

# Working Smarter in 2011

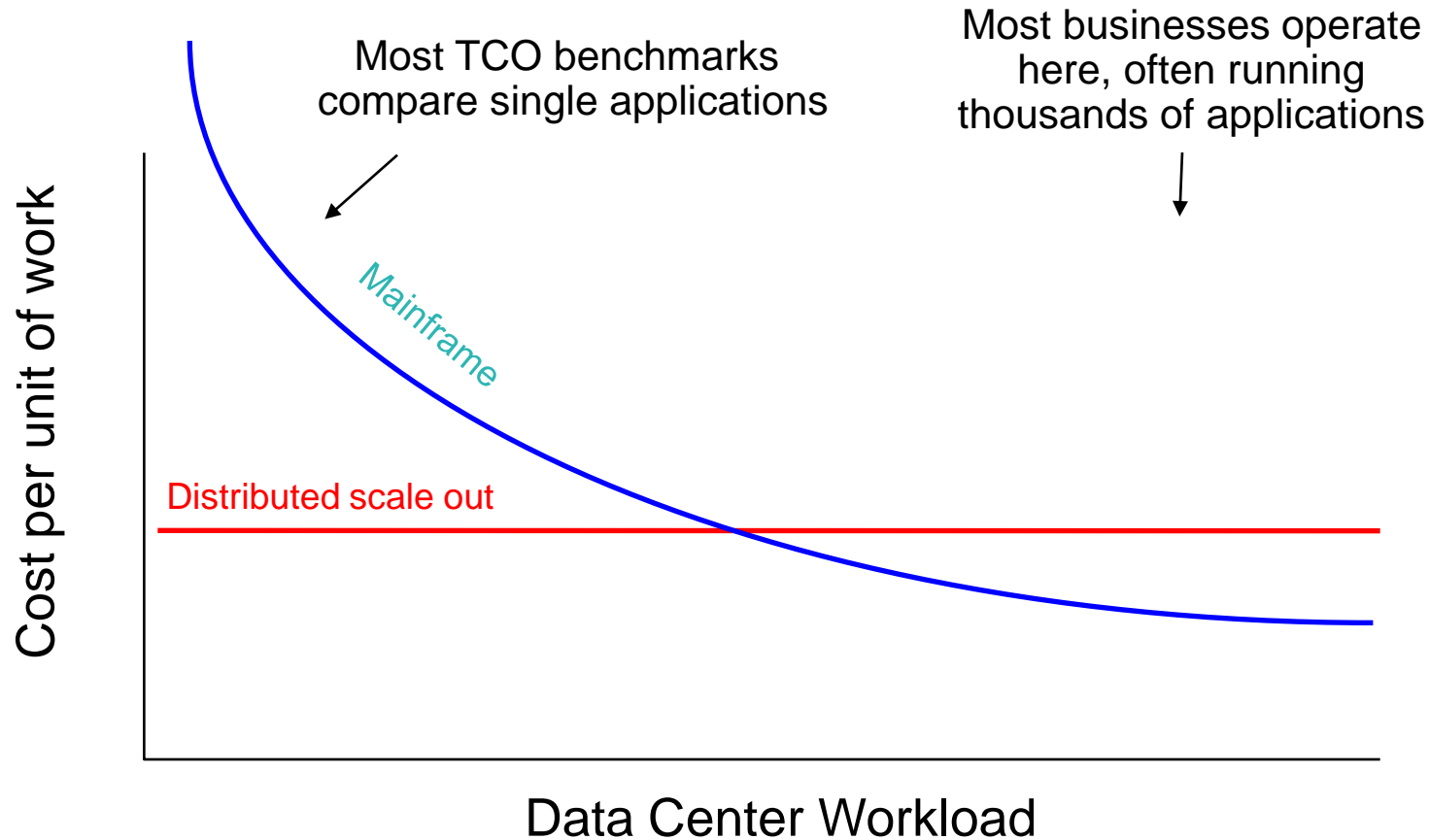


## How zEnterprise Drives Lower Cost for Workload Deployment

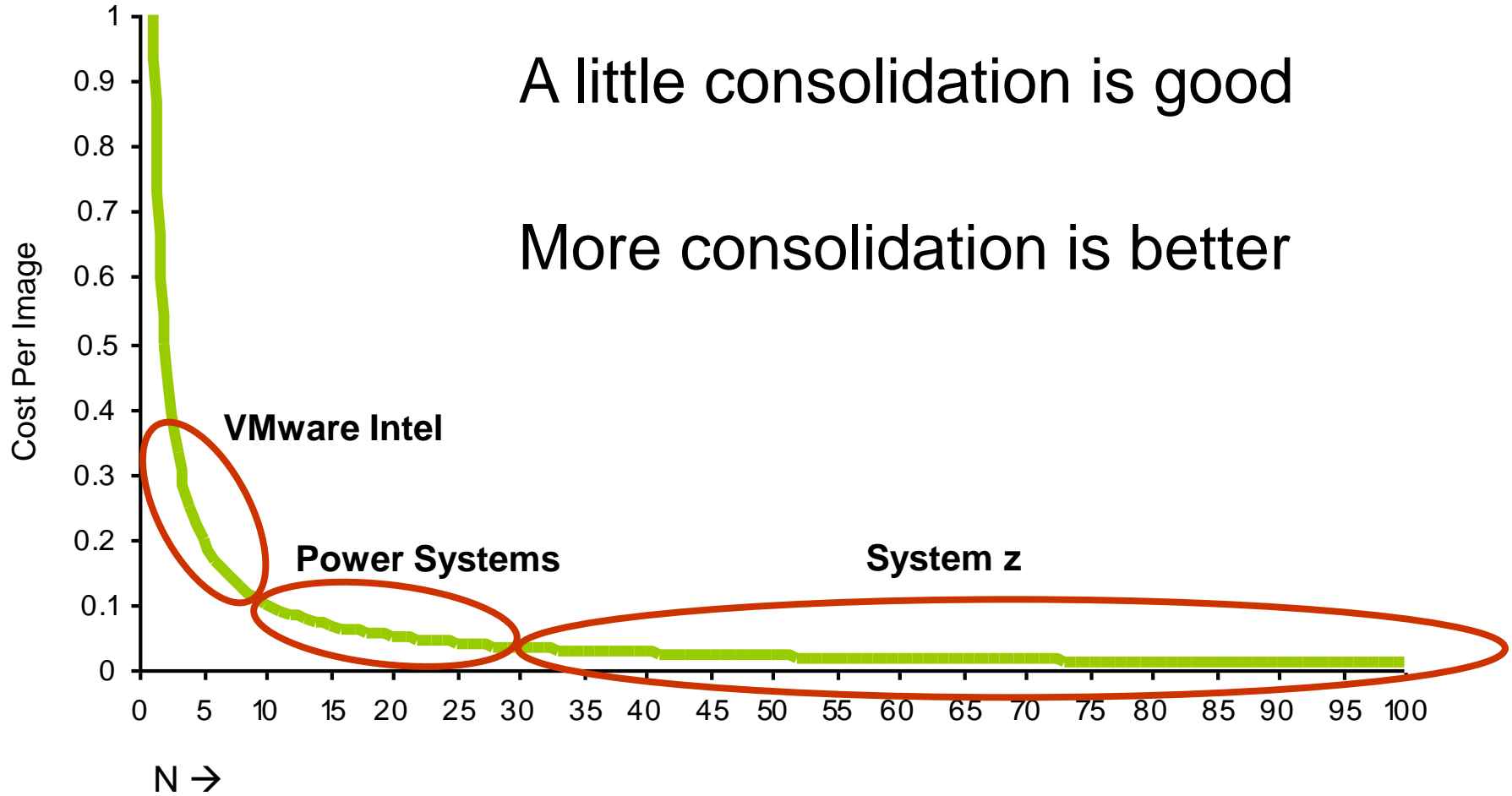
Ray Jones  
Vice President,  
Worldwide System z Software  
IBM Software Group



