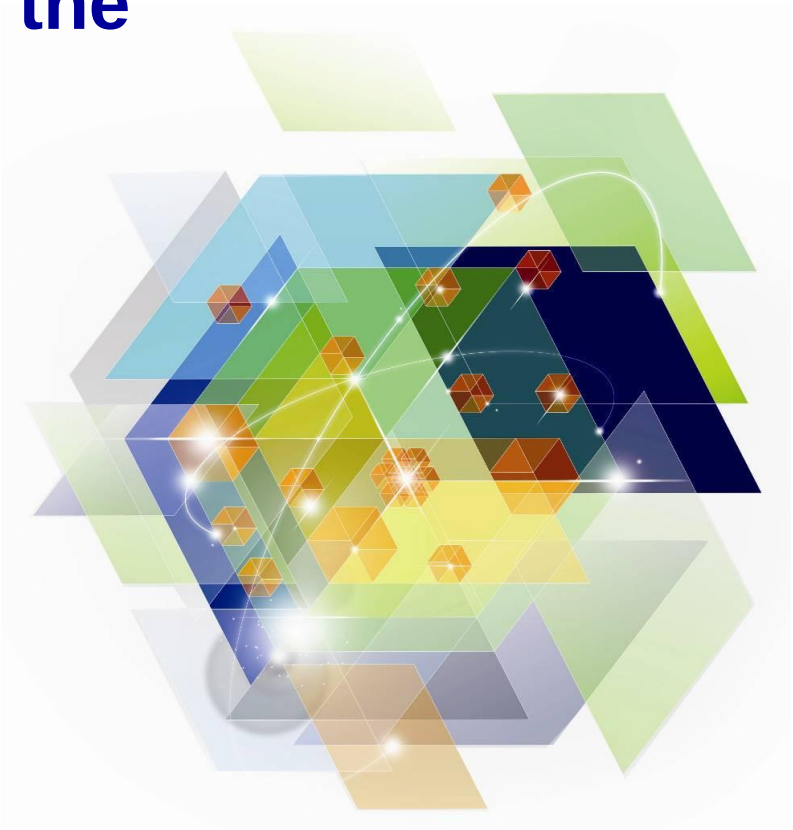
Analyzing IT Value and Cost Considerations - Maximizing the value of your mainframe



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

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Smarter Computing

Strategies to achieve breakthrough reductions in IT cost

Ascertain true elements of cost:

Hardware/Software/Maintenance
Networking
Energy
Labor
Storage

New metric for the age of Smarter Computing

COST PER WORKLOAD

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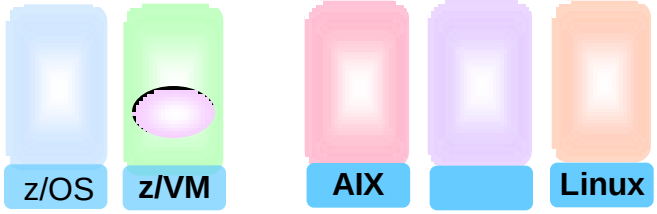
Smarter Computing With zEnterprise Delivers Breakthrough Economics

Platforms Optimized For Different Workloads



Best fit for workload

Consistent Structured Management

Consistent structured practices

Lowest Cost Of Acquisition Per Workload

Lowest Cost Of Operation Per Workload

Lowest Cost Per Workload

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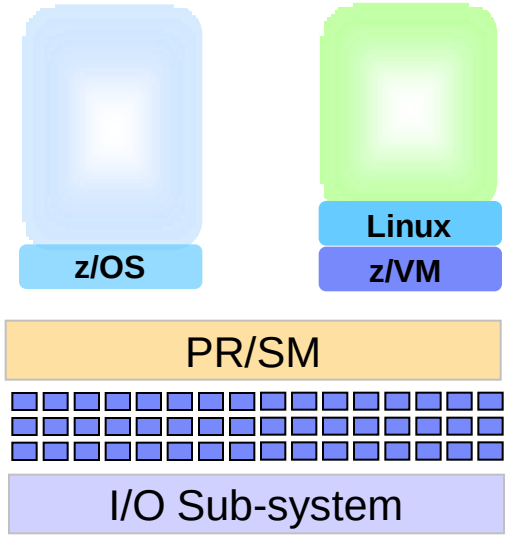
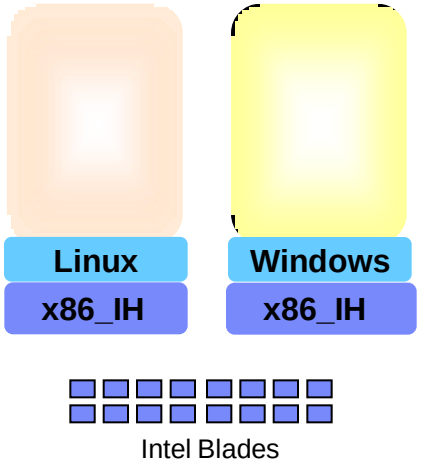
A Closer Look At Fit-For-Purpose Workload Assignment



- 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
- 4 fast processing threads per core
- Floating point accelerators



- Scales to 16 cores per blade
- 2 fast processing threads per core
- Commodity I/O
- Modest qualities of service

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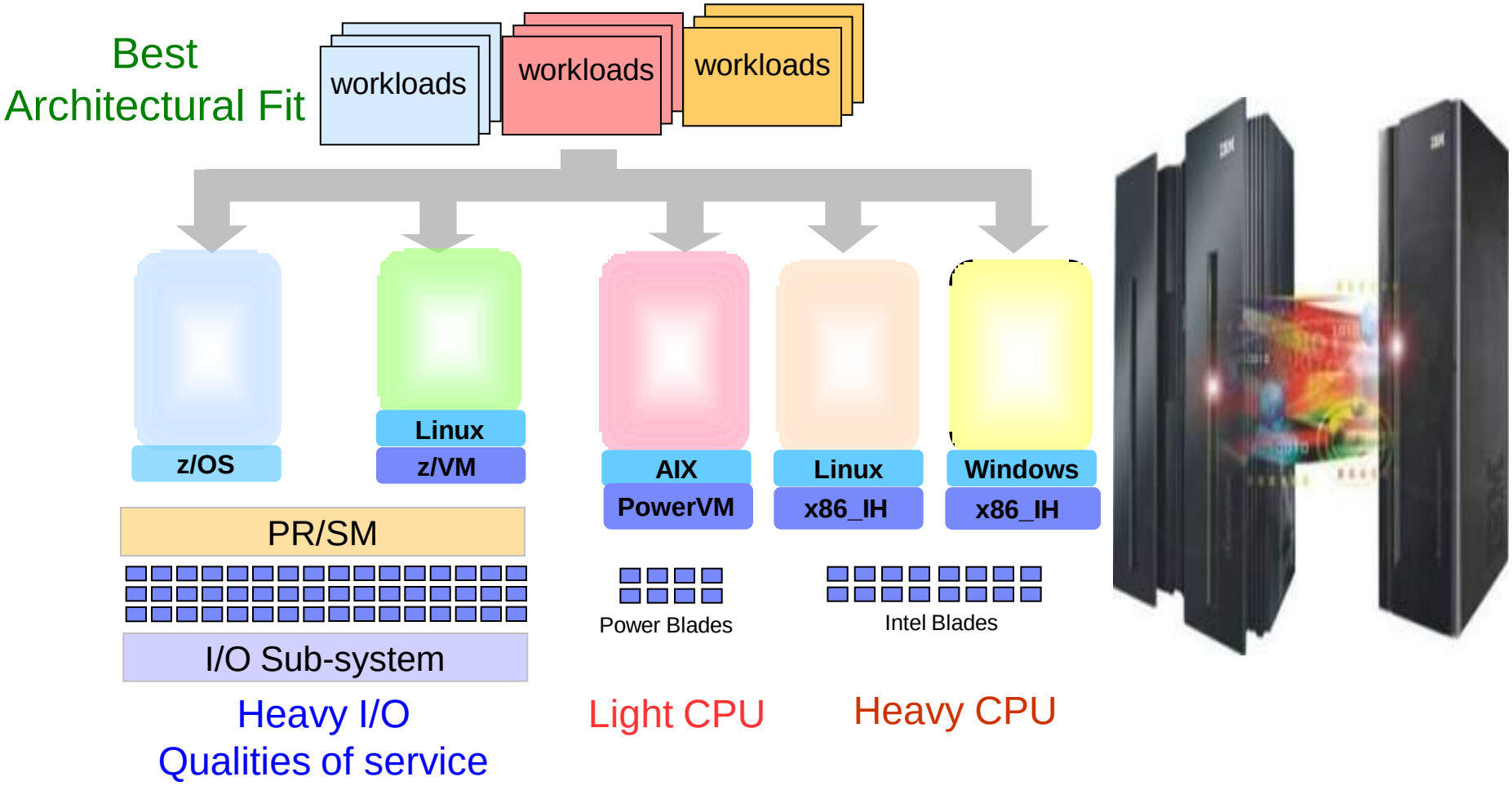
Workload Characteristics Influence The Best Fit Deployment Decision



Deploy or consolidate workloads on the environment best suited for each workload to yield lowest cost

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Deploying Stand Alone Workloads With Light CPU Requirements

Benchmark to determine which platform provides the lowest TCA over 3 years

Light workloads

- **IBM WebSphere ND**
- **Monitoring software**

Online banking workloads, each driving **22** transactions per second with light I/O

