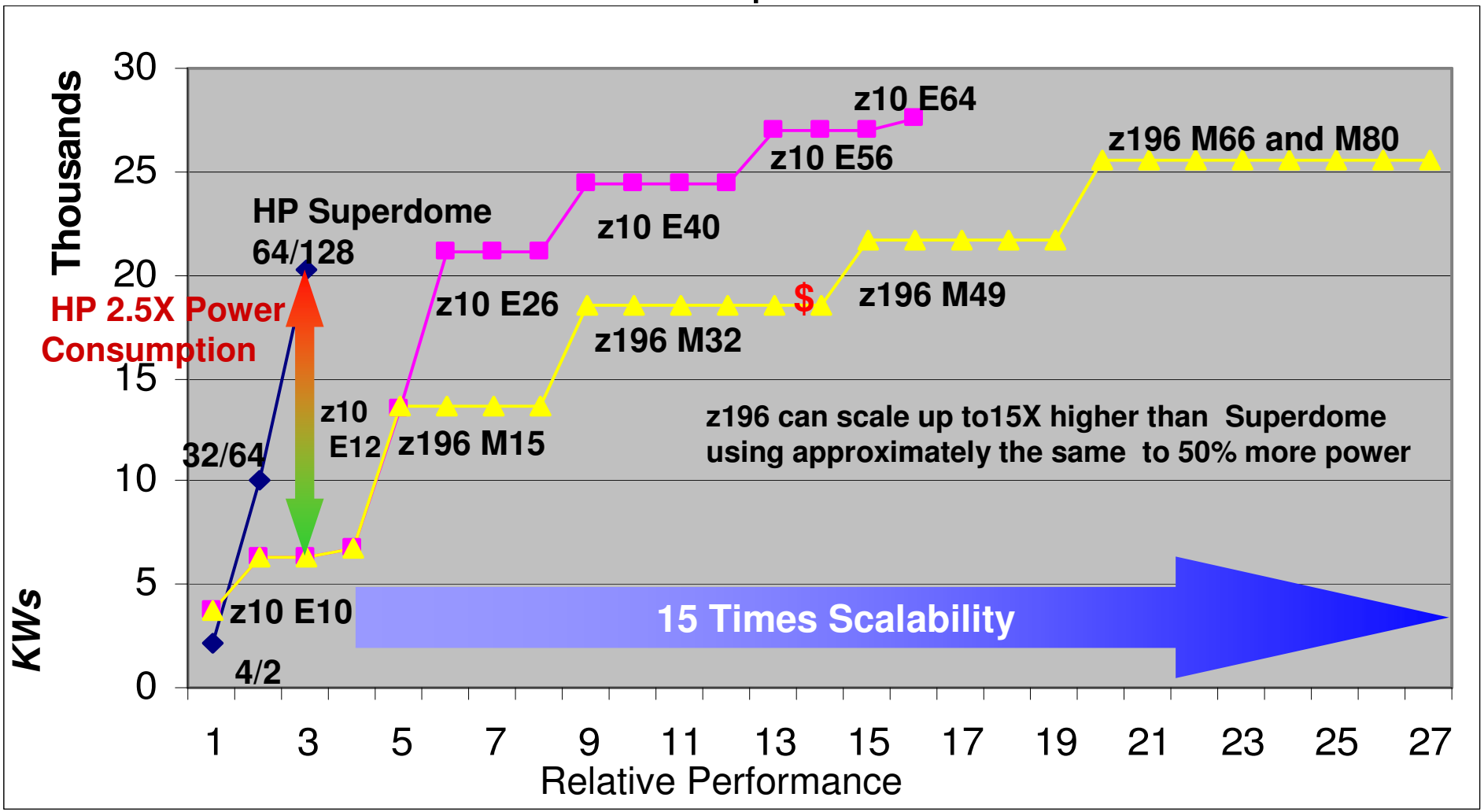
New Hardware Acquisition $0
(reuse some of old network hardware)