# Mainframe Cost/Unit of Work Decreases as Workload Increases



# Observed Consolidation Ratios



A little consolidation is good

More consolidation is better

# Utilization of Distributed Servers & Storage

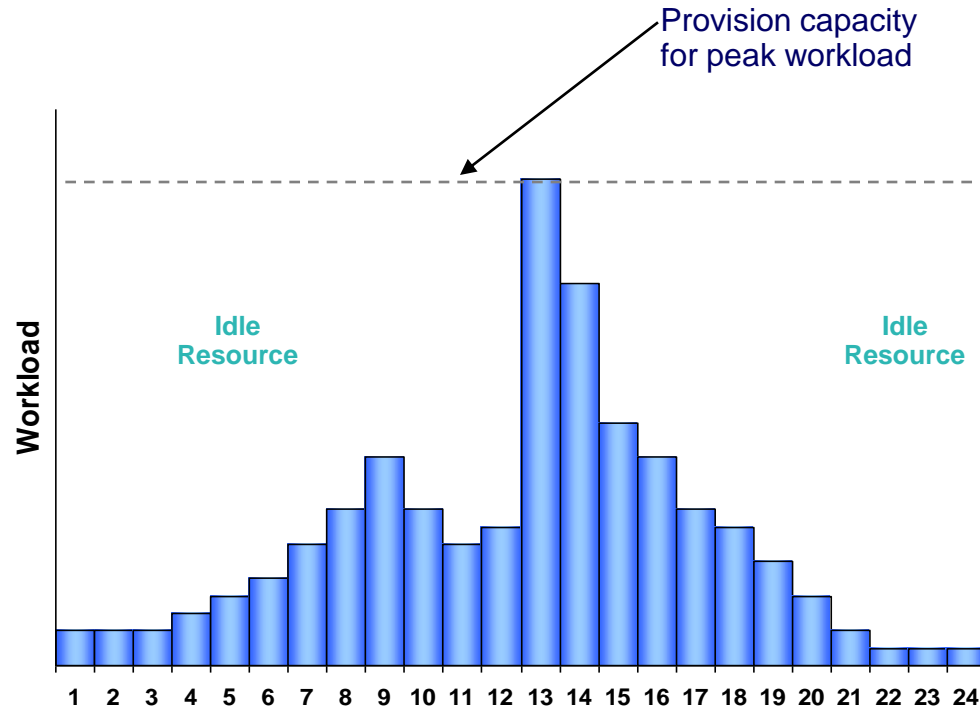
Typical utilization of:

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

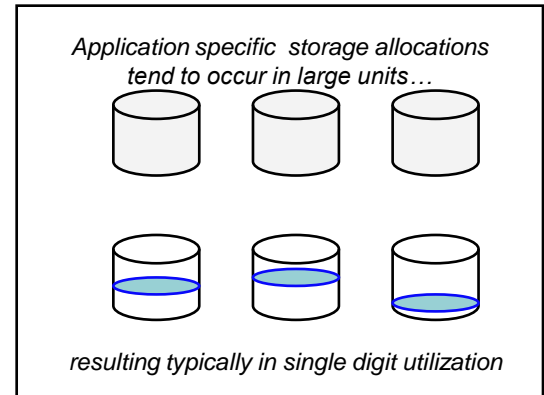
- Application-specific resulting in over-allocations
- Fine grained storage allocation mechanisms characteristic of mainframe storage are uncommon in distributed environments.

## 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
<b>Infrastructure</b>	<b>6%</b>	<b>35%</b>	<b>2.5 * Mean</b>
<b>Web Server</b>	<b>4%</b>	<b>24%</b>	<b>2.5 * Mean</b>
<b>Application</b>	<b>4%</b>	<b>34%</b>	<b>3.75 * Mean</b>
<b>Database</b>	<b>5%</b>	<b>37%</b>	<b>3.25 * Mean</b>
<b>Terminal</b>	<b>6%</b>	<b>45%</b>	<b>3.25 * Mean</b>
<b>E-Mail</b>	<b>4%</b>	<b>34%</b>	<b>3.75 * Mean</b>

IBM System x™ Servers and VMware Virtual Machine Sizing Guide

Legacy workloads on XEON 2.5-2.8GHz Servers

Normal probability distribution

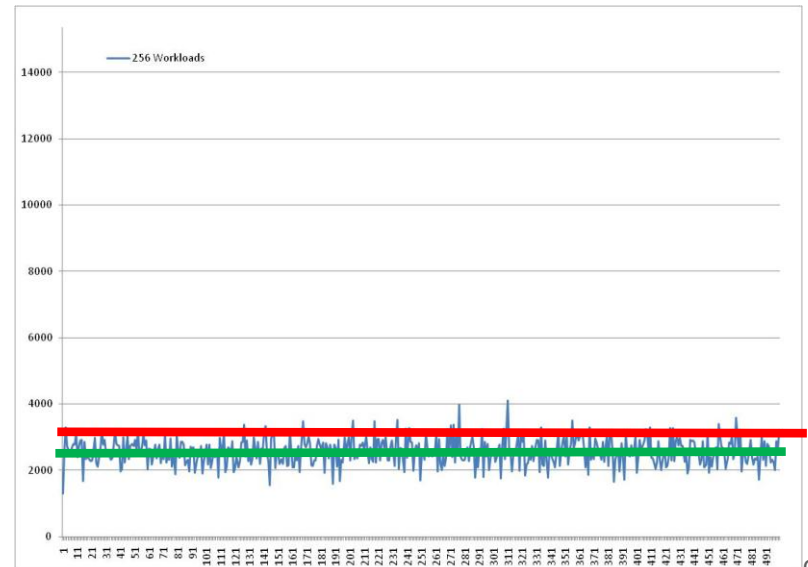
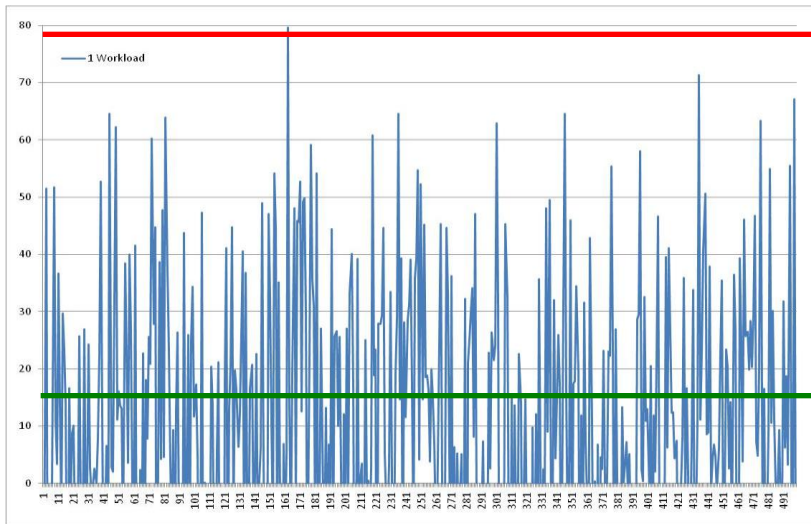
# New Workload Scenarios – Beware Benchmarks

- **Stress test benchmarks have no variability!**

- They drive the system under test to 100% 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  $\text{Sigma}=2.5*\text{Mean}$  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

