



# Pulse2011

## The Economics Of Workload Optimization

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# Smarter Computing

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Strategies to achieve breakthrough reductions in cost of IT

**New metric  
for the age  
of Smarter  
Computing**

**COST PER  
WORKLOAD**

# Workload Optimized Systems Drive Down Cost Per Workload

## IBM Software

Designed to exploit IBM hardware features automatically

## IBM Servers and Storage

Fit for Purpose servers and appliances  
Delivering more cores per server  
Plus purpose-built hardware innovations  
(Turbo Core, pureScale, SSD, Easy Tier,  
Max5, Parallel SysPlex, DataPower...)

## Optimized Systems



IBM software optimized for IBM hardware features

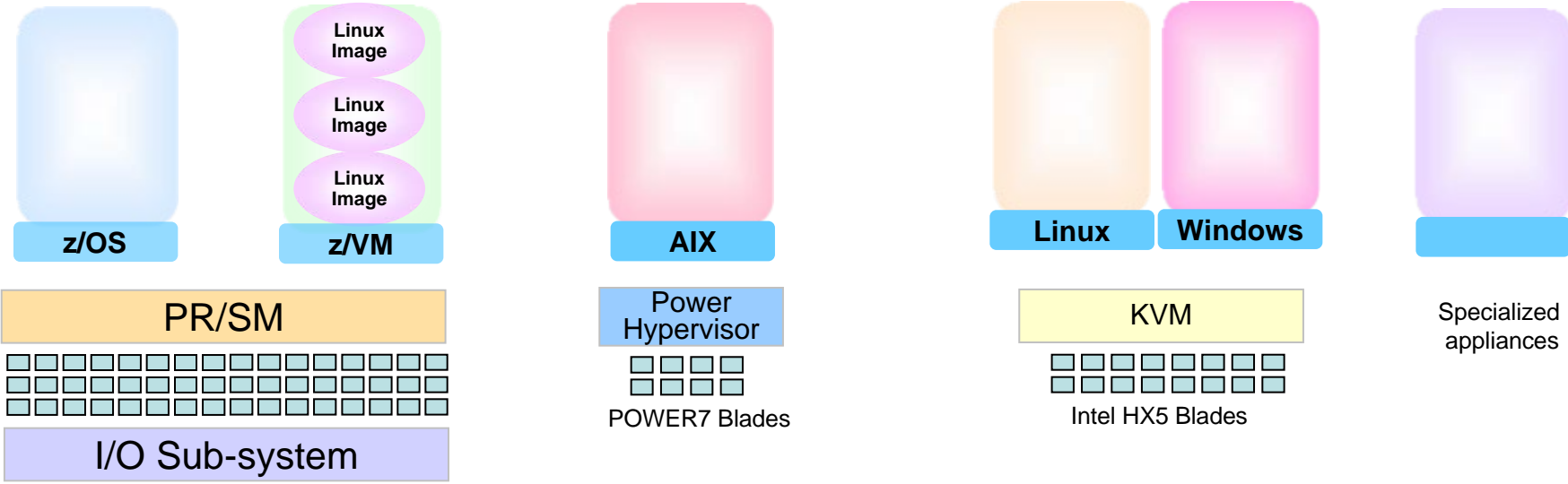
*Lowest Cost Per Workload*

# Optimized Systems Examples



	<b>Flexible</b>	<b>Focused</b>
<b>Install Time</b>	<b>Days → Weeks</b>	<b>Days</b>
<b>Technical Skills</b>	Deep Product and Performance Tuning Knowledge	Little or No Product Knowledge

# zEnterprise - Environments Optimized For Different Workloads



- Scale up to 80 cores in a frame
- Parallel Sysplex
- Dedicated I/O Sub System
- Superior qualities of service

- Scales to 8 cores per blade
- Fast processing threads
- Floating point accelerators