"After" Network Annual Cost $253K

Network Annual Cost Savings $344K

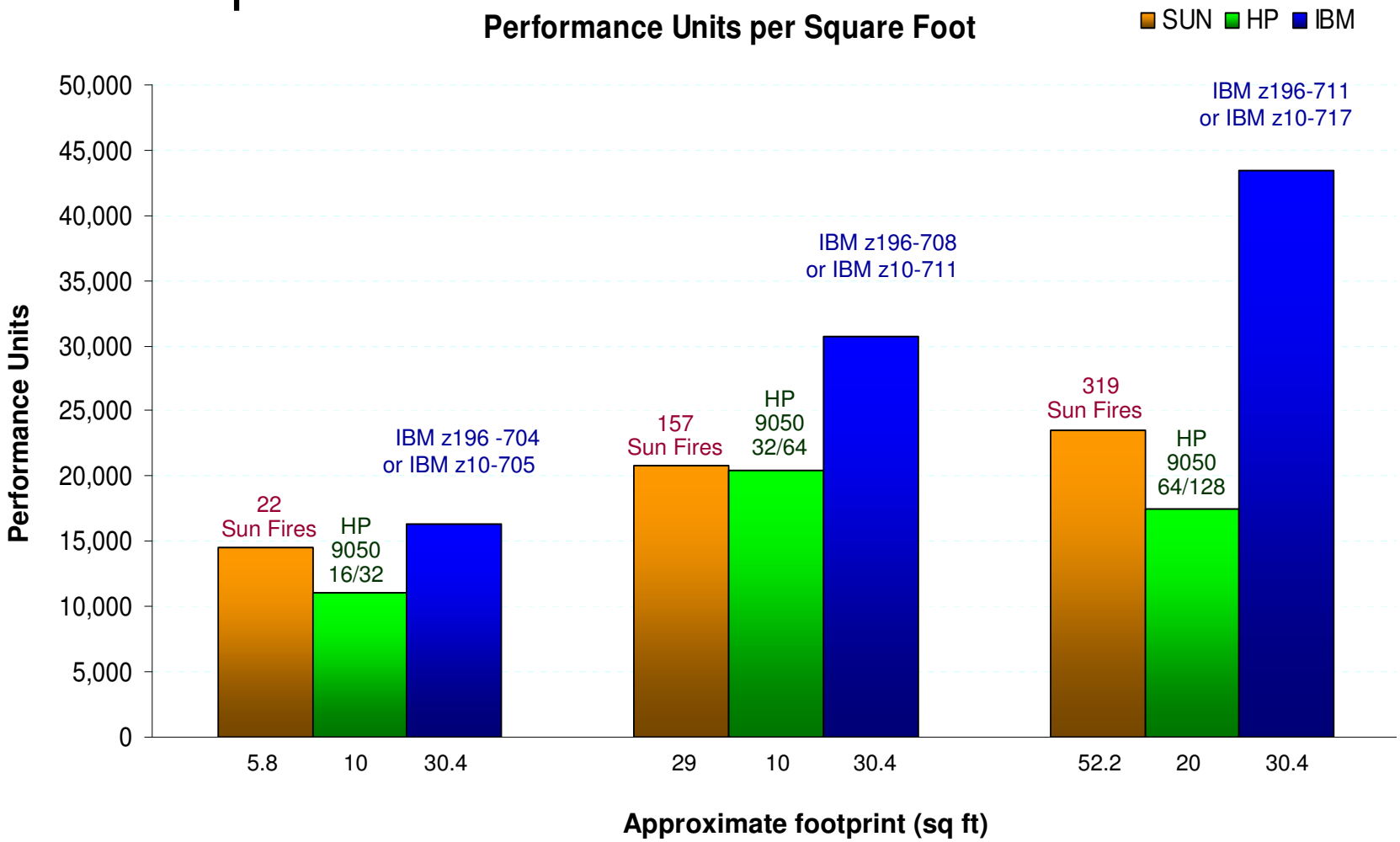


Mainframe Scales 2.5 to 15X Superdome



Notes: Performance as per Eagle TCO studies. Multiply by 2 for MIPS. HP performance based on 122 perf units / MIPS. z10 and z196 power is max value. It is very rare that any mainframe is even 80% of max. Typical mainframe power is less - approximately 60% of maximum as per field data. Mainframe Power scales by model or book package.

The Mainframe Also Delivers More Compute Power Per Footprint Unit



Based on 122 performance units per MIP

MainframeE10 EC and z196 footprint remains constant

Customer Survey – How Many People to Manage Servers?

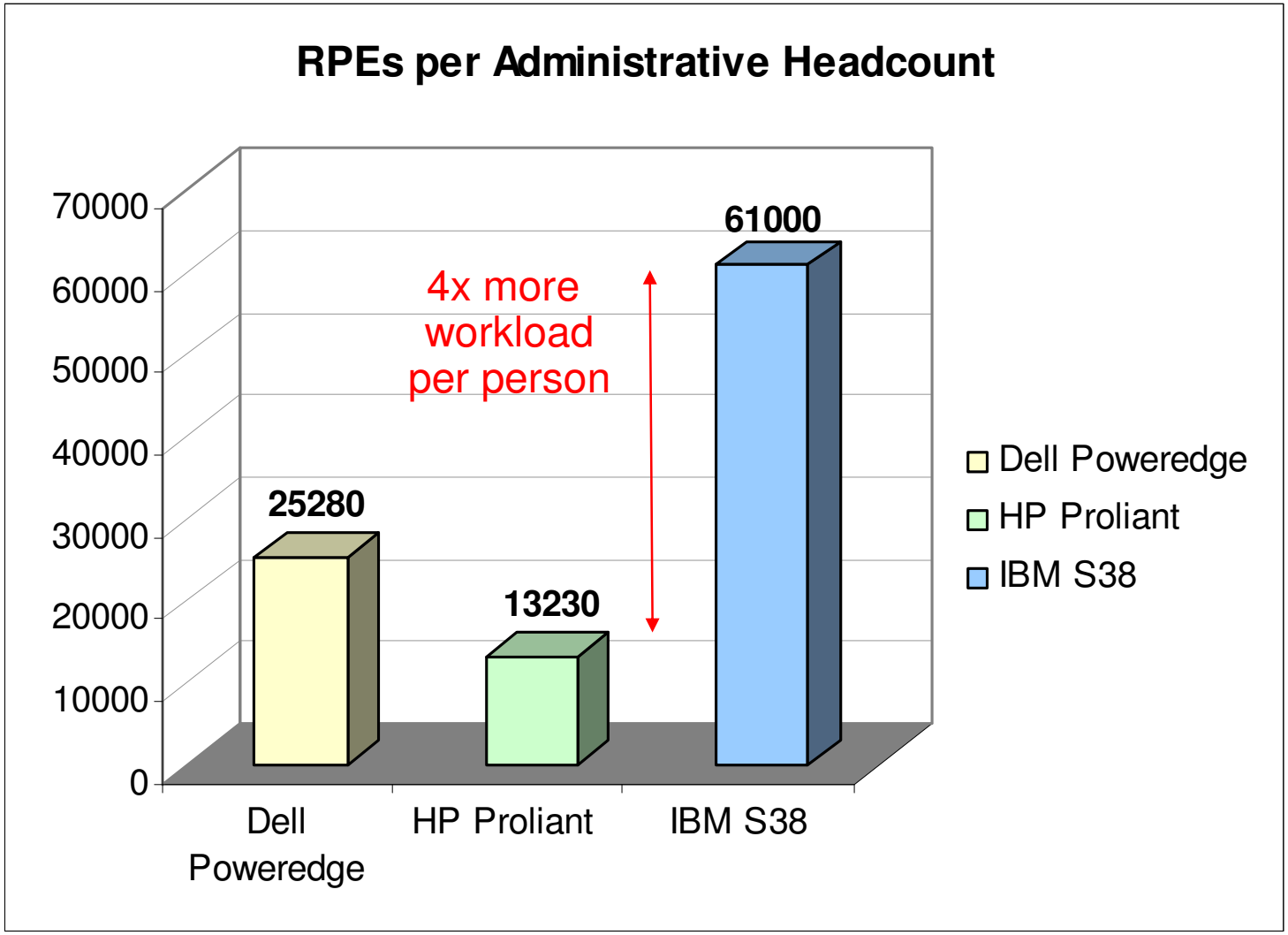
# NT Servers	# People	Ratio (s/p)
1123	68	**16.5**
228	20	**14.4**
671	51	**13.1**
700	65	11.5
154	18	8.5
431	61	7.1
1460	304	4.8
293	79	**3.7**
132	54	**2.0**

# UNIX Servers	# People	Ratio (s/p)
706	99	**7.1**
273	52	5.2
69	15	4.6
187	56	3.3
170	51	3.3
85	28	**3.0**
82	32	**2.6**
349	134	**2.6**
117	50	**2.3**
52	52	**1.0**

Mainframe administration productivity surveys range 167-625 MIPS per headcount (500 is typical), so…