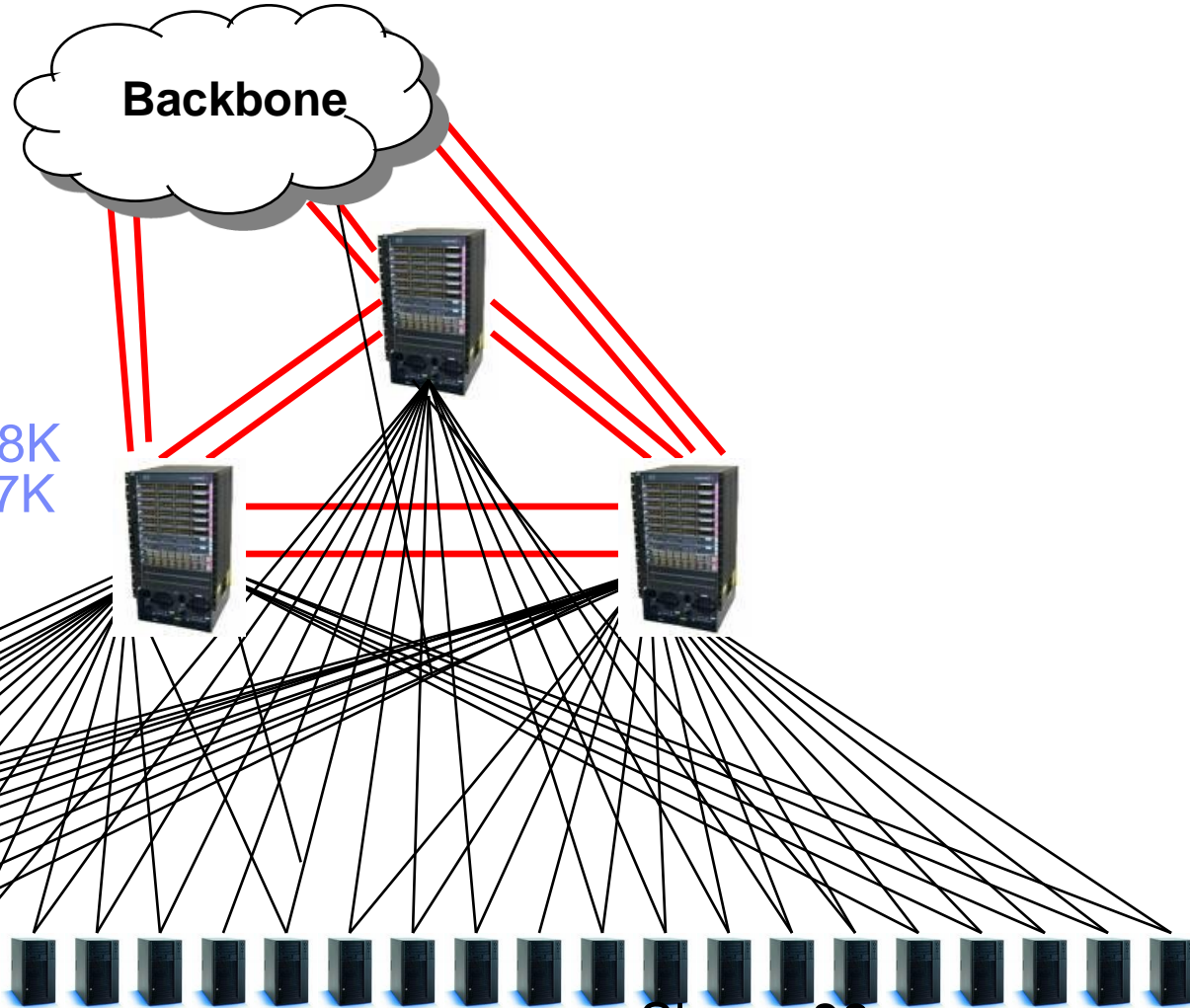


\* If we add one more workload to a pool of 256 consolidated workloads the computing resource required for the pool goes up by  $1.00047 * \text{Mean}$  6