47 workloads per Intel blade

Virtualized on Intel
16 core HX5 Blade
$8,086 per workload

28 workload per POWER7 blade

Fast low cost threads

PowerVM on PS701
8 core POWER7 Blade
$7,287 per workload
Best Fit

155 workloads per 32-way z/VM

z/VM on z196 CPC
32 IFLs
$21,932 per workload

Consolidation ratios derived from IBM internal studies. HX5 2.13GHz 2ch/16co performance projected from x3550 2.66GHz 2ch/12co measurements. zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

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Deploying Stand Alone Workloads With Heavy I/O Requirements

Benchmark to determine which platform provides the lowest TCA over 3 years

Heavy I/O workloads

- **IBM WebSphere ND**
- **Monitoring software**

Online banking workloads, each driving **22** transactions per second, with **1 MB I/O per transaction**

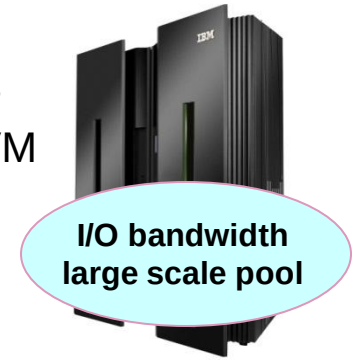
1 workload
per Intel blade

Virtualized on Intel
16 core HX5 Blade
$380,046 per workload

1 workload
per POWER7 blade

PowerVM on PS701
8 core POWER7 Blade
$204,036 per workload

40 workloads
per 32-way z/VM



z/VM on z196 CPC
32 IFLs
$84,985 per workload
Best Fit

Consolidation ratios derived from IBM internal studies. HX5 2.13GHz 2ch/16co performance projected from x3550 2.66GHz 2ch/12co measurements. zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

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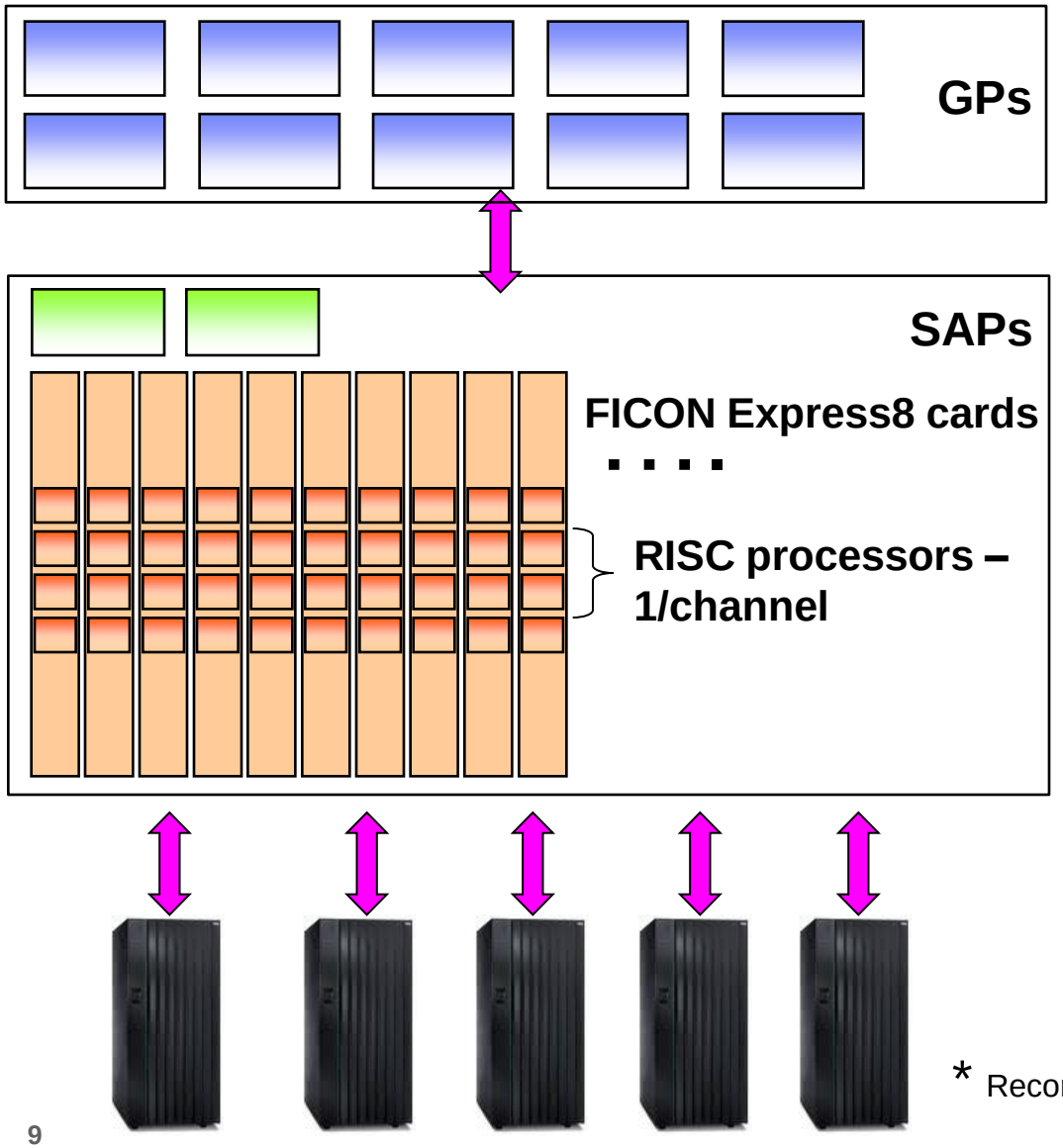
Optimized For High I/O Bandwidth – z114



- **Up to 10 General Purpose (GP) or Specialty Engine processors**
  - Execute business logic
- **Up to 2 System Assist Processors (SAP) to manage I/O requests**
  - Can sustain up to **230K IOPS***
- **Up to 64 physical FICON Express8s cards for I/O transfers**
  - Up to **128 RISC channel I/O processors**
- **IBM DS8800 Storage System**
  - Up to **440K IOPS capability**

* Recommend 70% max SAP Utilization – 161K IOPS

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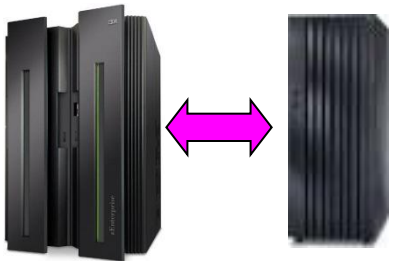
Optimized For High I/O Bandwidth – Reduce Batch Window By 83%

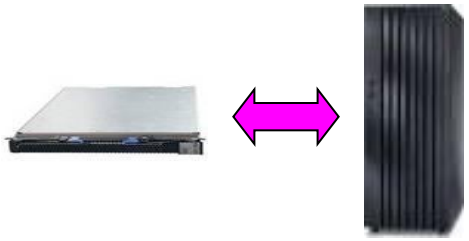
zEnterprise + DS8300

8 processors
128GB memory
16 IO channels



Power Blade 701 + DS8300

8 processors
128GB memory
2 IO channels



300 jobs each to sort 3GB file

Sorting Total Elapsed	1229 Seconds	Sorting Total Elapsed	6900 Seconds
Concurrency	20	Concurrency	20
Bytes Per Sec	1600MB	Bytes Per Sec	280MB

10 jobs each to merge 30 sorted files into 90GB master file

Merging Total Elapsed	1422 Seconds	Merging Total Elapsed	7920 Seconds
Concurrency	10	Concurrency	10
Bytes Per Sec	1350MB	Bytes Per Sec	244MB

Results may vary based on customer workload profiles/characteristics. IBM internal benchmark.