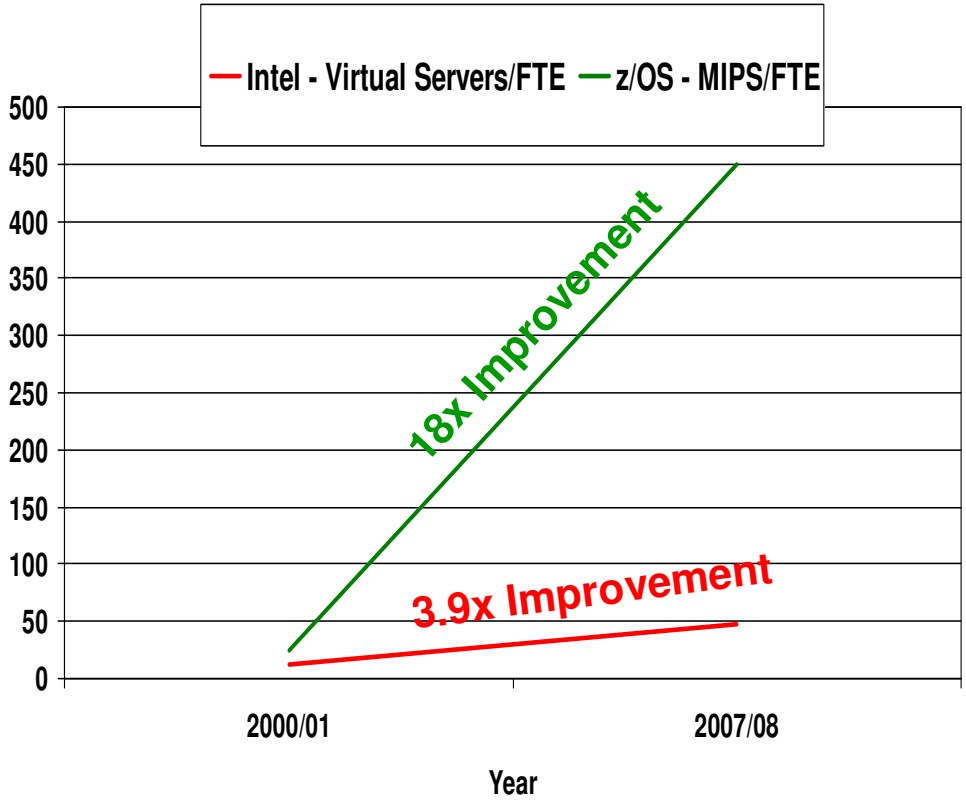
Source: IBM Scorpion Customer Studies NOTE: Figures for total administration cost

Manage More Workload Per Headcount



Compared at 122 RPE's = 1 MIP

System z Labor Cost Trends Favor A Centralized Approach To Management



Large scale consolidation and structured management practices drive increases in labor productivity

Small scale consolidation achieves lesser gains

The more workloads you consolidate and manage with structured practices…
the lower the management labor cost

Source: IBM Scorpion Studies

Average Costs for Customers
System z vs distributed – Empirical Findings

Cost Ratios (z vs Distributed)

		z	Distributed	z vs distributed (%)
Rehosting	**5-Year TCO**	**$29,428,593**	**$51,965,131**	**56.63%**
	Software	$19,520,910	$17,484,548	111.65%
	Hardware	$7,183,032	$9,327,146	77.01%
	System Support Labor	$4,643,964	$8,255,061	56.26%
	Electricity	$40,840	$363,945	11.22%
	Space	$61,277	$225,078	27.22%
	Migration	$371,847	$7,067,787	5.26%
	DR	$1,009,618	$13,903,509	7.26%
Conslidation	**5-Year TCO**	**$9,739,125**	**$23,325,530**	**41.75%**
	Software	$2,579,985	$13,726,812	18.80%
	Hardware	$4,813,952	$5,425,007	88.74%
	System Support Labor	$1,100,500	$4,237,050	25.97%
	Electricity	$37,190	$271,895	13.68%
	Space	$236,542	$578,605	40.88%
	Migration	$2,297,676		
	DR			

Software costs on mainframe include production, batch and management

Software costs on distributed often do not include systems management software

Understand The Cost Components

Annual Operations Cost Per Server
(Averaged over 3917 Distributed Servers)

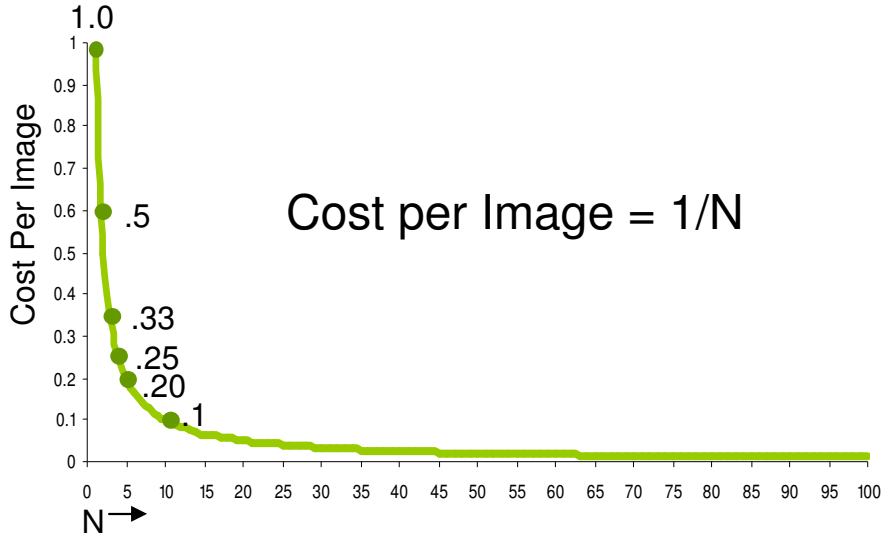
Power	**$731**
Floor Space	**$987**
Annual Server Maintenance	**$777**
Annual connectivity Maintenance	**$213**
Annual Disk Maintenance	**$203**
Annual Software support	**$10,153**
Annual Enterprise Network	**$1,024**
Annual Sysadmin	**$20,359**
Total Annual Costs	**$34,447**

The largest cost component was labor for administration
7.8 servers per headcount @ $159,800/yr/headcount

Source: IBM internal study

How Does Consolidation Reduce Costs?