- Scales to 16 cores per blade
- Commodity I/O
- Lower qualities of service

← Structured Management →

# 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**

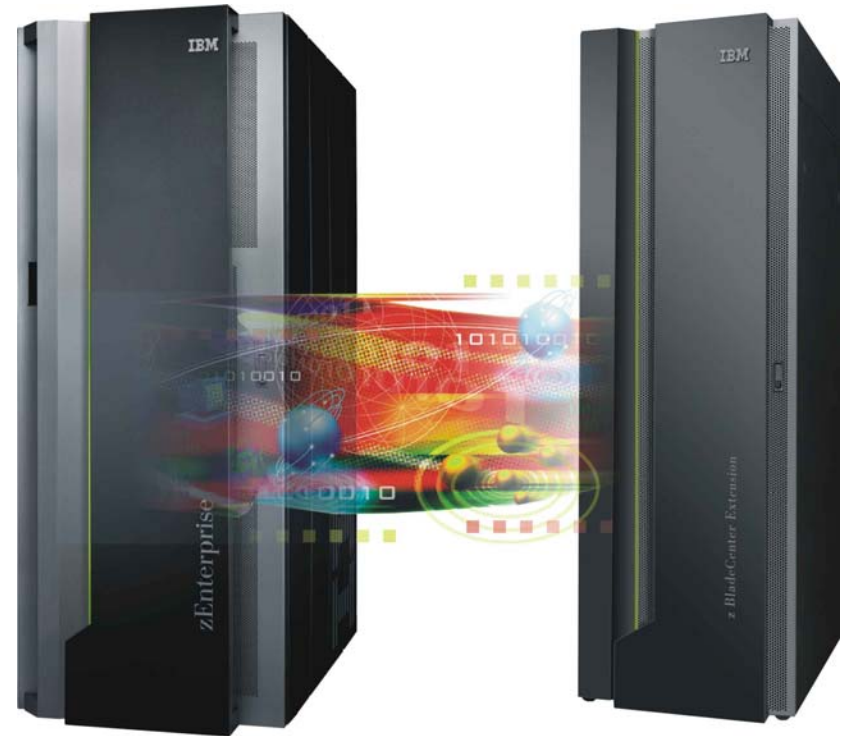
# July 12, 2011 – System z Announcement

- **A new entry point for hybrid computing**
  - ▶ Introducing the IBM zEnterprise 114, specifically designed for mid-sized businesses
- **Increased flexibility to deploy and manage zEnterprise**
  - ▶ Plan to deliver new APIs for the Unified Resource Manager\* enables end-to-end management of services and infrastructure
- **Extending the boundaries of hybrid computing**
  - ▶ Adding support for System x blades for Linux and, in the future, Windows\* along with Linux on z, AIX, z/OS, z/VSE, z/VM, and z/TPF gives new flexibility for workload deployment

\*Statement of direction. All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

# Introducing The IBM zEnterprise 114

- Priced, packaged and performance-optimized for the mid-sized business
- Extreme granularity to best fit existing and new workloads
- Built to support future data center design, modernization and efficiencies
- Investment protection with upgradeability from z9BC and z10BC and to z196 M15



Bringing the strengths and capabilities of the IBM zEnterprise in a package designed for mid-sized businesses

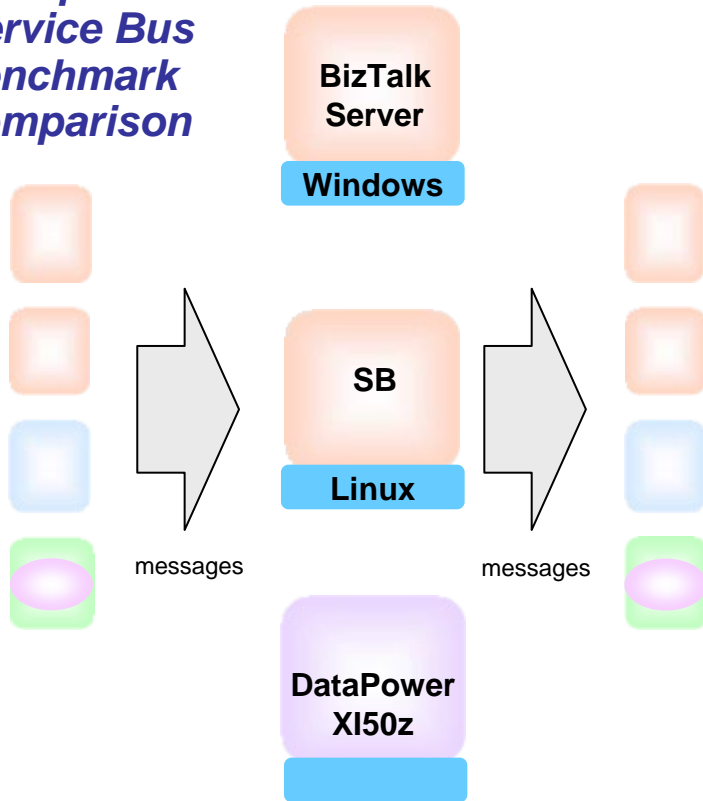


# zEnterprise Workload Optimizations

- **Optimizations to deliver lowest cost per workload for**
  - ▶ **Service Oriented Architecture workloads**
  - ▶ **Web processing front ends**
  - ▶ **Transactional core workloads**
  - ▶ **Workloads with large data**
  - ▶ **Private clouds**

# Optimized For SOA Environments

## Enterprise Service Bus benchmark comparison



Source: IBM internal benchmarks. Tests consists of measuring maximum throughput of ESB while performing a variety of message mediation workloads: pass-through, routing, transformation, and schema validation.

3 yr TCA calculation includes hardware acquisition, maintenance, software acquisition and S&S. Publicly available US list prices, prices will vary by country.



Microsoft BizTalk Server  
Windows on Intel Server  
4 sockets, 32 cores  
128 GB