# 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



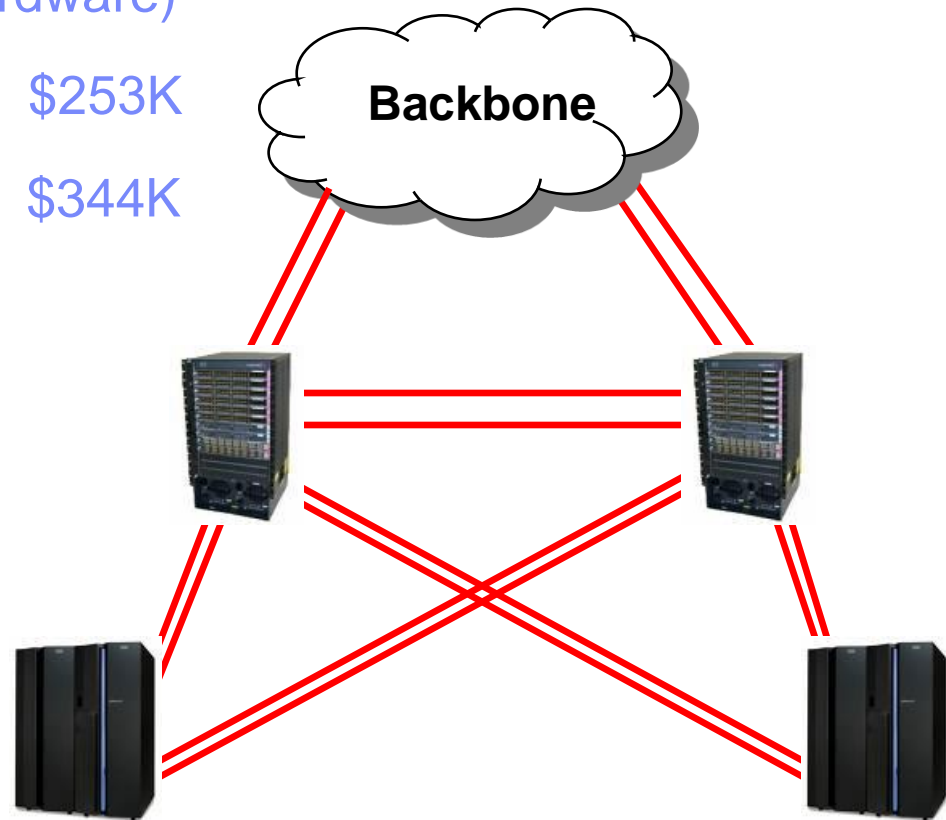
Shows 30 of the 483 Servers

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

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

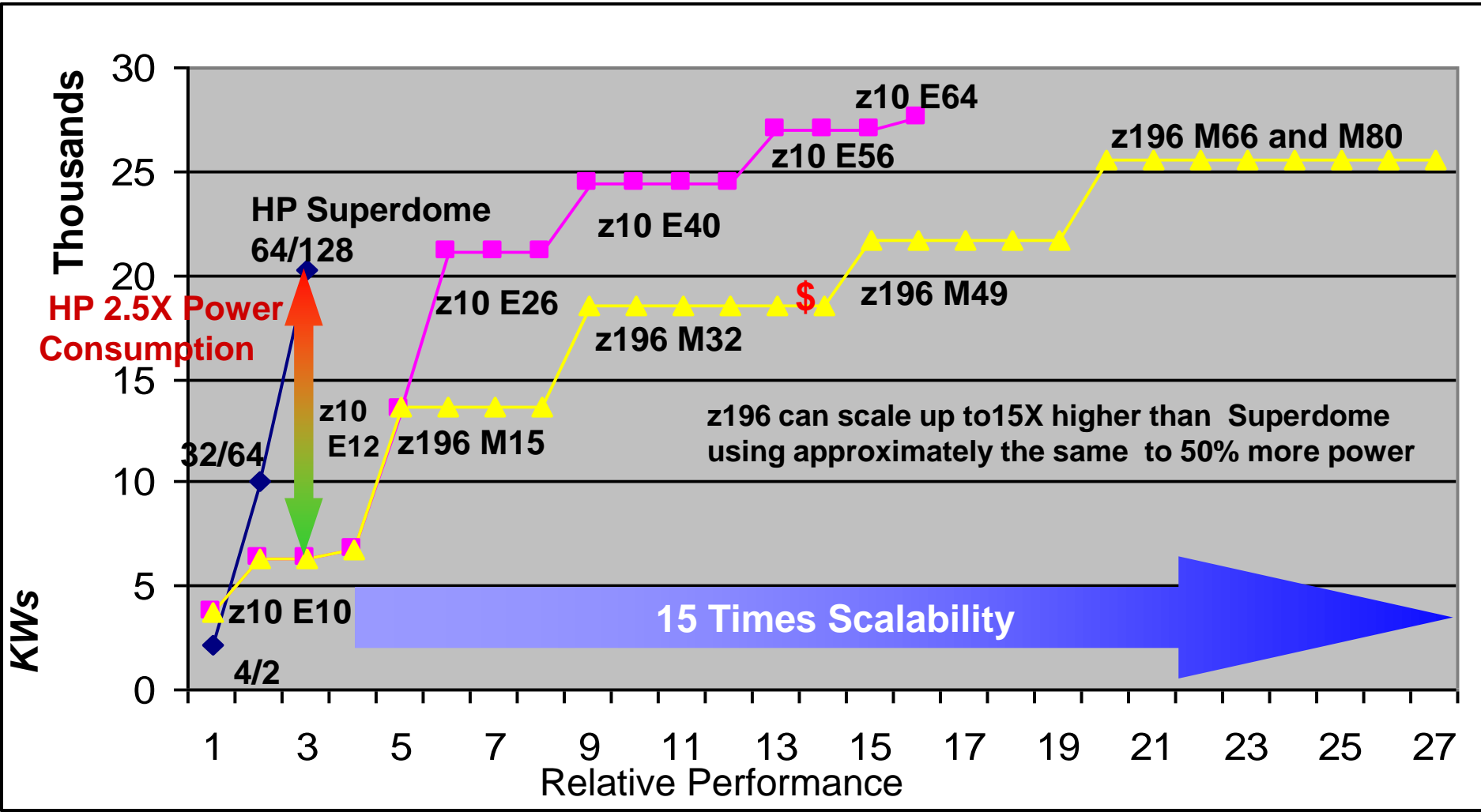
“After” Network Annual Cost \$253K

Network Annual Cost Savings \$344K





# Mainframe Scales 2.5 to 15X Superdome

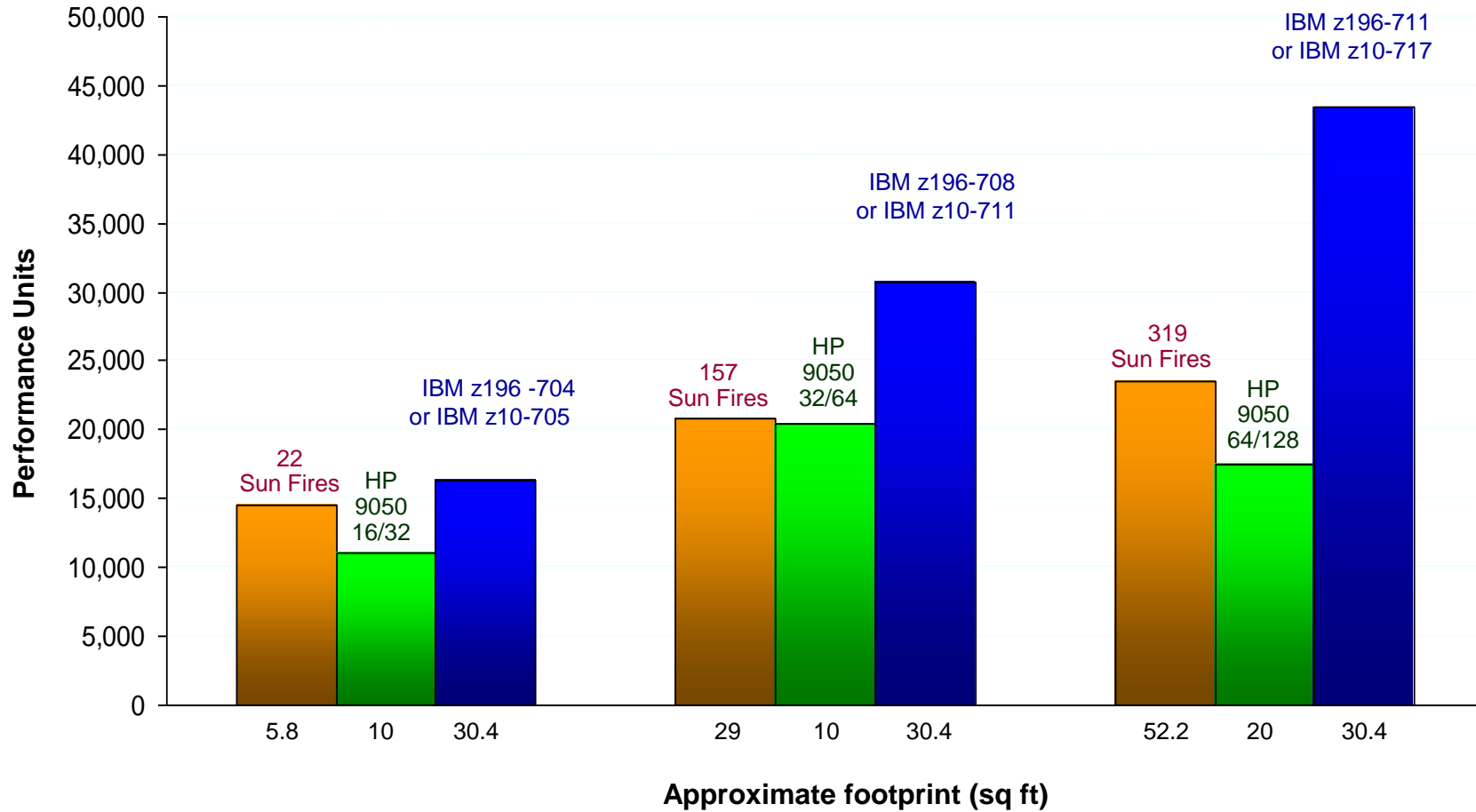


Notes: Performance as per Eagle TCO studies. Multiply by 2 for MIPS. HP performance based on 122 perf units / MIPS. z10 and z196 power is max value. It is very rare that any mainframe is even 80% of max. Typical mainframe power is less - approximately 60% of maximum as per field data. Mainframe Power scales by model or book package. © 2010 IBM Corporation

# The Mainframe Also Delivers More Compute Power Per Footprint Unit

Performance Units per Square Foot

■ SUN ■ HP ■ IBM



Based on 122 performance units per MIP

MainframeE10 EC and z196 footprint remains constant

# Customer Survey – How Many People to Manage Servers?

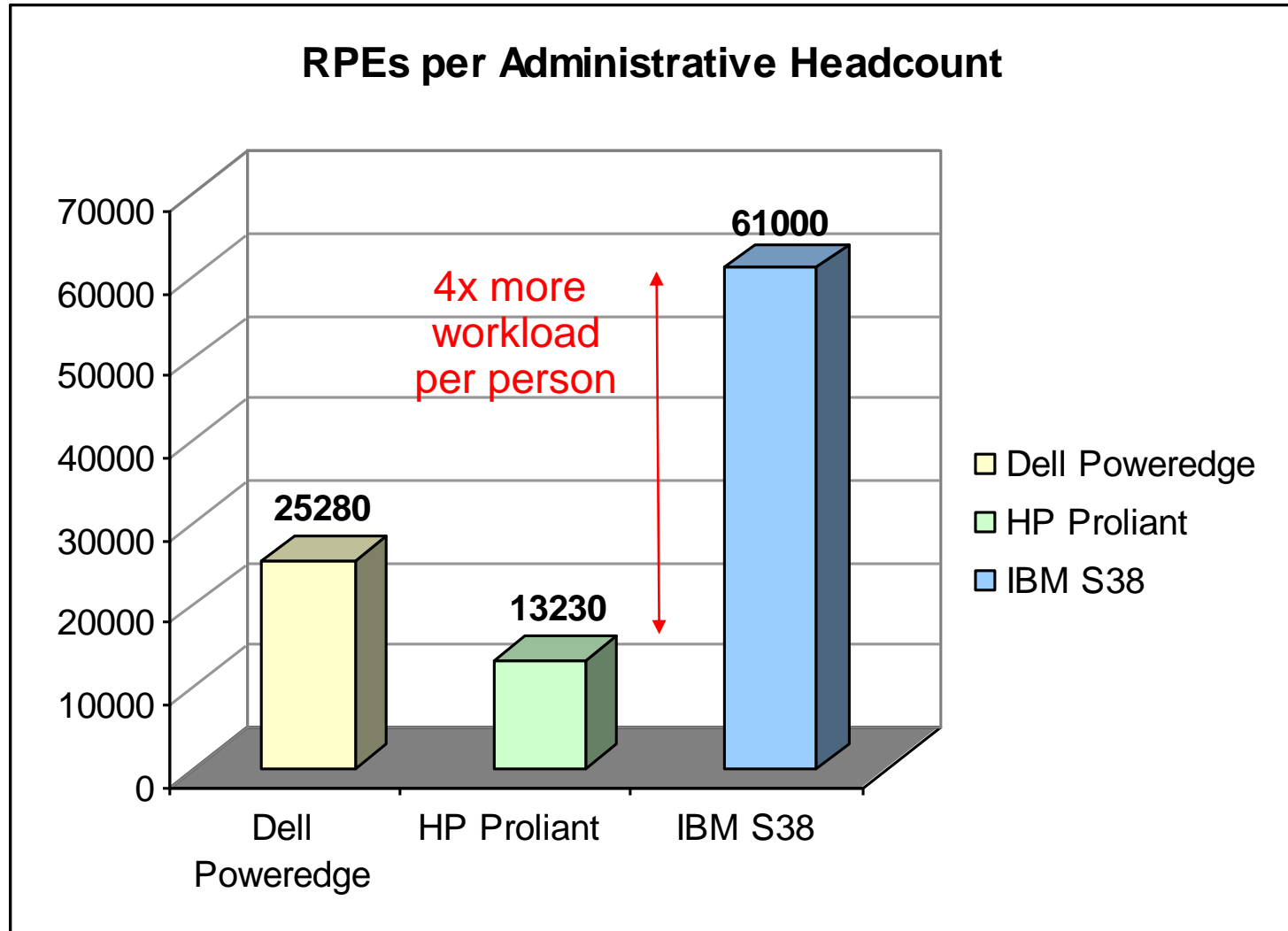
# NT Servers	# People	Ratio (s/p)
1123	68	16.5
228	20	14.4
671	51	13.1
700	65	11.5
154	18	8.5
431	61	7.1
1460	304	4.8
293	79	3.7
132	54	2.0