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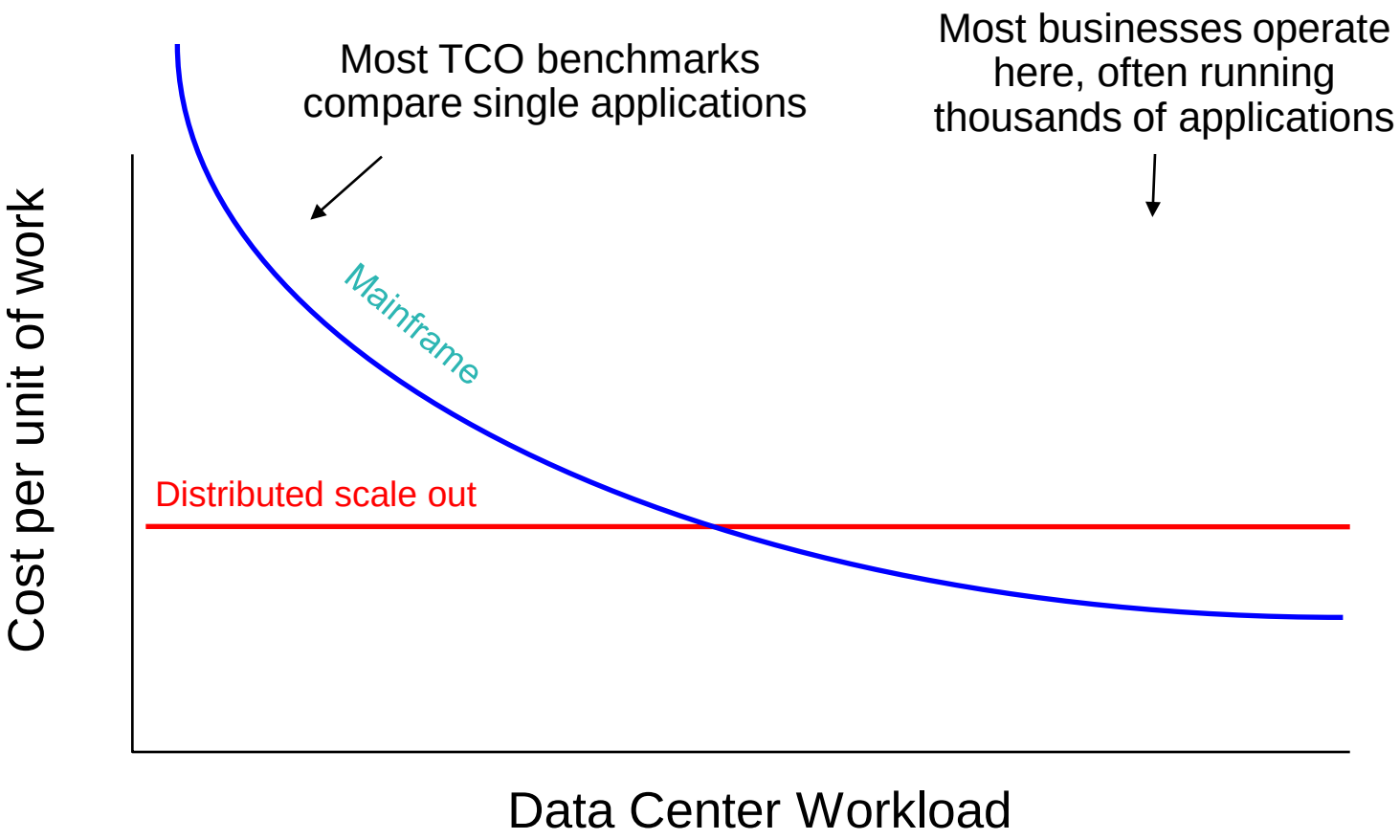
Mainframe Cost/Unit of Work Decreases as Workload Increases



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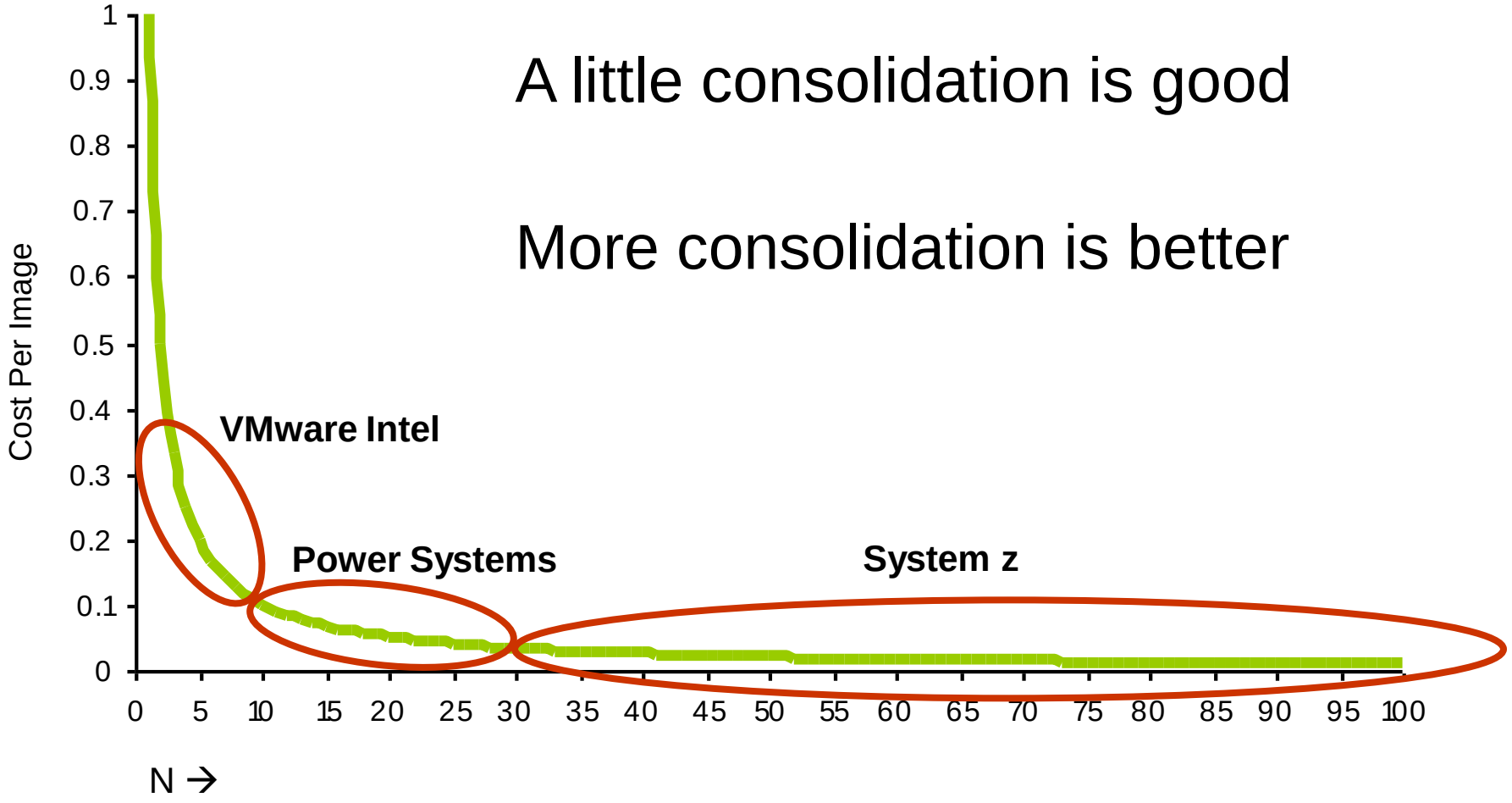
Observed Consolidation Ratios



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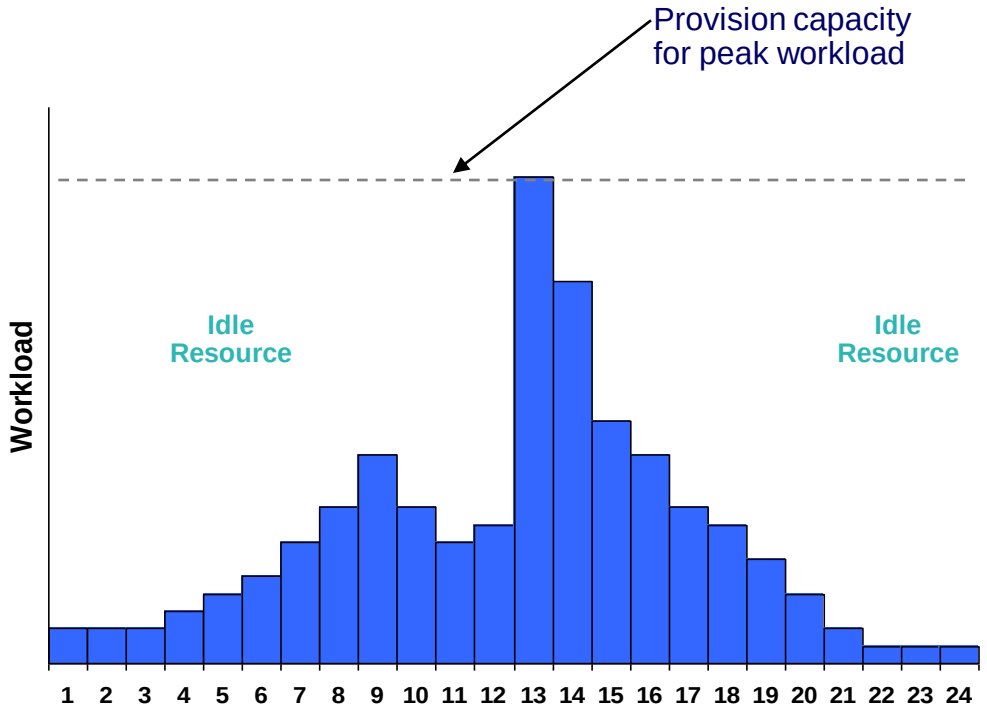
Utilization of Distributed Servers & Storage

Typical utilization of:

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

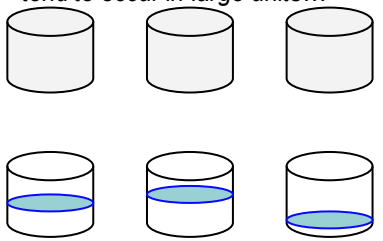
Server dedicated to one application

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

Application specific storage allocations tend to occur in large units…



resulting typically in single digit utilization

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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