492 messages per sec  
**\$764 per mps**



Competitor Service Bus  
Linux on Intel Server  
2 sockets, 12 cores  
128 GB

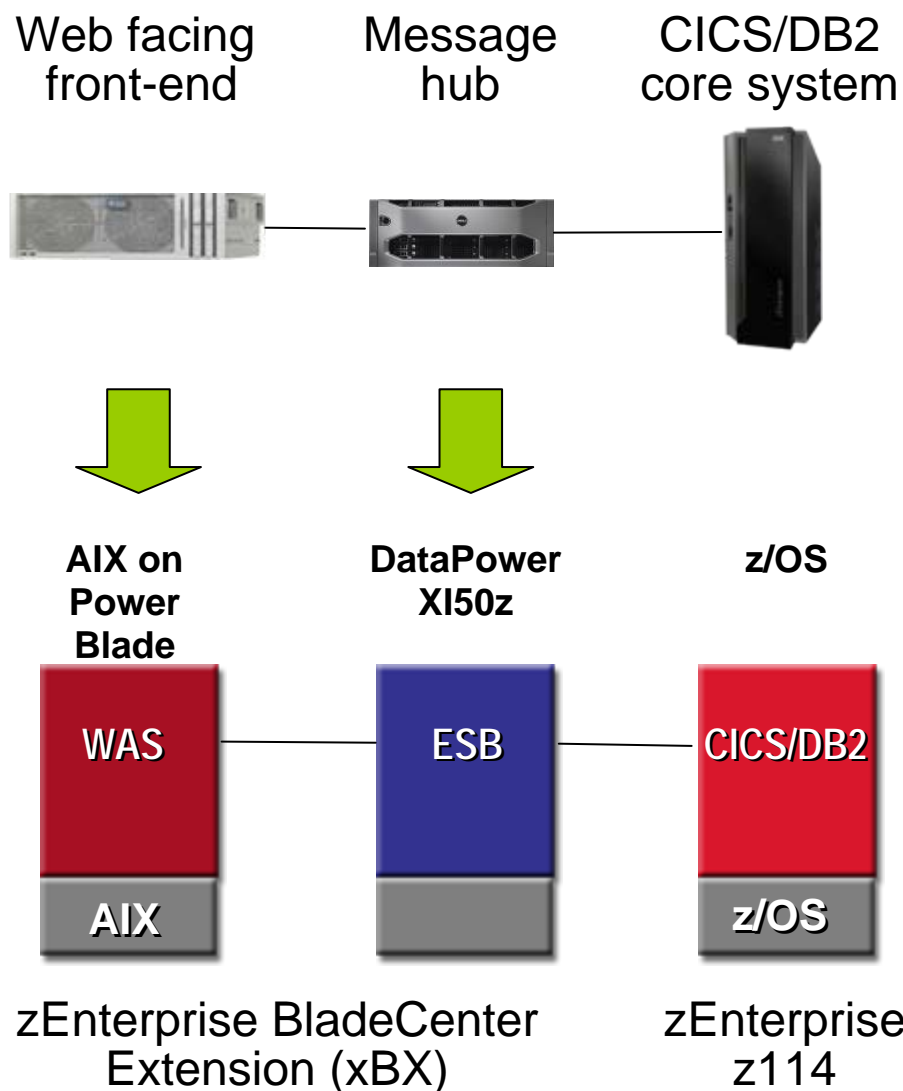
5,839 messages per sec  
**\$120 per mps**



**DataPower**  
XI50z in zBX  
HS 22, 8 cores

5,117 messages per sec  
**\$33 per mps**

# Optimized For Web Front End Workloads



- Extends mission critical quality of service to hybrid environments
- Virtualization for workload isolation
- Run as ensemble of virtual servers
- Unified management of virtual machines
- Manage ensemble as a single workload with service goals
- Assign best fit to Power blade for lowest cost per workload
- Embedded pre-configured data network

# Web Front Ends Cost 59% Less On zEnterprise

## Competitor

24 12-core Xeon servers

2 servers  
(for ESB)  
312 cores total



Competitor System

**\$433K**

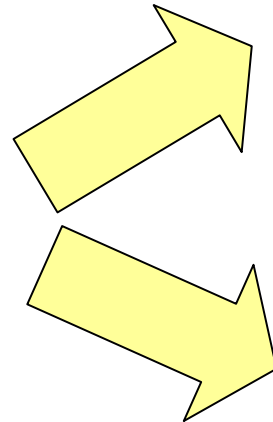
Per workload  
3yr TCA  
Front end  
HW+SW