- Costs shared by all “N” consolidated images
  - Hardware
  - Software
  - Power
  - Floor Space
  - Local Network Connectivity



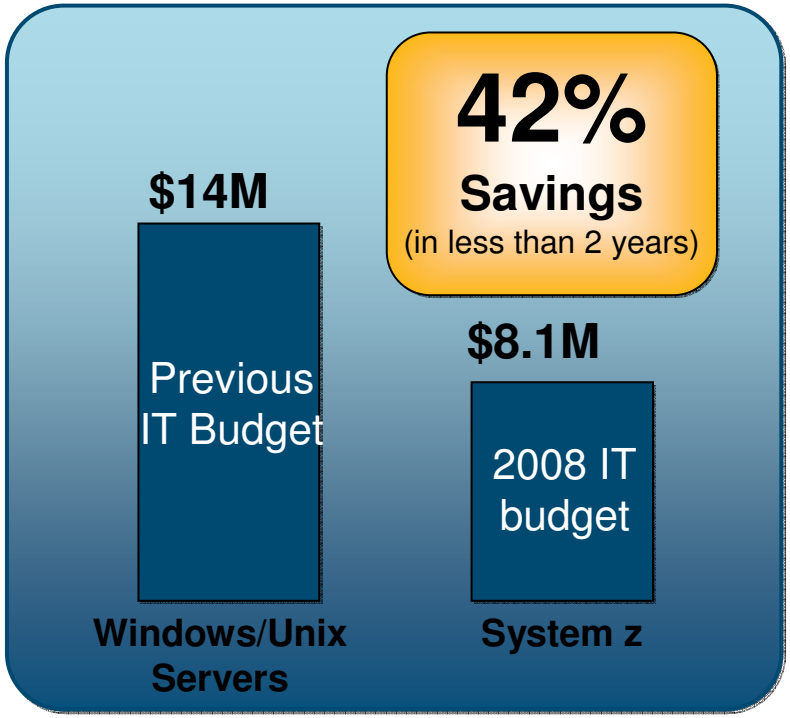
Cost per Image = 1/N

- Costs not shared by consolidated images
  - Migration cost per image — Fixed cost per image
  - Off premise network cost
  - Labor cost per image — Fixed cost per image, but typically less than unconsolidated labor cost

The more workloads you can consolidate, the lower the cost per image

Optimize deployment of applications and data

Deploying SAP database and application servers



Top three reasons for savings

- Software and hardware licensing costs dramatically reduced
- Software and hardware maintenance costs are significantly down
- Networking costs plunged, while infrastructure was drastically simplified

BALDOR $1.8 billion Electric motors manufacturer

Expected Benefits Realized: Availability and Performance

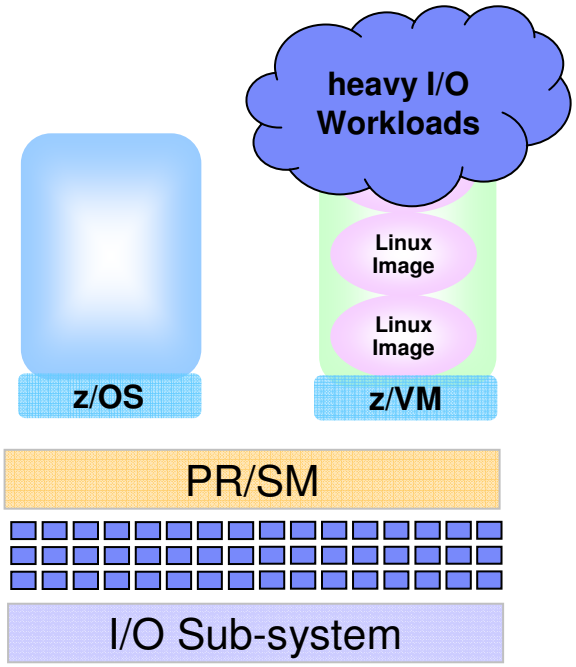
The System z decision was driven by expected benefits:

- **Reduced complexity**
- **High availability**
- **Ease of maintenance**
- **Dynamic Workload**
- **Good consistent application response time (SAP)**
- **zLinux for rich toolset, ease of use**

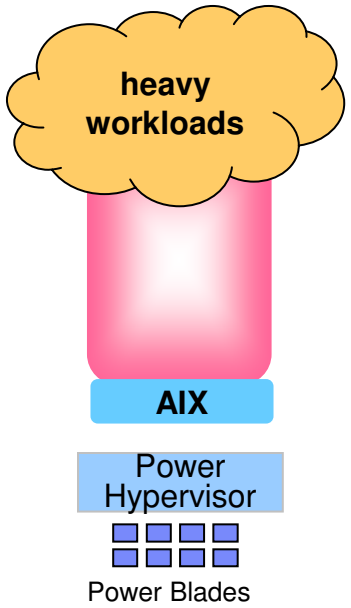
Additional Benefits Realized: Significant Cost Savings

- **+Reduced IT budget by 42% - in less than 2 years**
- **+Reduced floor space by 70%**
- **+Reduced software and hardware maintenance by more than 50%**
- **+Reduced power consumption by more than 60%**
- **+Reduced total TCO from 2% of sales to below 1% - and realized 1 year ahead of schedule**

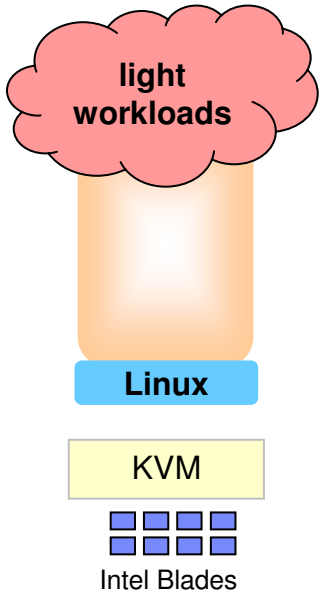
zEnterprise Extends Cost Advantages To A Broad Range Of Workloads



- Scale up to 80 cores in a frame (z/OS clusters with sysplex)
- Dedicated I/O Sub System
- Superior qualities of service