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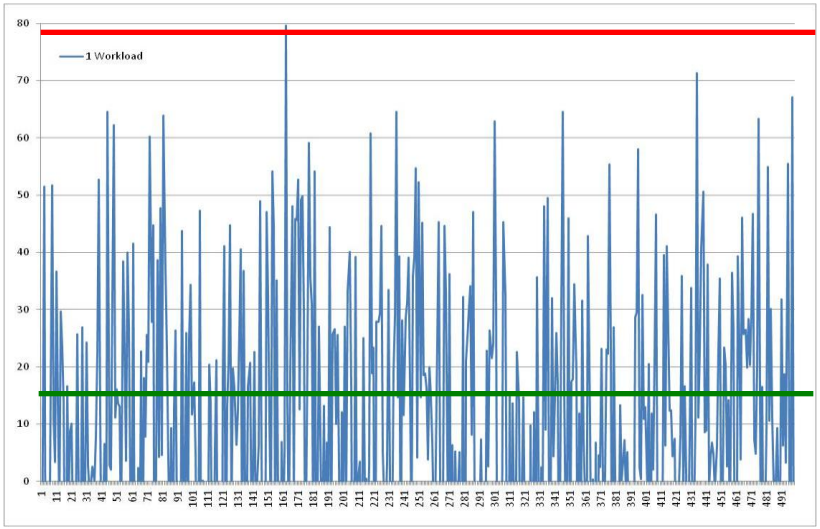
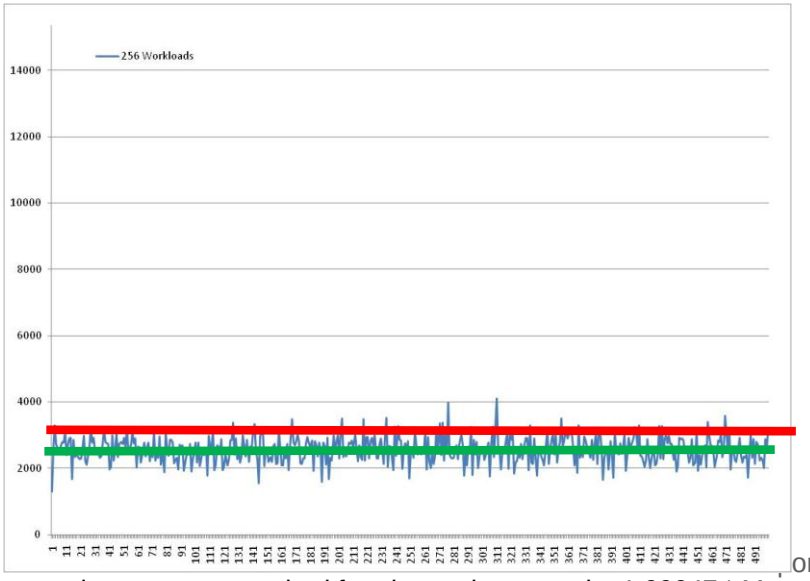
New Workload Scenarios – Beware Benchmarks

- **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

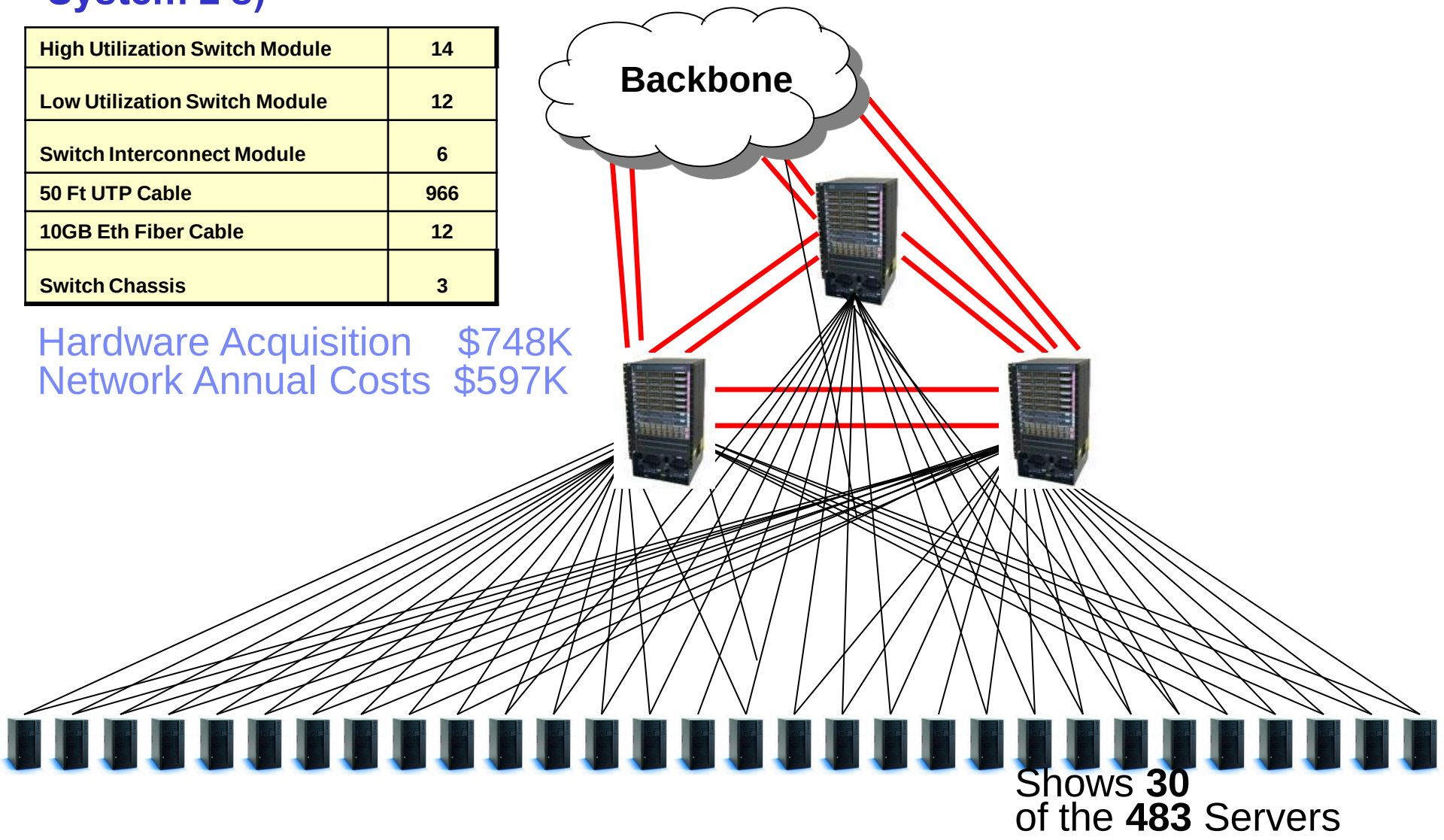


* If we add one more workload to a pool of 256 consolidated workloads the computing resource required for the pool goes up by 1.00047 * Mean

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



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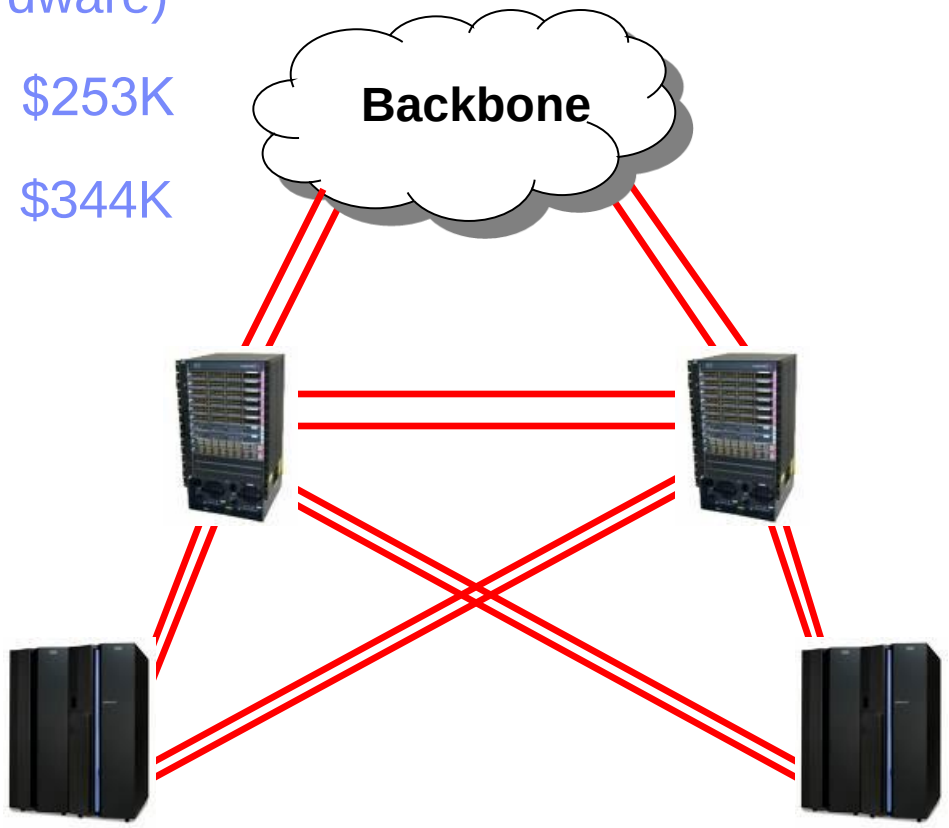
Case Study: Network Costs – After Consolidation (483 Servers to 2 System z's)