24 mission critical  
web facing  
applications

Web Facing

24 workloads  
each driving  
3080 tps

High availability  
Workload isolation



## WebSphere App Server

24 POWER7  
8-core blades  
2 DataPower XI50z  
in zBX  
192 cores total



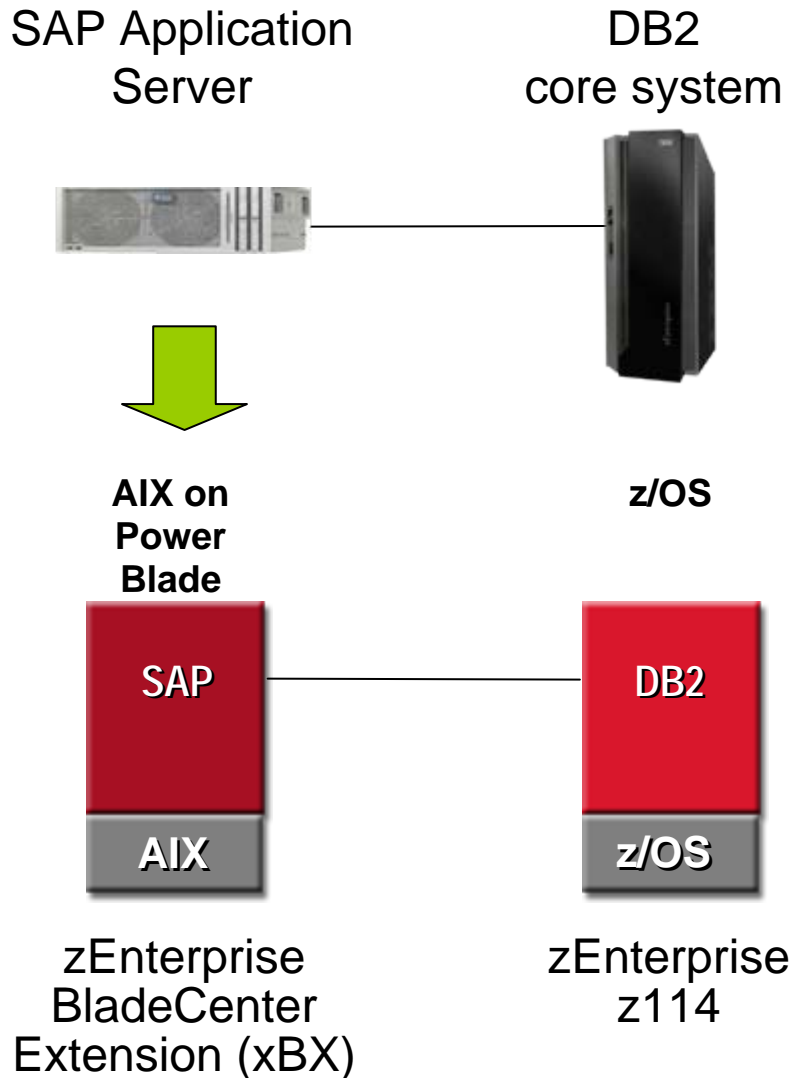
Power Blades  
in zBX

**\$177K**

Per workload  
3yr TCA  
Front end  
HW+SW

Source: IBM internal benchmarks. 3 yr TCA calculation includes hardware acquisition, maintenance, software acquisition and S&S. U.S. list prices. Prices will vary by country.

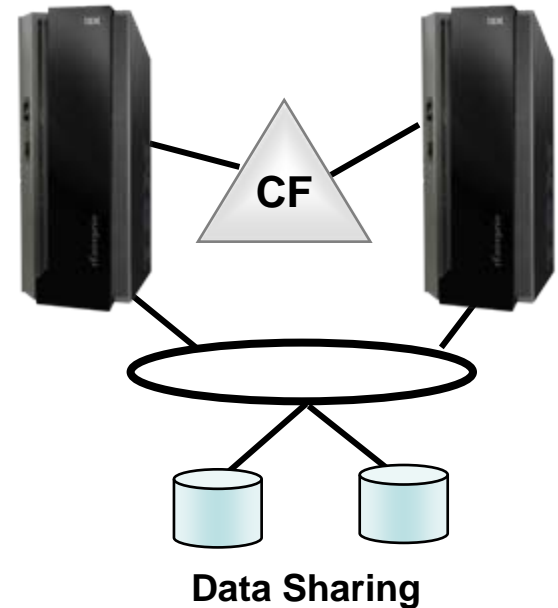
# Collapse SAP Front End Applications Into zEnterprise Platform



- Run as ensemble of virtual servers
- Unified management of virtual machines
- Manage ensemble as a single workload with service goals
- Assign best fit to Power blade for lowest cost per workload
- Embedded pre-configured data network

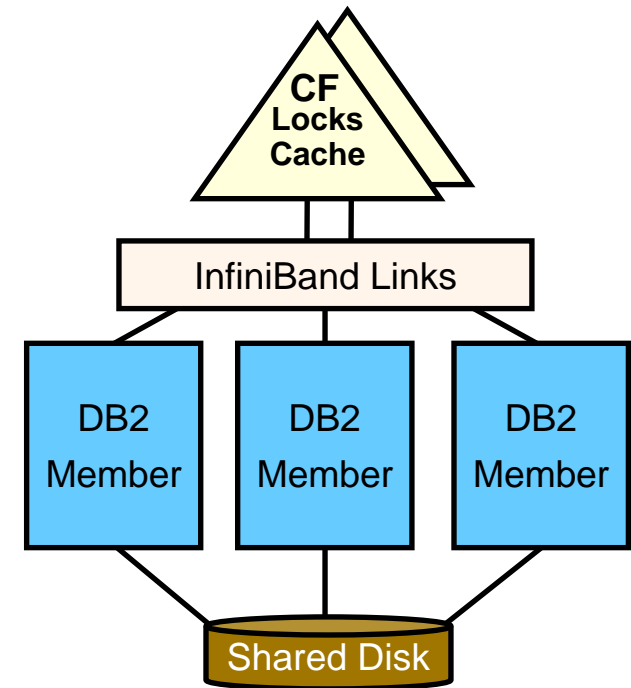
# Optimized For Transaction Processing With High Availability

- Specialized hardware - Coupling Facility
  - ▶ Dedicated processor with specialized microcode to coordinate shared resources
  - ▶ High speed inter-connect to clustered systems
  - ▶ Hardware invalidation of local cache copies
  - ▶ Special machine instructions
- Exploited by IMS, CICS, DB2, MQ, and other middleware on z/OS for transaction processing



# DB2 For z/OS Supports Parallel Sysplex Shared Data Clustering

- Shared data across nodes
- Hardware-based centralized lock and cache management
  - ▶ Provided by Coupling Facility
  - ▶ Supports near linear scalability
- Recovery from a node failure without a freeze
- Supports rolling upgrades with up to two different releases in a data sharing group