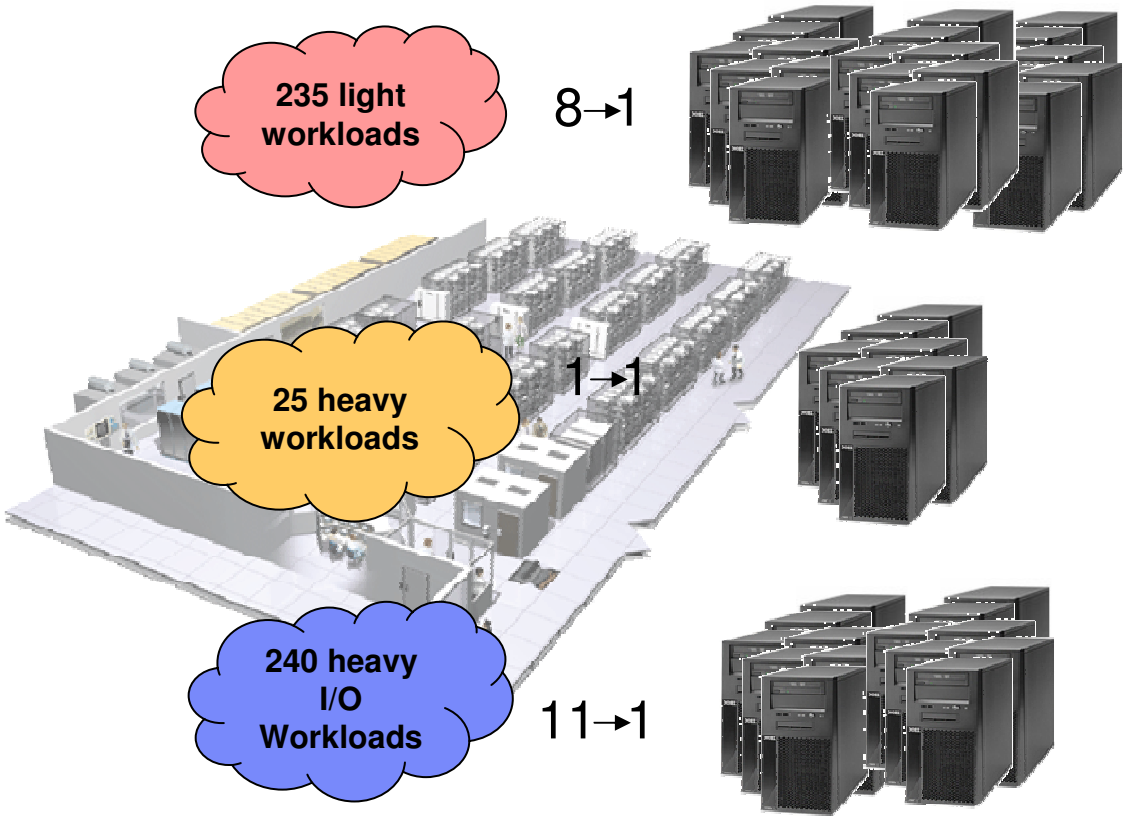


- Scales to 8 cores per blade
- Larger number of fast processing threads
- Floating point accelerators



- Scales to 8-12 cores per blade
- Fast processing threads
- Commodity I/O
- Modest qualities of service

Large Data Center – What Did It Cost to Deploy 500 Workloads on Virtualized Intel Servers?



Deployed on **30** Intel Xeon Servers using VMware
(8 cores each)

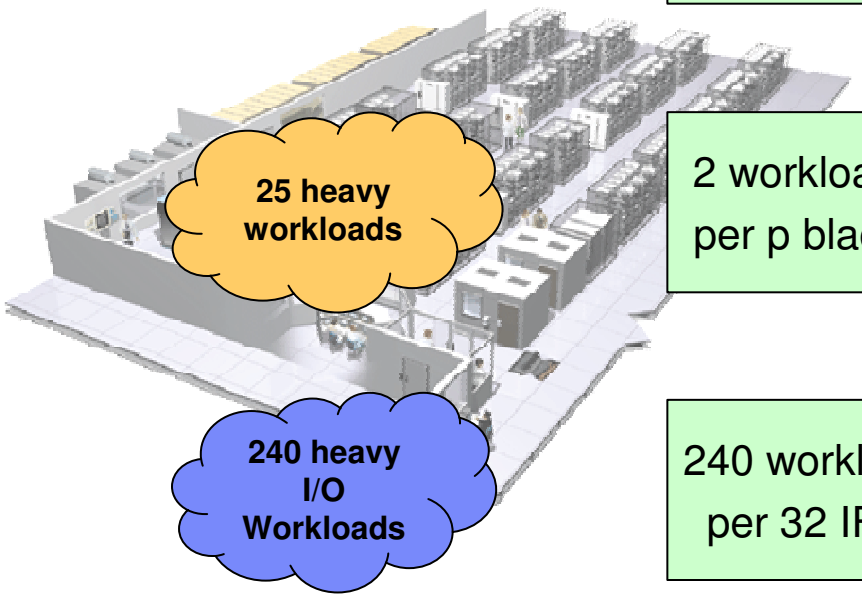
Deployed on **25** Intel Nehalem Servers
(8 cores each, non-virtualized)

Deployed on **22** Intel Nehalem Servers using VMware
(8 cores each)

500 workloads **77 servers**

IBM analysis of a customer scenario with 500 distributed workloads. Deployment configuration is based on consolidation ratios derived from IBM internal studies.

Large Data Center – What Does it Cost to Deploy 500 Workloads on zEnterprise?



36 workloads per x blade

7 System x blades in 1 zBx

2 workloads per p blade

13 Power7 blades in same zBx

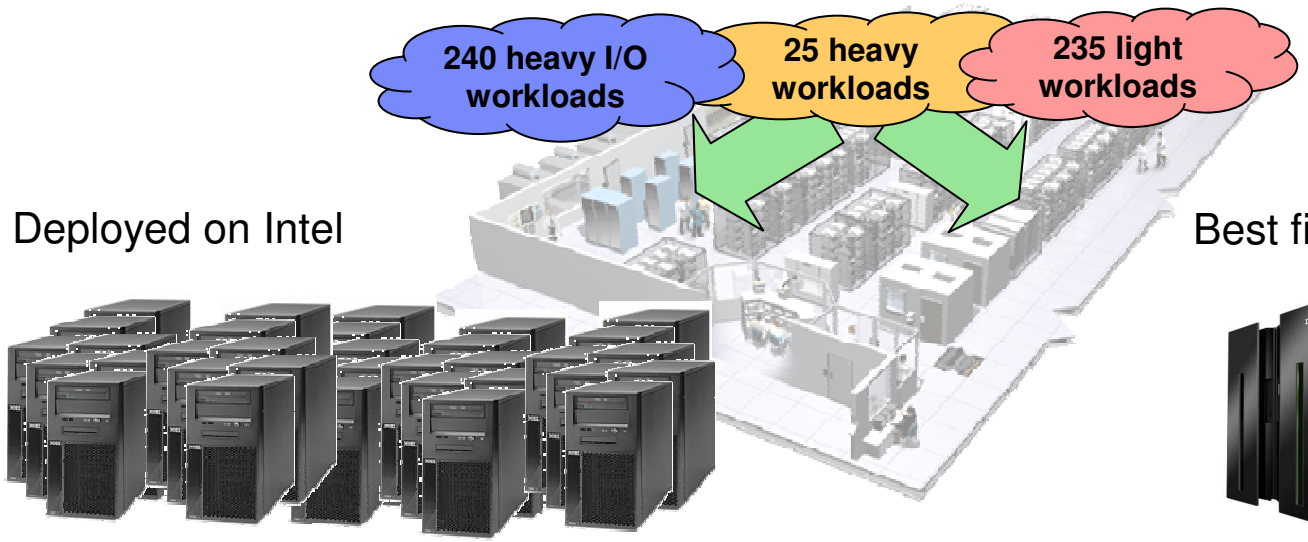
240 workloads per 32 IFLs

1 zEnterprise CPC 32 IFL's

Best fit assignments

Configuration is based on consolidation ratios derived from IBM internal studies. z196 32-way performance projected from z196 8-way and z10 32-way measurements. The zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics.