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

"After" Network Annual Cost $253K

Network Annual Cost Savings $344K



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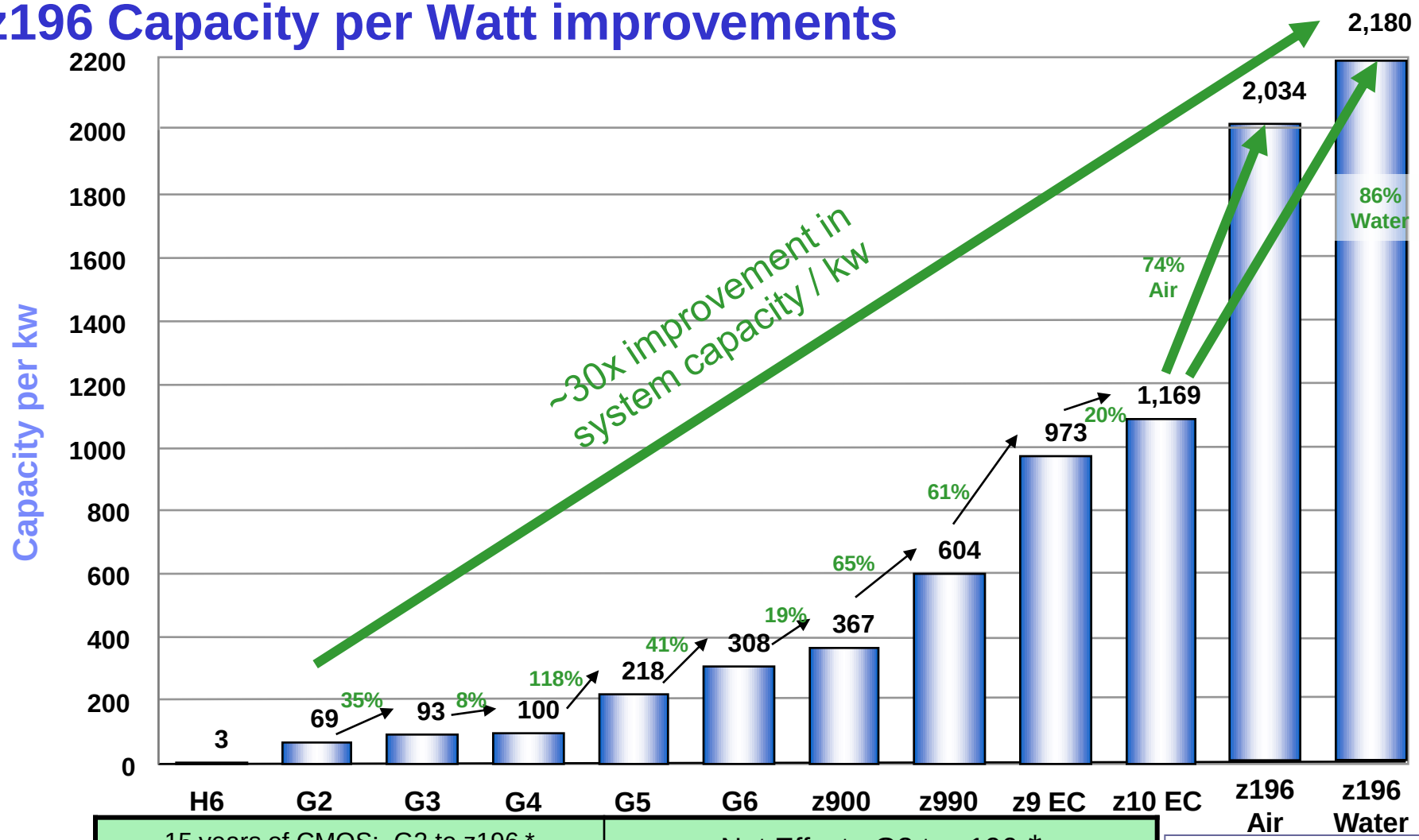
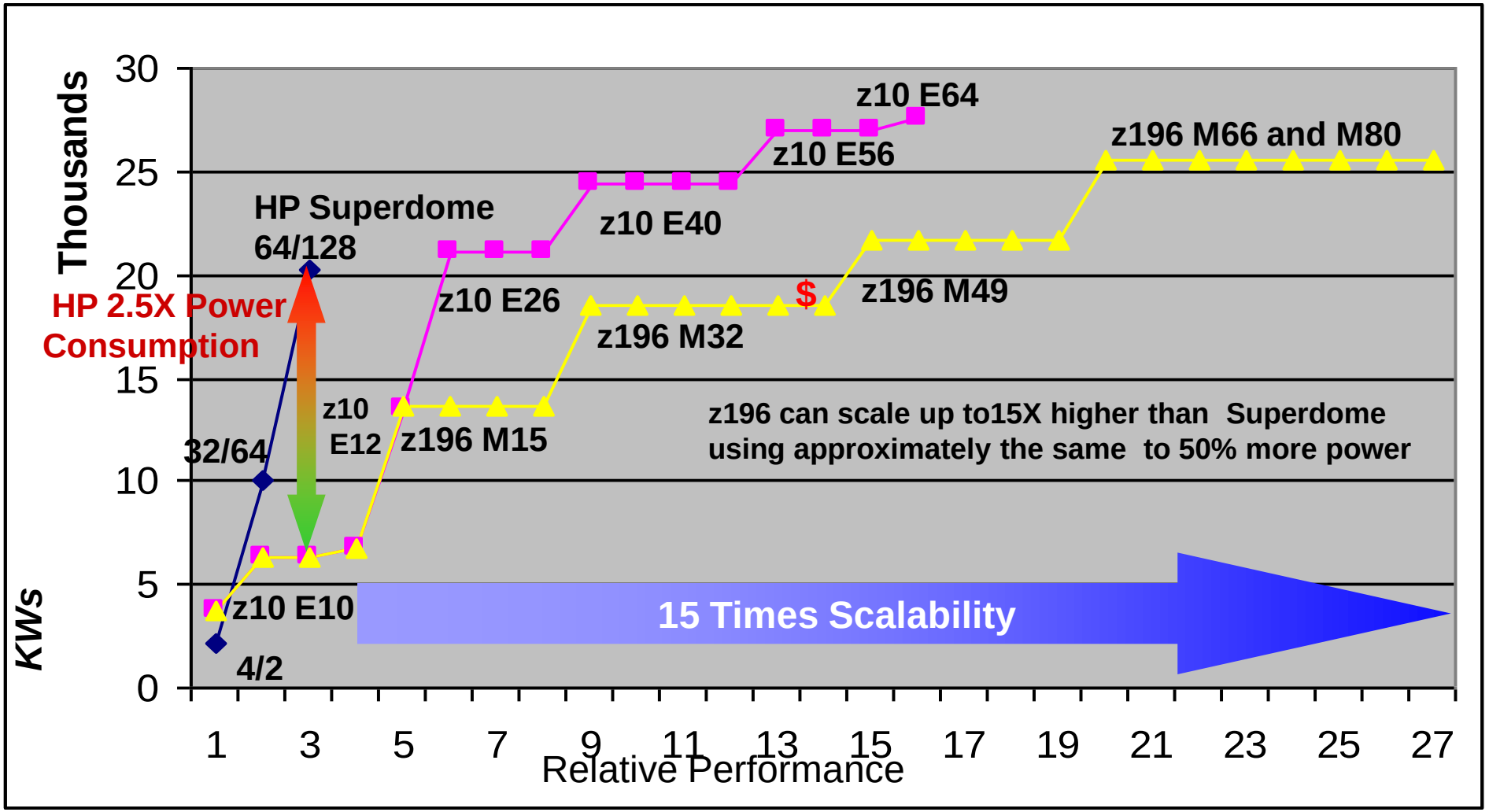
z196 Capacity per Watt improvements



15 years of CMOS: G2 to z196 *		Net Effect: G2 to z196 *	
Power Increase:	17% **per year**	**Performance increased by:**	300x
Performance increase:	46% **per year**	Performance / kWatt increased by:	30x
Power density	13% **per year**	**Performance / sq ft increased by:**	190x

Note: Capacity/kWatt assumes hot room, max plugged I/O power, max memory power and all engines turned on. Real world max capacity system is about 3/4 of this.

Mainframe Scales 2.5 to 15X Superdome
More Performance / Watt



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.

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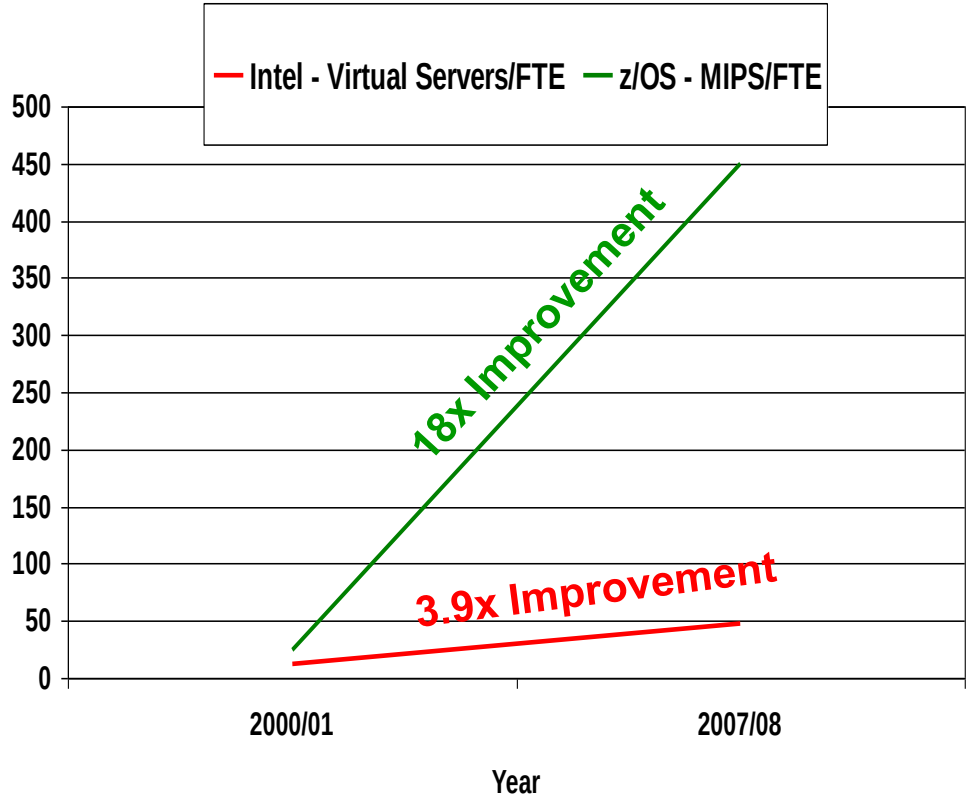
System z Labor Cost Trends Favor A Centralized Approach To Management