## Now Available DB2 10 for z/OS:

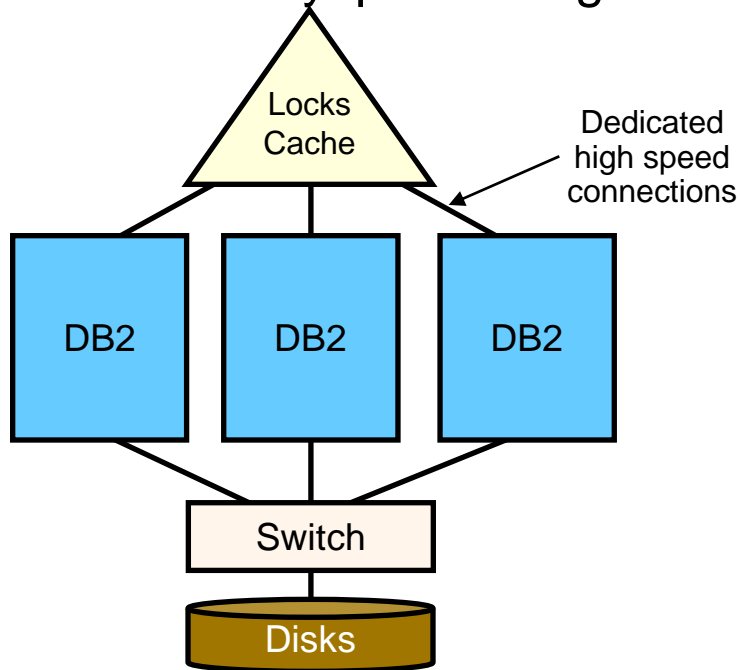
Up to 20% faster performance  
Hash access for faster OLTP  
Automatic snapshots of changing data  
Improvements in DB2 QMF and Tools suite

10x more concurrent users  
More online administration  
SQL and pureXML enhancements