# 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...

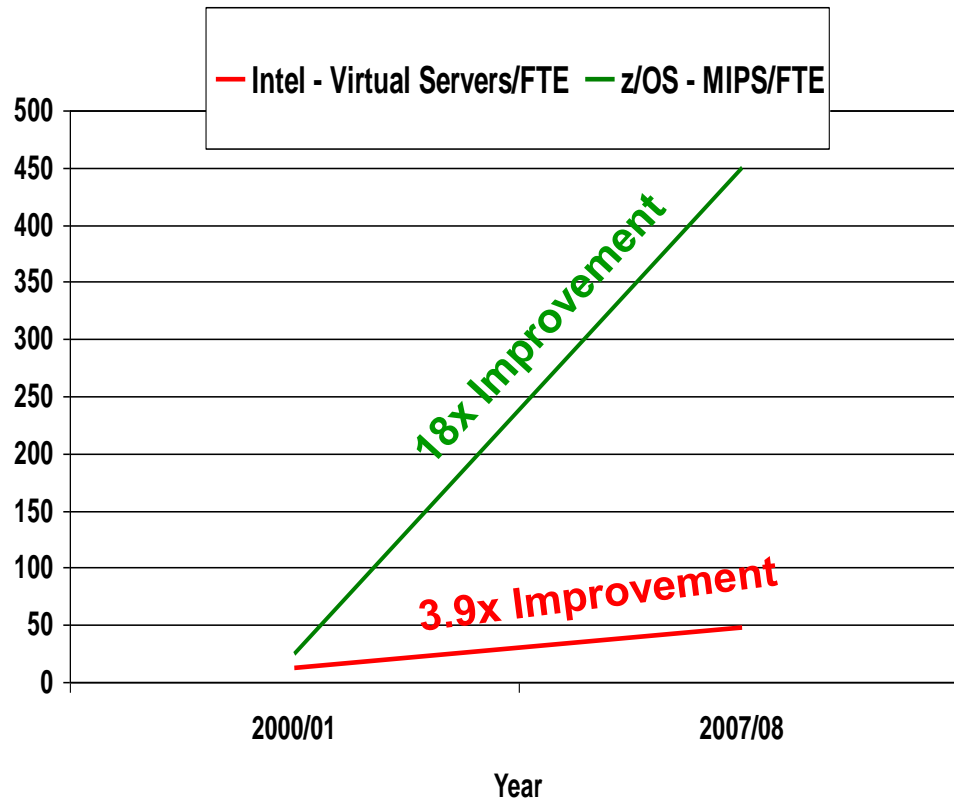
*Source: IBM Scorpion Customer Studies NOTE: Figures for total administration cost*

# 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**

# Average Costs for Customers

## System z vs distributed – Empirical Findings

### Cost Ratios (z vs Distributed)

		z	Distributed	z vs distributed (%)
<b>Rehosting</b>	<b>5-Year TCO</b>	<b>\$29,428,593</b>	<b>\$51,965,131</b>	<b>56.63%</b>
	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%
<b>Consolidation</b>	<b>5-Year TCO</b>	<b>\$9,739,125</b>	<b>\$23,325,530</b>	<b>41.75%</b>
	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)

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

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

Source: IBM internal study

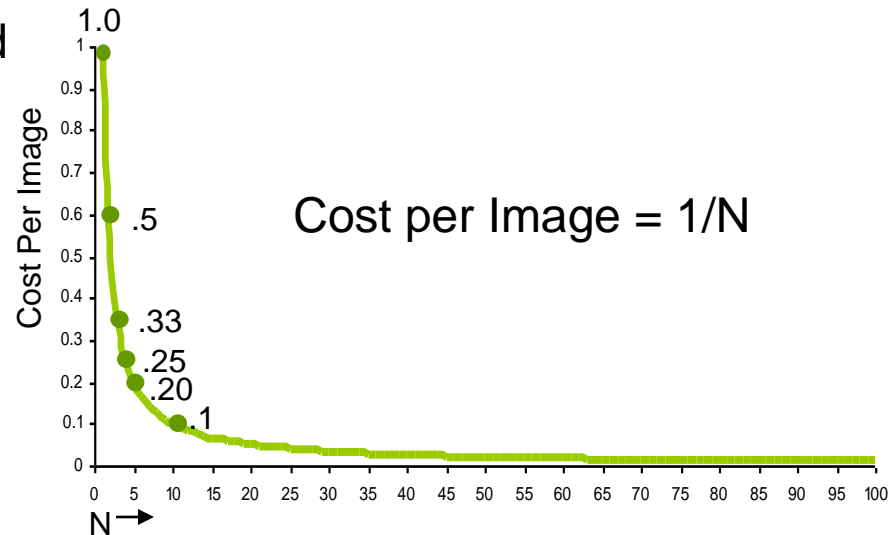
# How Does Consolidation Reduce Costs?

## ■ Costs shared by all “N” consolidated images

- ▶ Hardware
- ▶ Software
- ▶ Power
- ▶ Floor Space
- ▶ Local Network Connectivity

## ■ Costs not shared by consolidated images

- ▶ Migration cost per image
- ▶ Off premise network cost
  
- ▶ Labor cost per image



Fixed cost per image

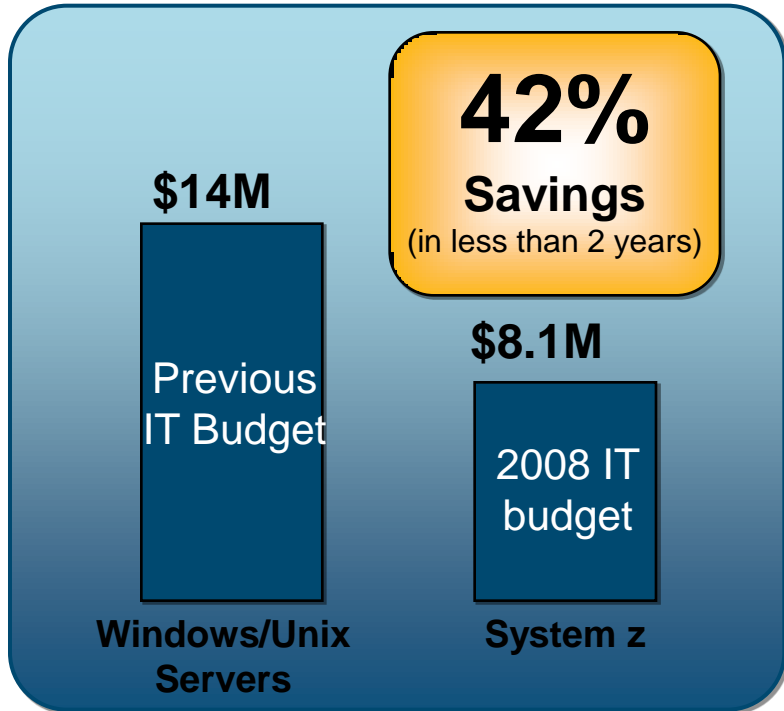
Fixed cost per image, but typically less than unconsolidated labor cost

**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**

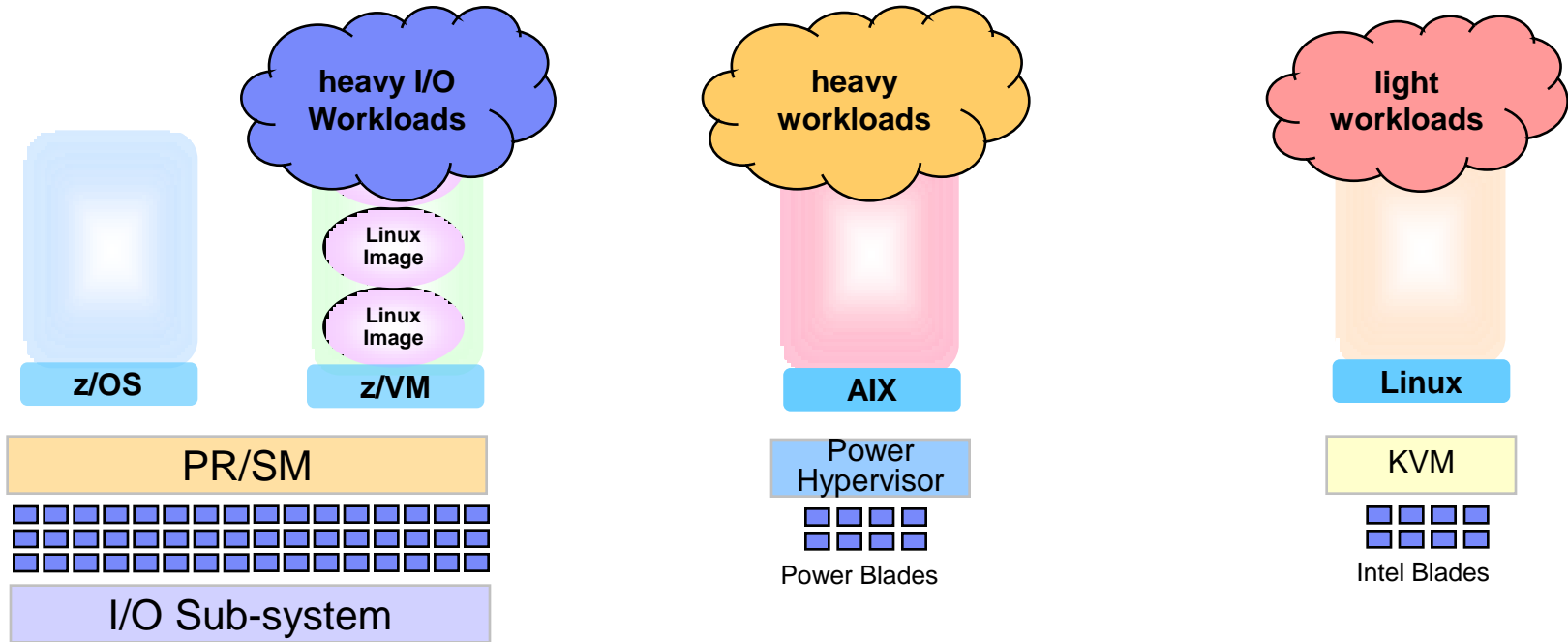
The System z decision was driven by expected benefits:

- **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

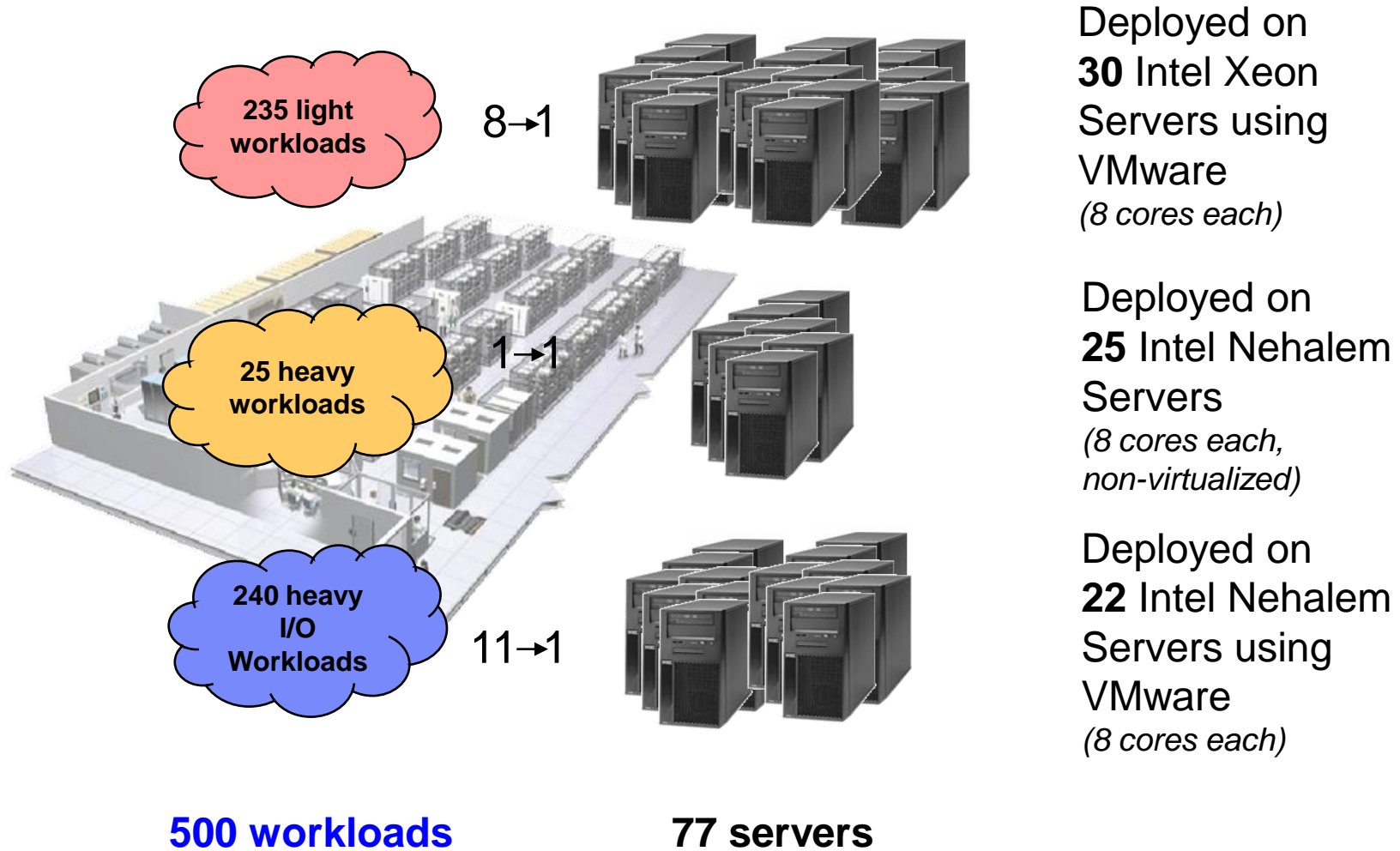


- Scale up to 80 cores in a frame (z/OS clusters with sysplex)
- Dedicated I/O Sub System
- Superior qualities of service

- 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?



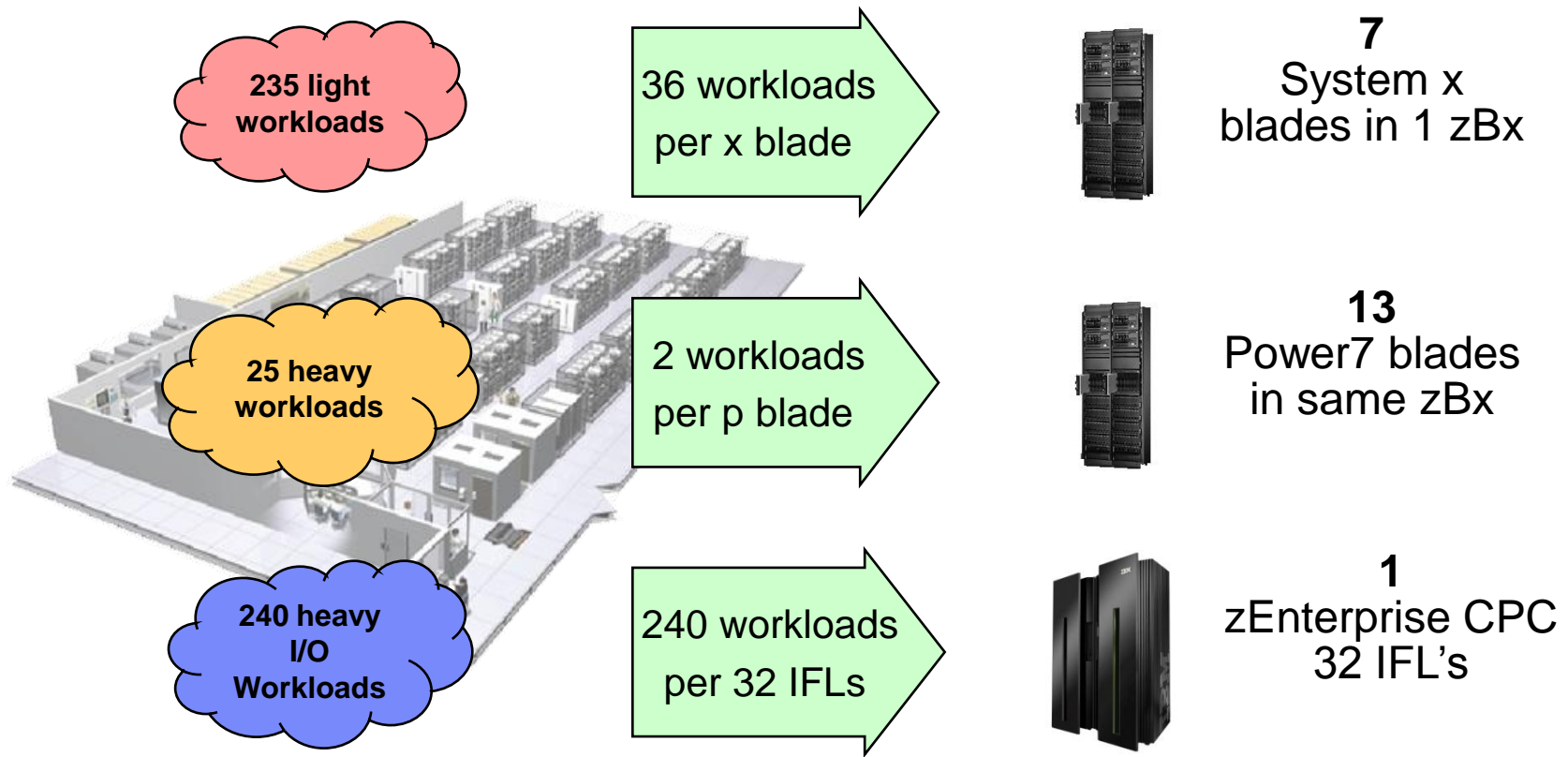
Deployed on  
**30** Intel Xeon  
Servers using  
VMware  
*(8 cores each)*