Compare Server Cost of Acquisition



Deployed on Intel

77 Intel Servers
616 cores

$15.2M TCA (3 years)

Best fit on zEnterprise

2 Frames
192 cores

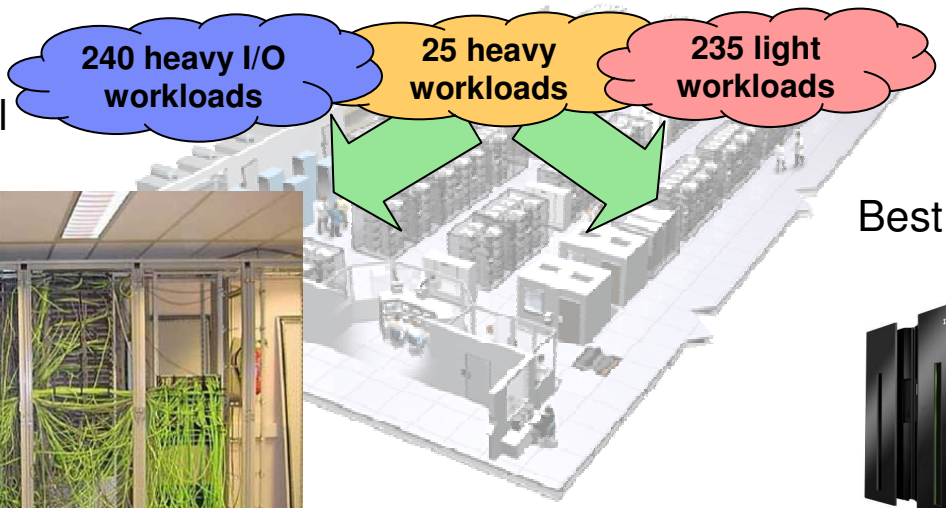
$7.5M TCA (3 years)

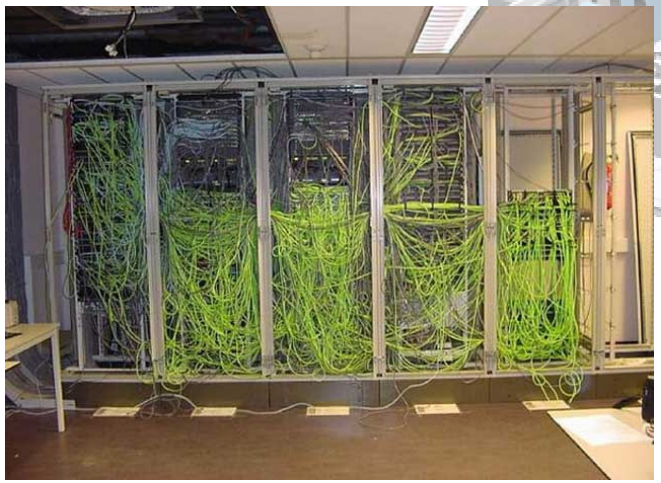
51% less

Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency, prices will vary by country

Compare Network Cost of Acquisition

Deployed on Intel





Additional network parts
- 16 switches
- 340 cables
- 308 adapters

664 total network parts

$0.20M TCA

Best fit on zEnterprise

Additional network parts
- 1 switches
- 10 cables
- 10 adapters

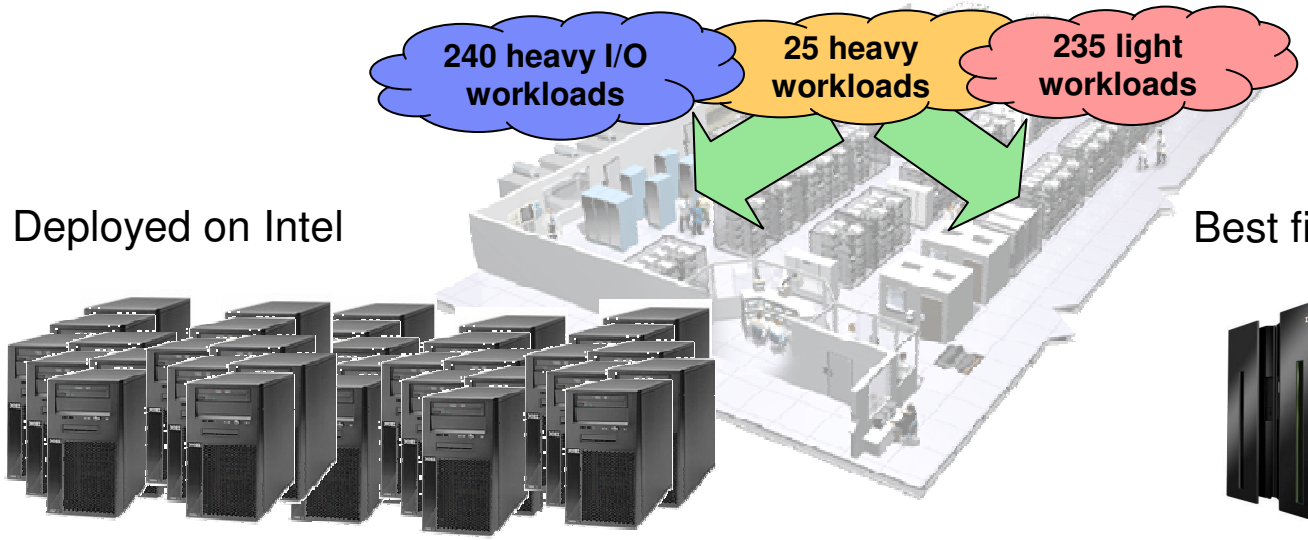
21 total network parts

$0.03M TCA

86% less

Network configuration is based on IBM internal studies.
Prices are in US currency, prices will vary by country