# Compare Clustered Database Designs

## DB2 for z/OS

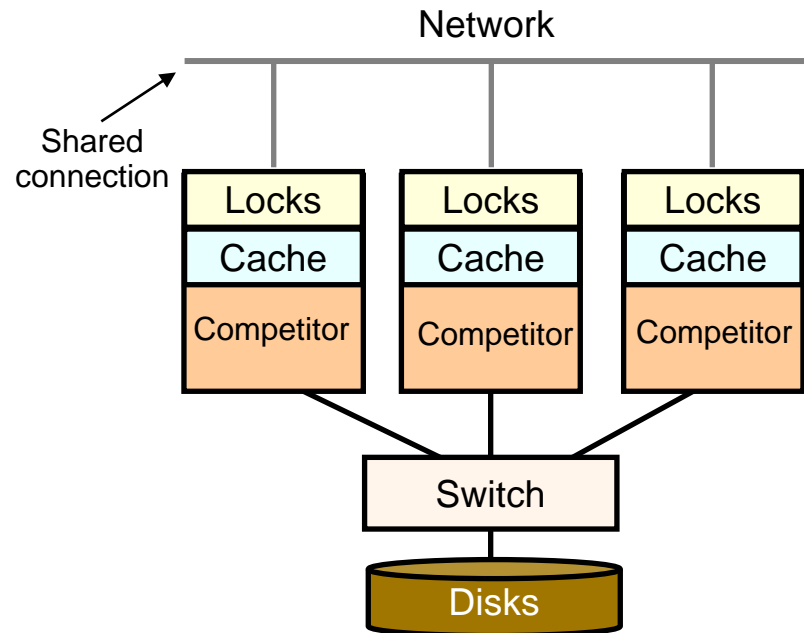
Centralized Sysplex Design



**High speed centralized**  
lock manager in  
coupling facility

## Competitor

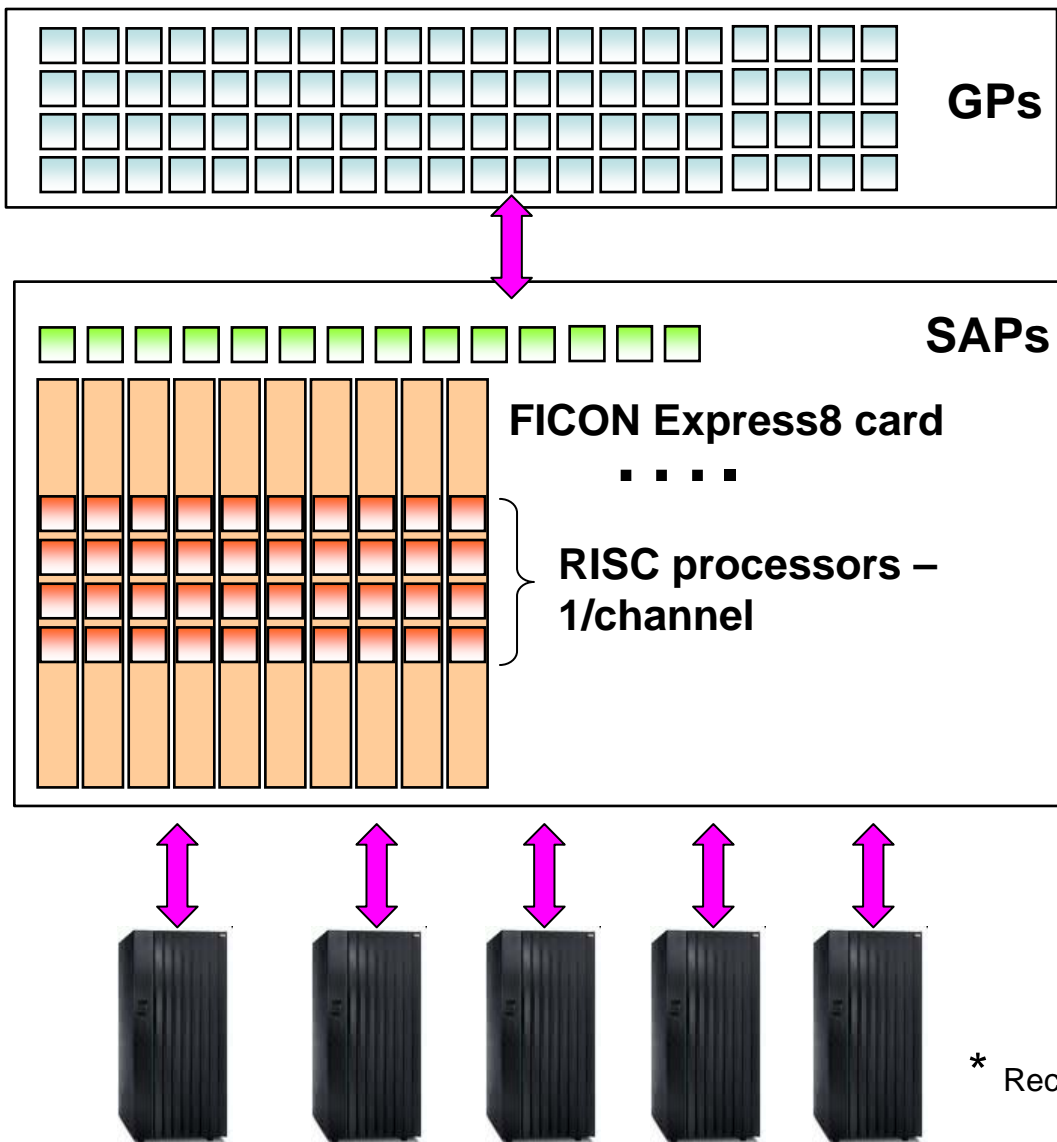
Distributed Lock and Data Design



**Distributed lock**  
management with  
high messaging **overhead**



# System z - Optimized For High I/O Bandwidth

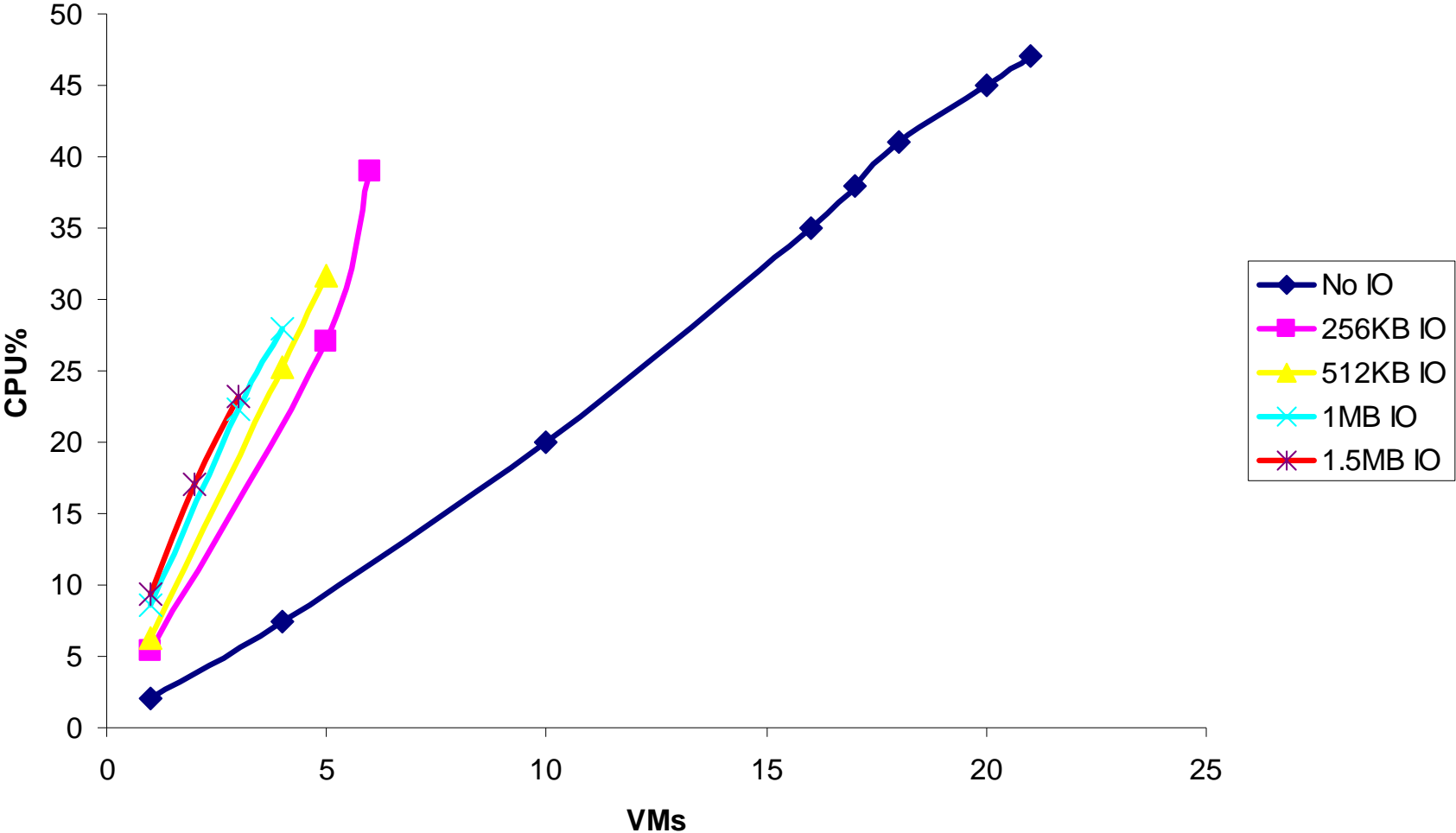


- Up to 80 General Purpose (GP) or Specialty Engine processors
  - ▶ Execute business logic
- Up to 14 System Assist Processors (SAP) to manage I/O requests
  - ▶ Can sustain up to **2.2M IOPS\*** operations per second
- Up to 84 physical FICON cards for I/O transfers
  - ▶ Up to **336 RISC channel I/O processors**
  - ▶ Up to 1024 logical channels
- IBM DS8800 Storage System
  - ▶ Up to **440K IOPS capability**

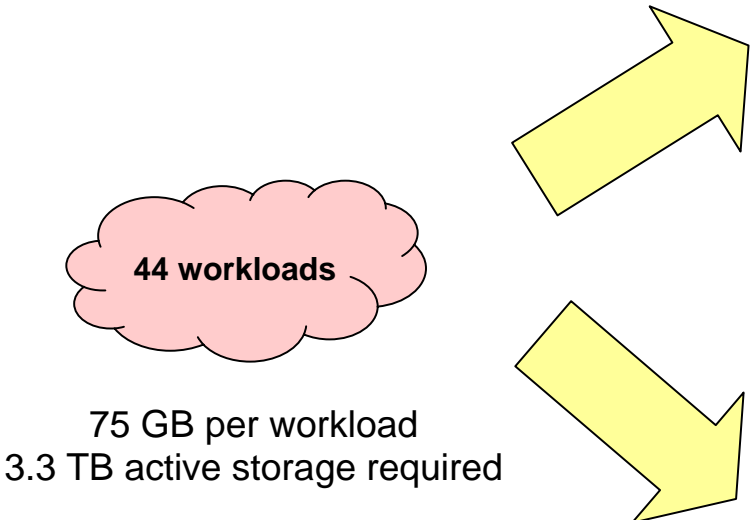
\* Recommend 70% max SAP Utilization – 1.5M IOPS

# CPU Behavior When Consolidating On Systems Not Optimized For IO

Intel CPU As IO Load Increases