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

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

IBM analysis of a customer scenario with 500 distributed workloads. Deployment configuration is based on consolidation ratios derived from IBM internal studies. © 2010 IBM Corporation

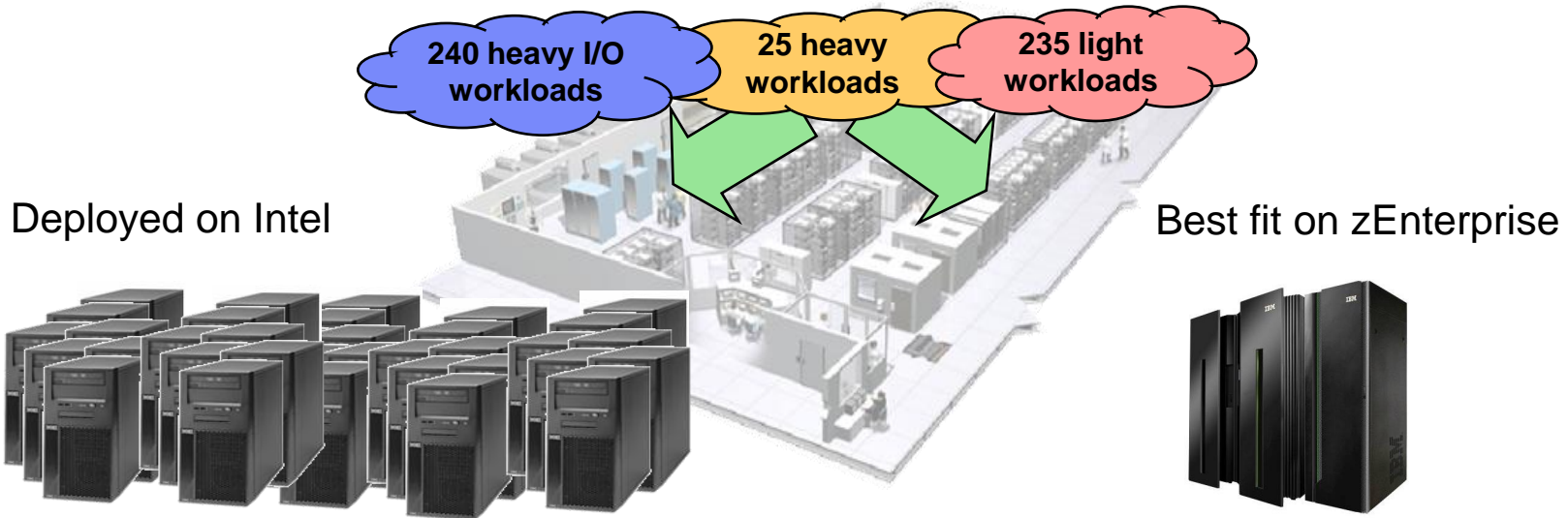
# Large Data Center – What Does it Cost to Deploy 500 Workloads on zEnterprise?



## 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. © 2010 IBM Corporation

# Compare Server Cost of Acquisition



Deployed on Intel

Best fit on zEnterprise



**77 Intel Servers**

616 cores

**2 Frames**

192 cores

**\$15.2M** TCA (3 years)

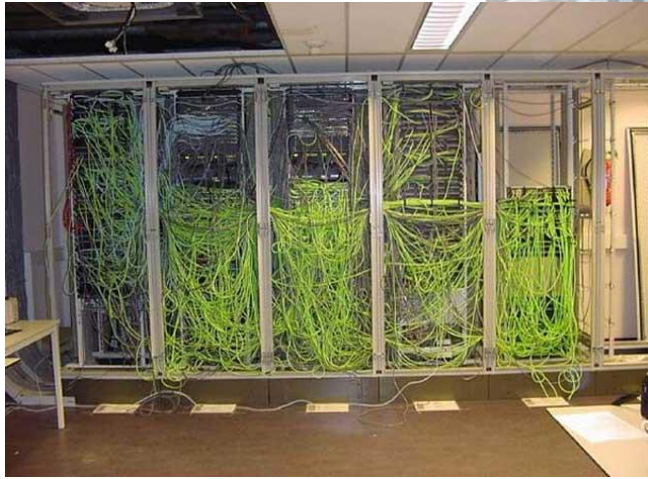
**\$7.5M** TCA (3 years)

**51% less**

22 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



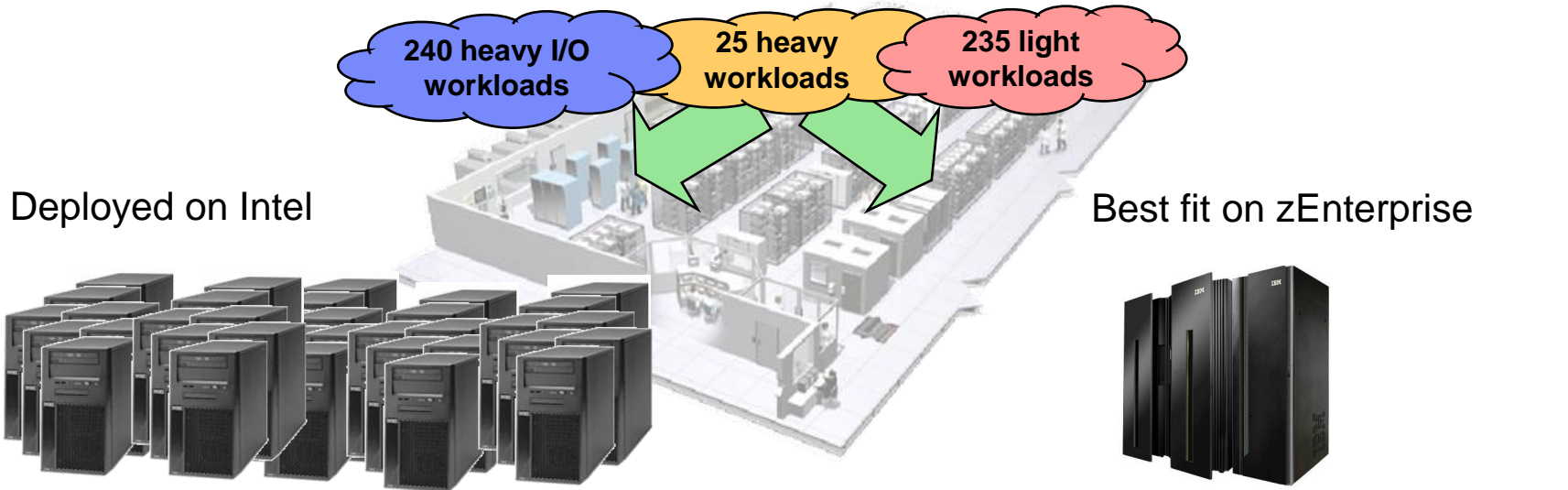
- Additional network parts
- 1 switches
- 10 cables
- 10 adapters