Compare Power Consumption



Deployed on Intel

Best fit on zEnterprise

77 Servers
289 kW

2 frames
67 kW

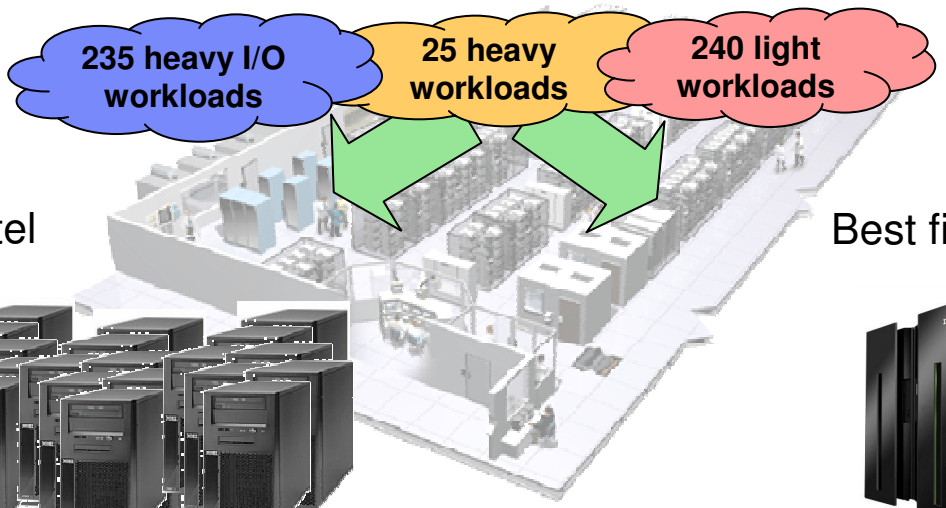
$0.25M
3 years@$0.10 per kWh

$0.06M
3 years@$0.10 per kWh

77% less

Server configuration based on IBM internal studies.
Calculations for Intel servers based on published power ratings and industry standard rates. Prices are in US currency, prices will vary by country

Compare Server Infrastructure Labor Cost



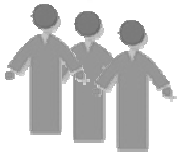
As deployed on Intel

20,464 labor hours/yr

9.84 administrators

$4.71M for labor

Best fit on zEnterprise



7,673 labor hours/yr

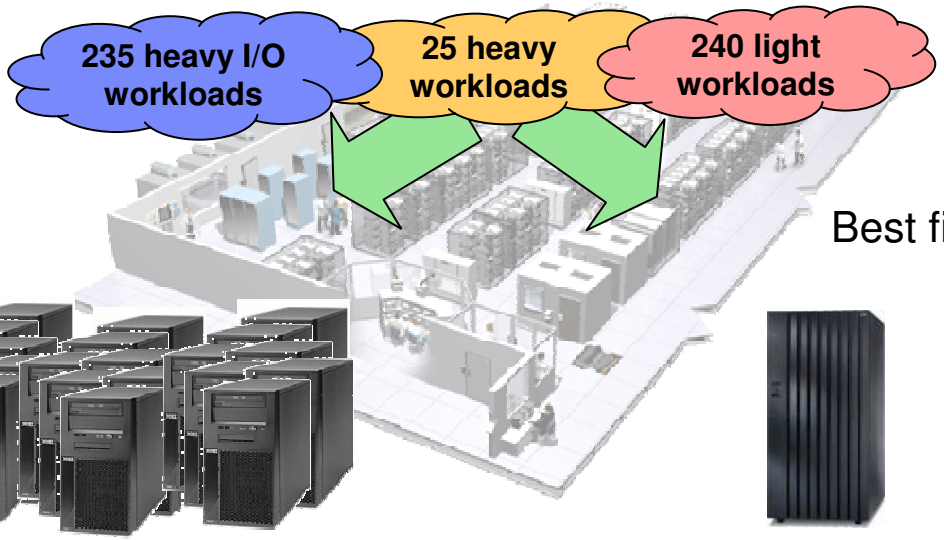
3.68 administrators

$3.66M for labor + Tivoli software costs

22% less

Configuration based on IBM internal studies. Labor model based on customer provided data from IBM studies. Labor rates will vary by country

Compare Storage Cost



Deployed on Intel

Best fit on zEnterprise

1 DS8700

1 XIV via SAN

1 SONAS

484.4 TB embedded storage
24% utilization
580 points of admin

$9.1M TCO(3 years)

172.3 PB provisioned storage
67% utilization
3 points of admin

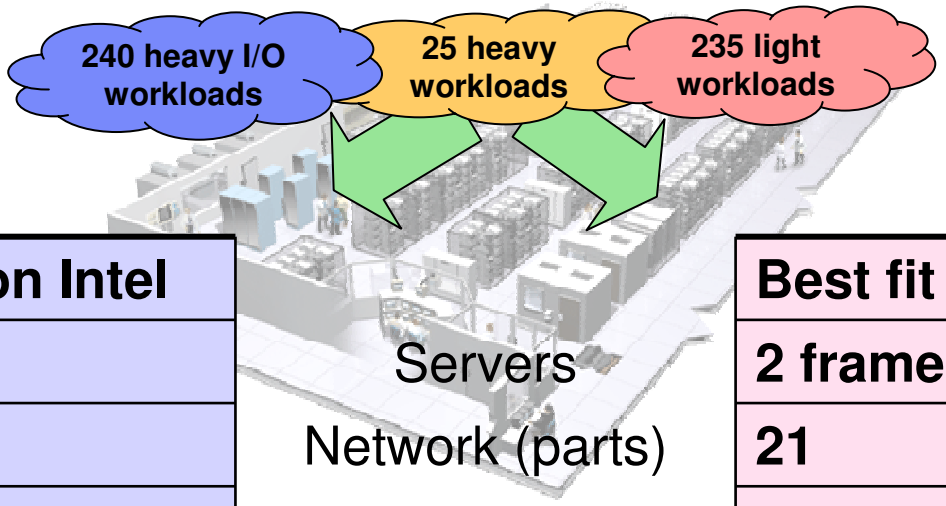
$6M TCO (3 years)

240GB active storage required per workload (2.4PB total)

34% less

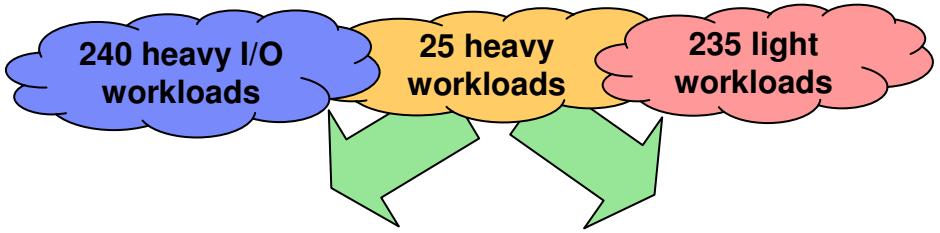
Storage configuration is based on IBM internal studies.
Prices are in US currency, prices will vary by country