# zEnterprise Lowers The Cost Of Storage For Hybrid Workloads



**Deploy storage  
in typical  
distributed  
environment**

z114



**Deploy storage  
in zEnterprise  
environment**

z114

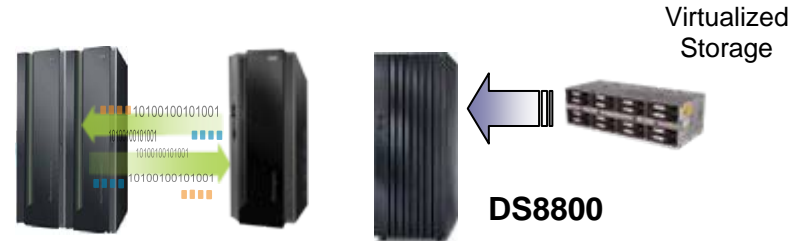
# Storage Costs 40% Less On zEnterprise With DS8800

## Distributed Environment



Add 2 DS5020 storage units with SAS drives

## zEnterprise Environment



Incrementally add DS8800 Drive Sets (16 SAS drives @ 450GB ea.)

44 workloads, 75GB per workload  
3.3TB active storage required

Storage HW	\$177,964
<u>Storage admin (3 yrs)</u>	<u>\$ 91,930</u>
Total (3 yr)	\$269,894

Storage HW	\$116,662
<u>Storage admin (3 yrs)</u>	<u>\$ 45,965</u>
Total (3 yr)	\$162,627

Assumes FTE rate is \$159,600. DS5020 labor rate is 50TB per FTE. DS8000 labor rate is 75TB per FTE.

Results may vary based on customer workload profiles/characteristics. Prices will vary by country. zEnterprise – The Economics Of Workload Optimization