**21** total network parts  
**\$0.03M** TCA

**86% less**

23 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

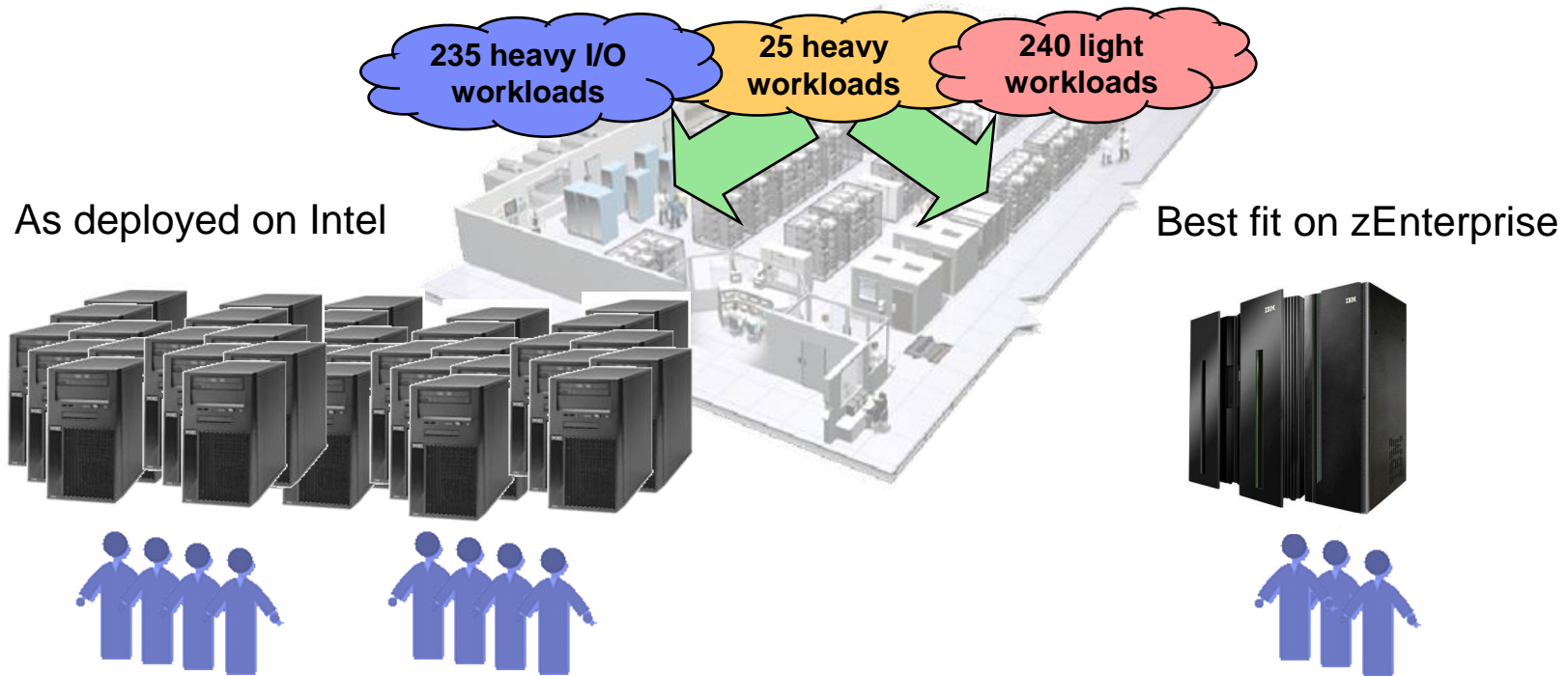
**\$0.06M**  
 3 years @ \$0.10 per kWh

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

**77% less**



# Compare Server Infrastructure Labor Cost



20,464 labor hours/yr  
**9.84** administrators

**\$4.71M** for labor

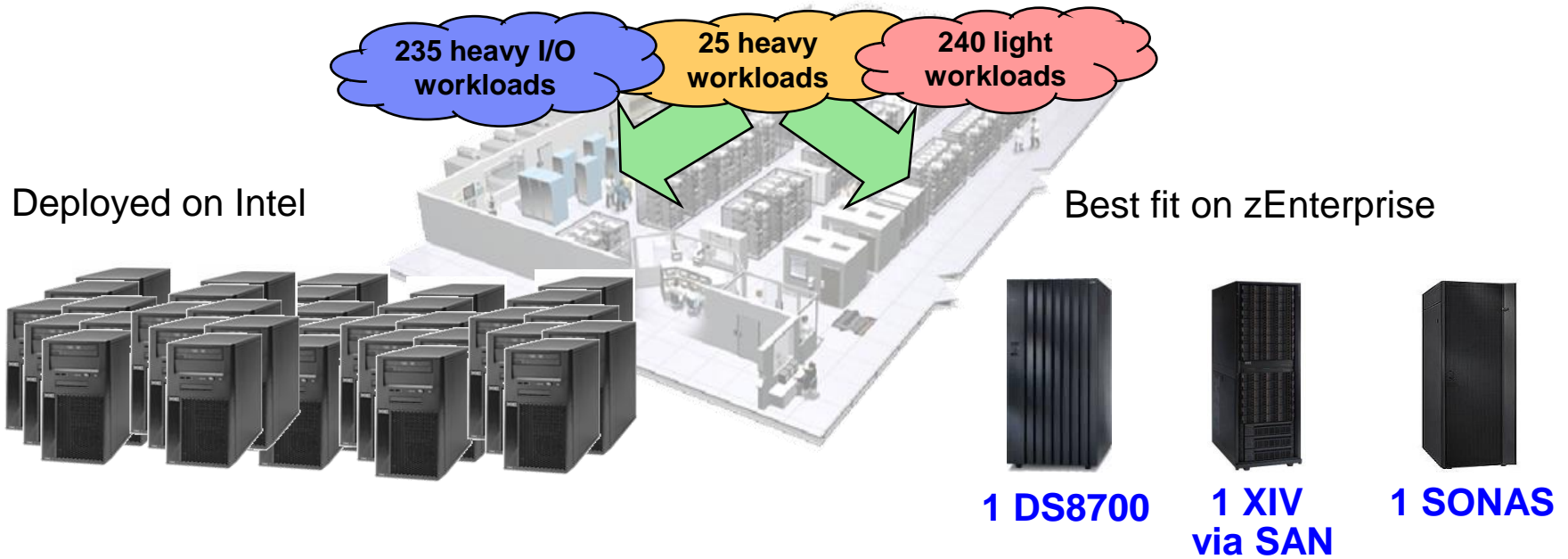
7,673 labor hours/yr  
**3.68** administrators

**\$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



**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.  
 26 Prices are in US currency, prices will vary by country

# Fewer Parts to Assemble and Manage



Deployed on Intel
77
664
289
10
580

Servers

Network (parts)

Power (KW)

Administrators

Storage admin points

Best fit on zEnterprise
2 frames
21
67
4
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
<b>Total cost per workload</b>	<b>\$59K</b>	<b>\$35K</b>

**41% less**

# Simplification – Fewer Parts To Assemble And Manage



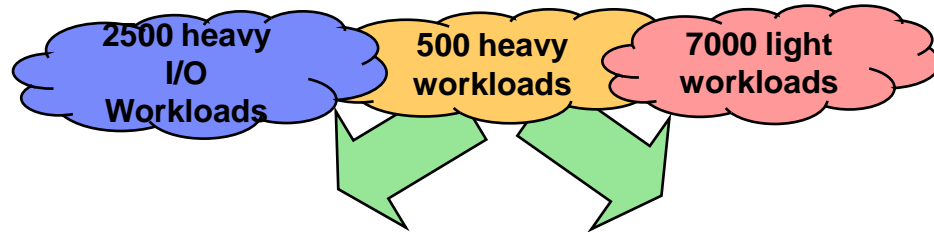
Deployed on Intel
1603
13,763
2131
198
1603

Servers  
 Network (parts)  
 Power (KW)  
 Administrators  
 Storage admin points

Best fit on zEnterprise
21 frames
223
419
76
10



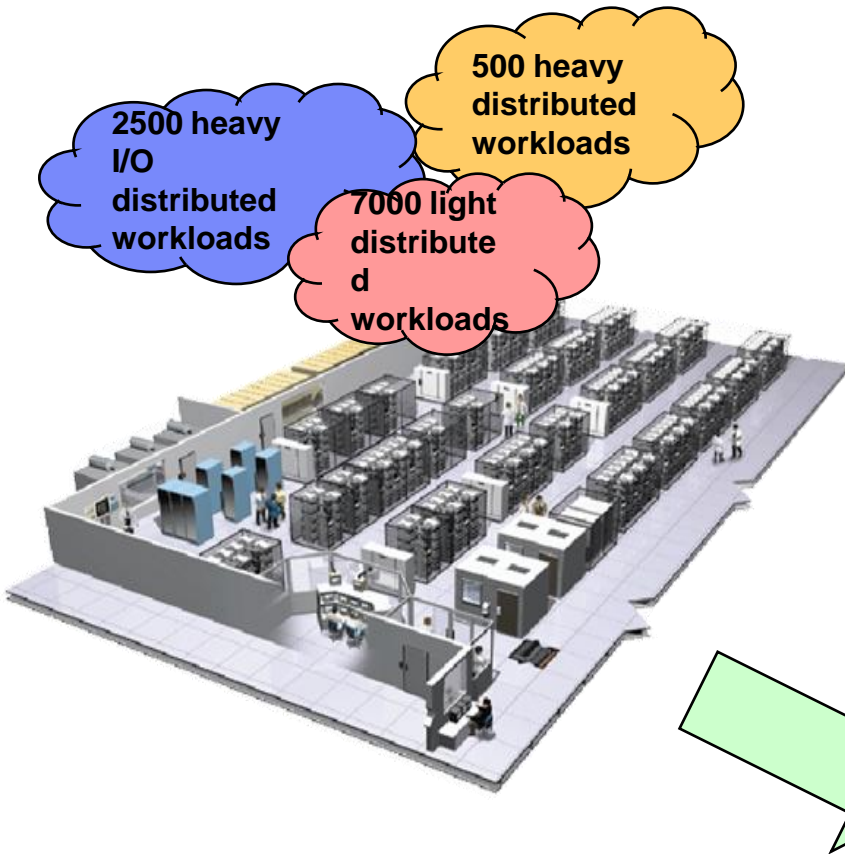
# The Savings Are Cumulative



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
<b>Total cost per workload</b>	<b>\$62K</b>	<b>\$28K</b>

**55% less**

# 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**



Thank  
YOU