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

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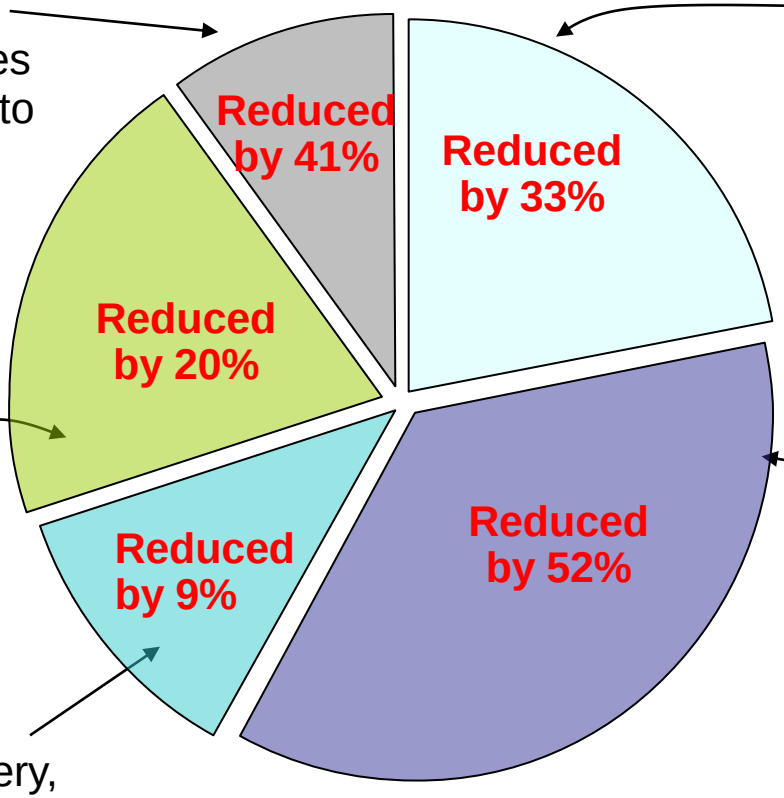
zManager Labor Cost Reduction Benefits

5032 total hours per year reduced by 35% to 3272 hours per year

Change Management
Standardization of images and firmware, visibility into relationships among resources

Deployment Management
Automatic setup and configuration of the hypervisor and out-of-the-box networks



Security Management
Centralized fine-grain administrator access control

Incident/Capacity Management
Automation to isolate and fix issues

Asset Management
Automated discovery, entitlement management

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Average Cost Ratios (z vs Distributed)

		z	Distributed	z vs distributed (%)
Offload	**5-Year TCO**	**$14,617,537**	**$25,016,633**	**58.43%**
	Annual Operating Cost	$2,930,180	$3,342,404	87.67%
	Software	$9,349,434	$10,045,104	93.07%
	Hardware	$3,045,738	$4,007,849	75.99%
	System Support Labor	$3,207,949	$5,109,879	62.78%
	Electricity	$36,144	$191,862	18.84%
	Space	$56,027	$148,727	37.67%
	Migration	$586,808	$8,716,612	6.73%
	DR	$715,357	$2,707,487	26.42%
	Average MIPS	3,128		
	Total MIPS	140,759		
New Workload	**5-Year TCO**	**$2,295,560**	**$6,821,249**	**33.65%**
	Annual Operating Cost	266,530	693,442	38.44%
	Software	1,073,625	2,785,542	38.54%
	Hardware	669,311	1,313,598	50.95%
	System Support Labor	1,418,025	1,247,685	113.65%
	Electricity	13,920	$85,569	16.27%
	Space	7,993	291,656	2.74%
	Migration	0	0	
	DR	68,005	2,269,640	3.00%
	Average MIPS	5,012		
	Total MIPS	15,035		
Consolidation	**5-Year TCO**	**$8,713,071**	**$14,347,493**	**60.73%**
	Annual Operating Cost	$1,087,137	$2,328,635	46.69%
	Software	$3,641,376	$9,734,725	37.41%
	Hardware	$3,068,105	$1,570,789	195.32%
	System Support Labor	$2,380,009	$4,491,882	52.98%
	Electricity	$192,962	$375,922	51.33%
	Space	$130,731	$270,787	48.28%
	Migration	$2,294,437	$0	
	DR	$416,326	$632,933	65.78%
	Average MIPS	10,635		
	Total MIPS	15,035		

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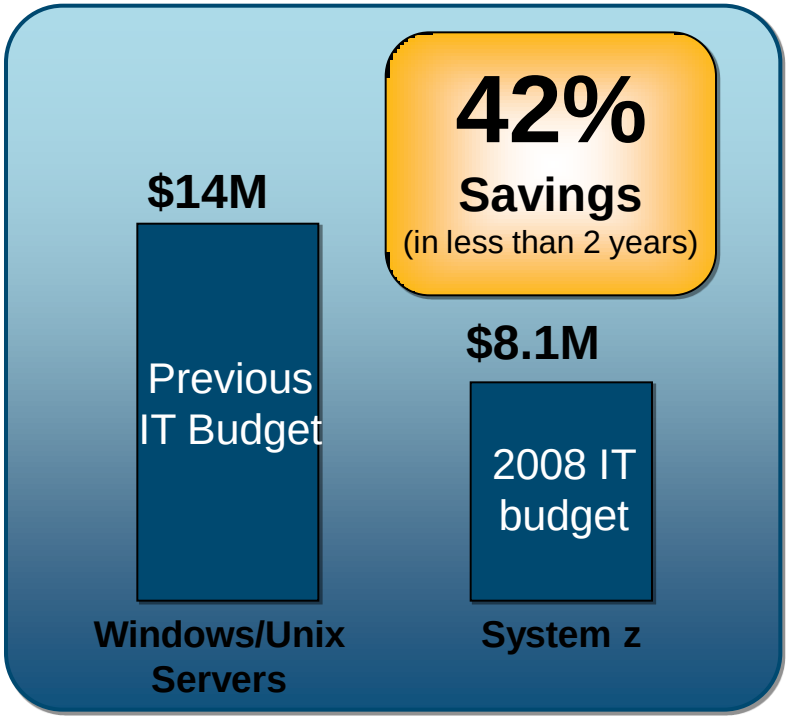
Optimize deployment of applications and data

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

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Expected Benefits Realized: Availability and Performance

The System z decision was driven by expected benefits:

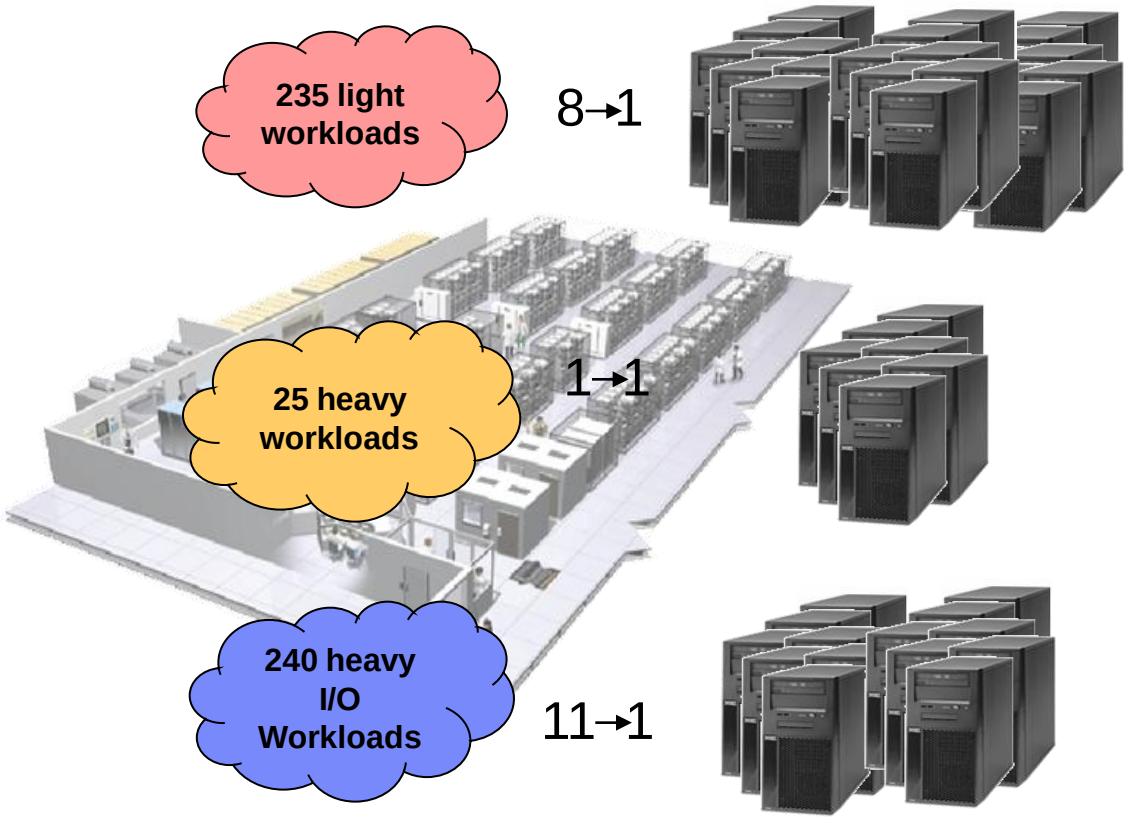
- **Reduced complexity**
- **High availability**
- **Ease of maintenance**
- **Dynamic Workload**
- **Good consistent application response time (SAP)**
- **zLinux for rich toolset, ease of use**

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**

© 2

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



500 workloads

77 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.