Fewer Parts to Assemble and Manage



Deployed on Intel		Best fit on
77	Servers	2 frames
664	Network (parts)	21
289	Power (KW)	67
10	Administrators	4
580	Storage admin points	3

The Savings are Cumulative

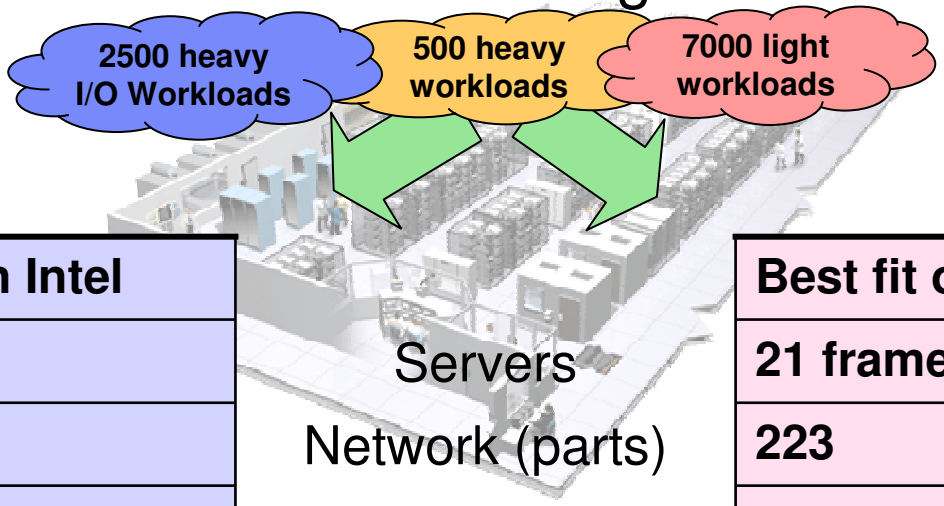


Three Year Cost Of	Deployed on Intel	Best fit on zEnterprise
Servers	**$15.2M**	**$7.5M**
Network	**$0.20M**	**$0.03M**
Power	**$0.25M**	**$0.06M**
Labor	**$4.71M**	**$3.66M**
Storage	**$9.1M**	**$6.0M**
Total	$29.46M	$17.25M
Total cost per workload	**$59K**	**$35K**

41% less

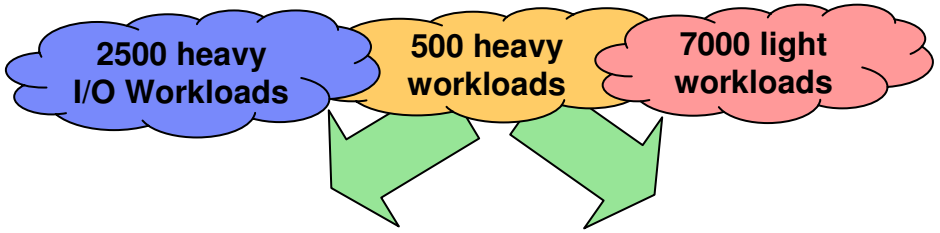
Results may vary based on customer workload profiles/characteristics. Prices are in US currency. Prices will vary by country

Simplification –
Fewer Parts To Assemble And Manage



Deployed on Intel		Best fit on zEnterprise
1603	Servers	21 frames
13,763	Network (parts)	223
2131	Power (KW)	419
198	Administrators	76
1603	Storage admin points	10

The Savings Are Cumulative

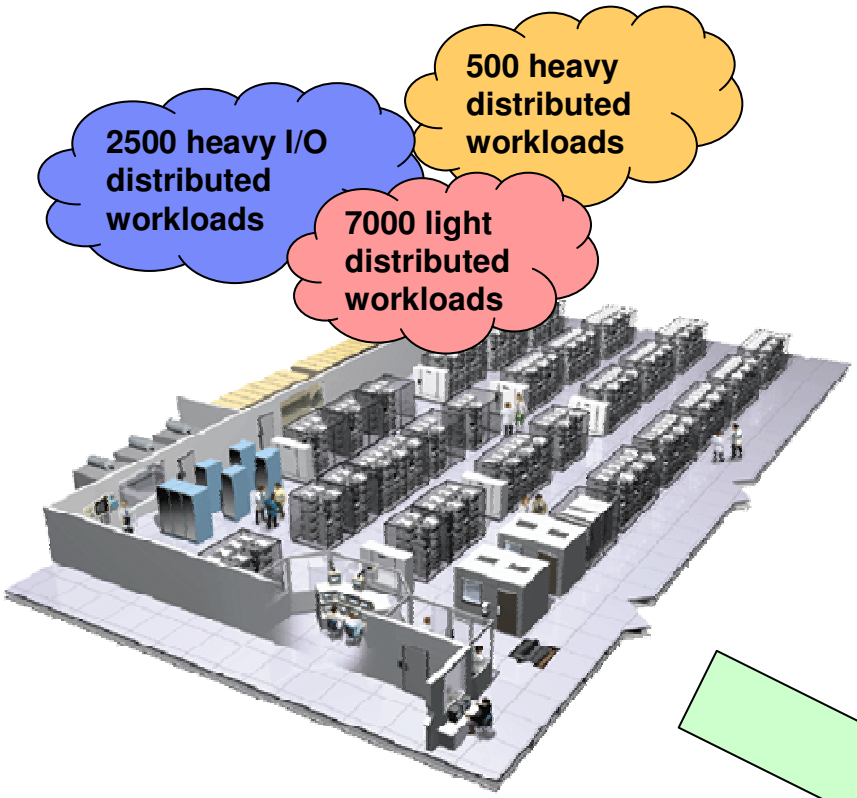


Three Year Cost Of	Deployed on Intel	Best fit on zEnterprise
Servers	**$314M**	**$138M**
Network	**$3.8M**	**$0.2M**
Power	**$5.6M**	**$1.1M**
Labor	**$94.8M**	**$36.4M**
Storage	**$211M**	**$108M**
Total	$629M	$284M
Total cost per workload	**$62K**	**$28K**

55% less

30 Results may vary based on customer workload profiles/characteristics. Prices based on publicly available US list prices. Prices may vary by

zEnterprise Is A Roadmap To The Data Center Of The Future



- **Lower cost per unit of work for large scale workloads**
- **Revolutionary cost reductions for smaller scale workloads**
- **Data center simplification**
- **Improve quality of service**
- **No other platform can match!**

Mainframe workloads
+
distributed workloads
best fit for cost