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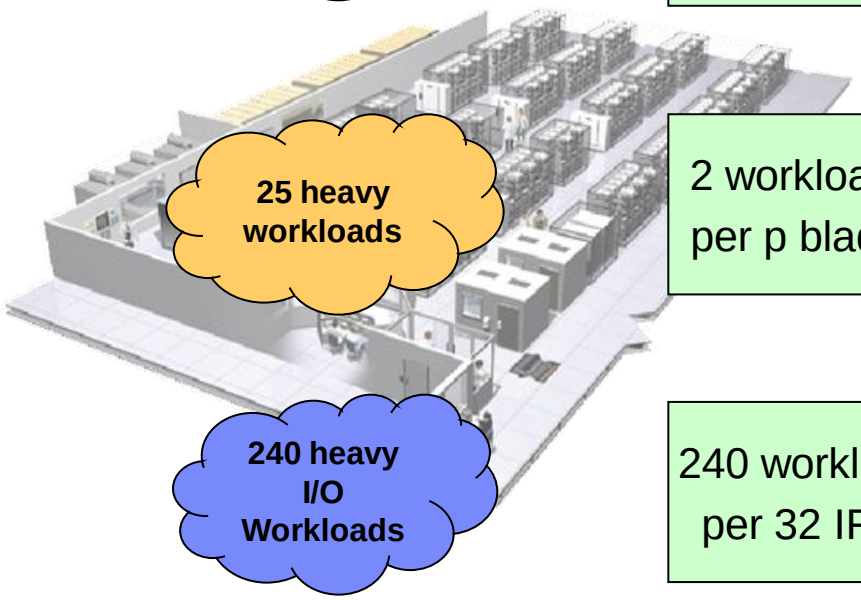
Large Data Center – What Does it Cost to Deploy 500 Workloads on zEnterprise?



235 light workloads

25 heavy workloads

240 heavy I/O Workloads

36 workloads per x blade

2 workloads per p blade

240 workloads per 32 IFLs

7
System x blades in 1 zBx

13
Power7 blades in same zBx

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.

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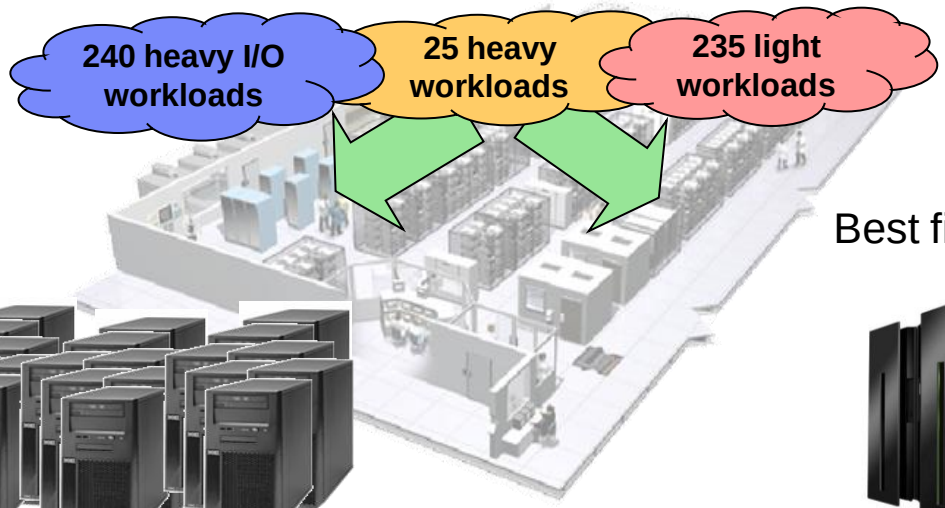
Compare Server Cost of Acquisition



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

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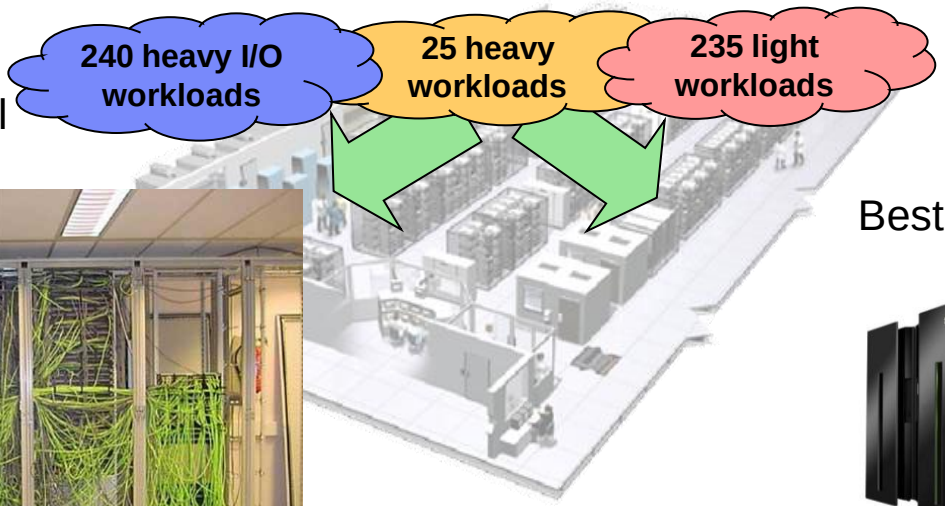
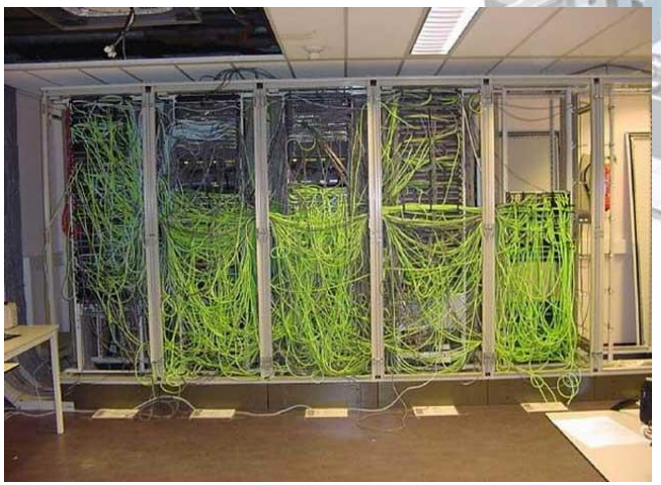
Compare Network Cost of Acquisition

Deployed on Intel





Best fit on zEnterprise

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

664 total network parts

$0.20M TCA

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

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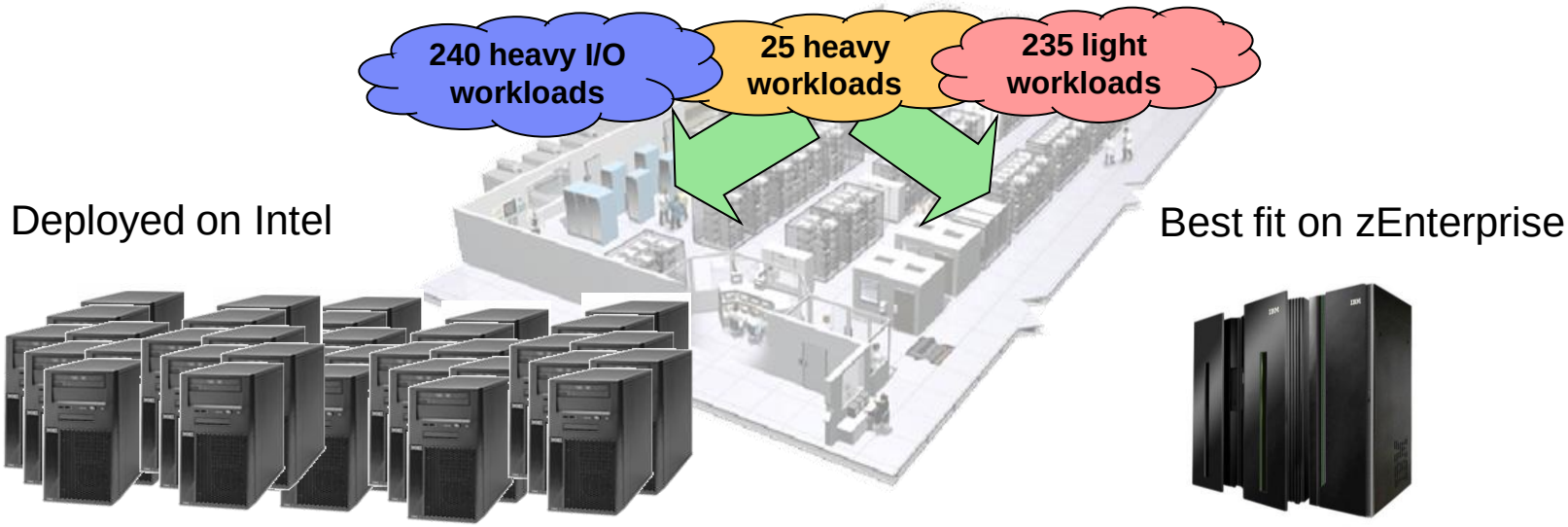
Compare Power Consumption



77 Servers
289 kW

2 frames
67 kW

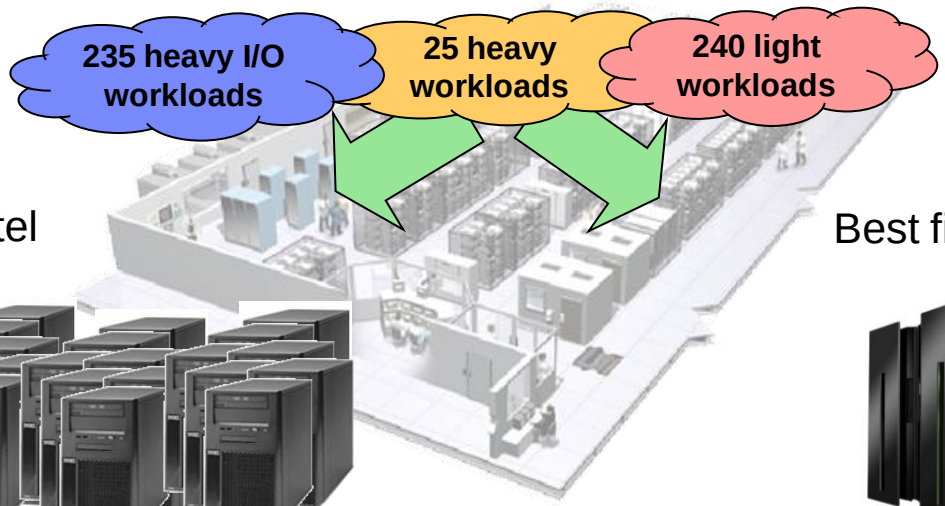
$0.25M
3 years@$0.10 per kWh

$0.06M
3 years@$0.10 per kWh

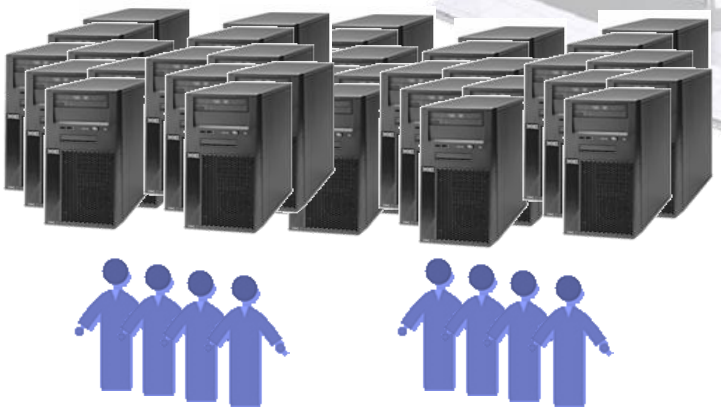
77% less

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

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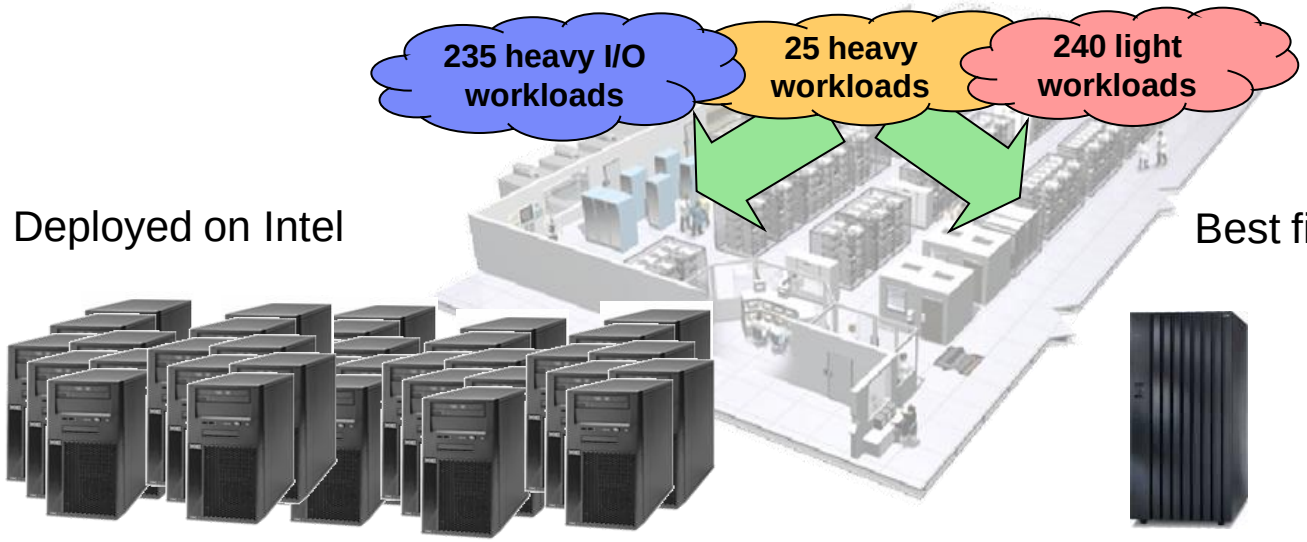
Compare Storage Cost



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

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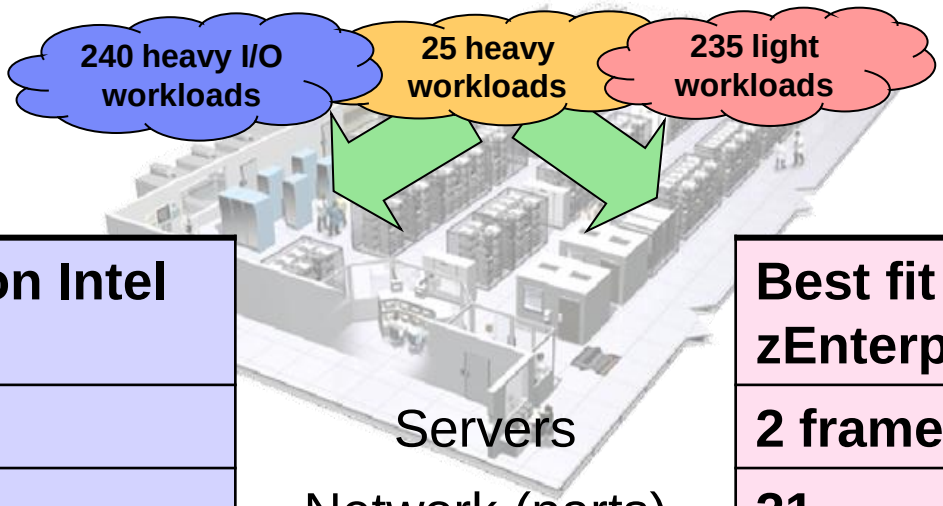
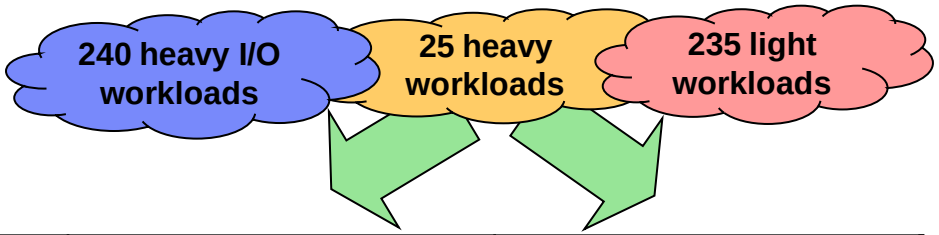
Fewer Parts to Assemble and Manage



Deployed on Intel		Best fit on zEnterprise
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

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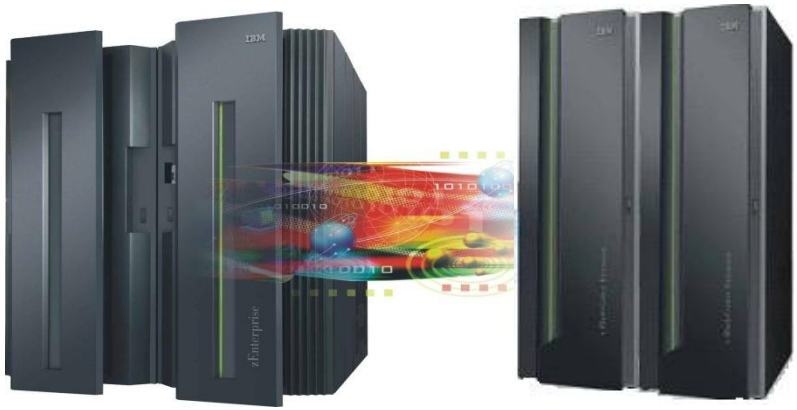
Summary

- **Cost per workload is the key metric for the new IT economics**
  - Mainframe cost per work goes down as workload increases



- **Fit for purpose reduces cost of acquisition per workload**

- **zEnterprise's integrated management reduces cost per workload with extreme automation for simplicity**

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Thank you

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