**40%** reduction  
in storage costs

# Solid State Is Revolutionizing Storage Performance

## Hard Disk Drives

## Solid State Storage

SATA /SAS interface

**200 IOP's**

**\$0.73/GB**

SAS interface

**300 IOP's**

**\$3.66/GB**

SAS interface

**45,000 IOP's**

**\$88.00/GB**

PCIe interface

**100,000 IOP's**

**\$25.93/GB**

**SLC Durability**

**MLC Durability**



IBM 2TB SATA  
3.5" LFF HDD  
Cost: \$1499.00

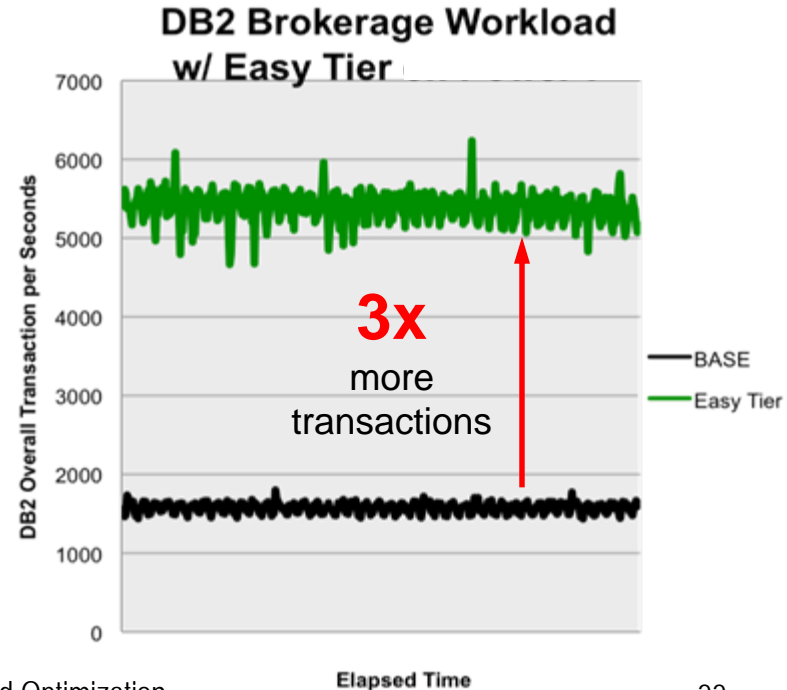
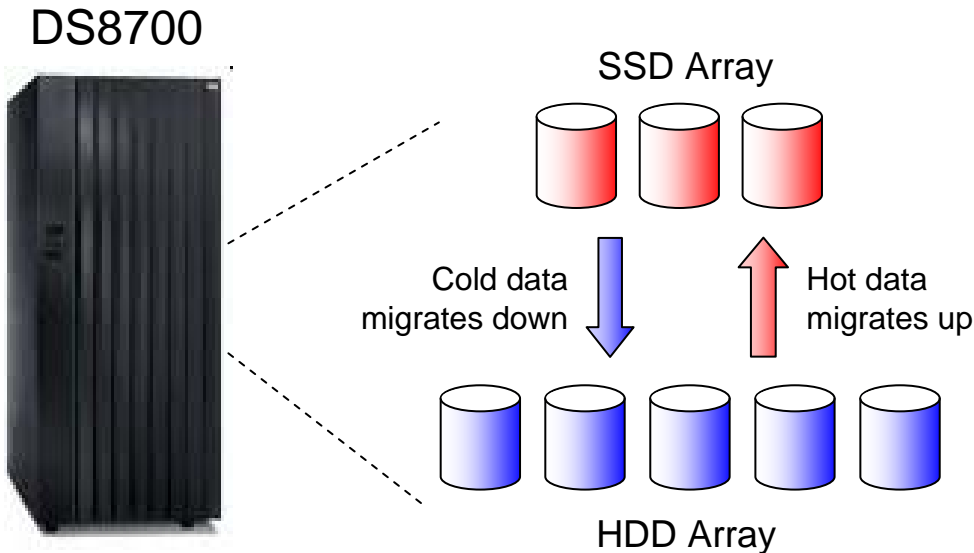
IBM 300GB 10K SAS  
2.5" SFF Slim-HS HDD  
Cost: \$1099.00

IBM 300GB  
2.5" SFF SAS SSD  
Cost: \$26,399

IBM 320GB HIGH IOP MS  
CLASS SSD PCIe ADPT  
Cost: \$8,299

# DS8700 Easy Tier Capability Automatically Migrates Frequently Accessed Data To SSD

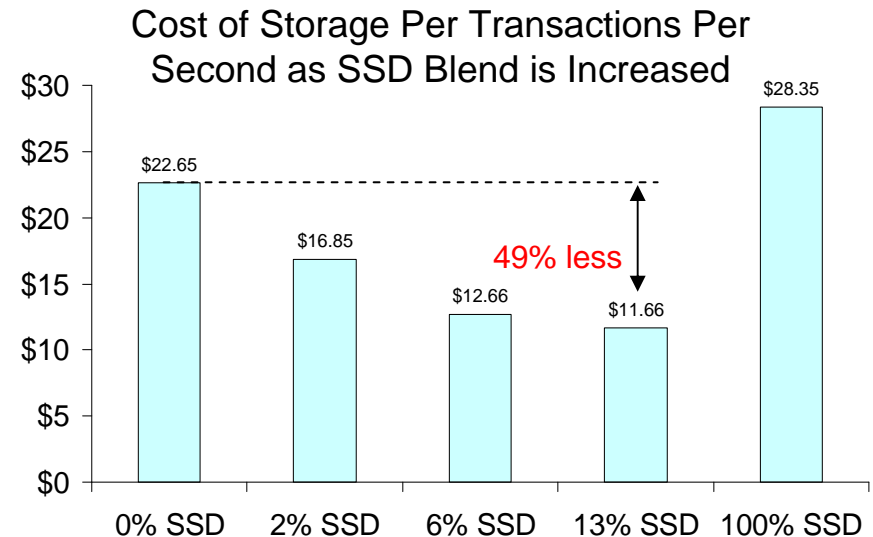
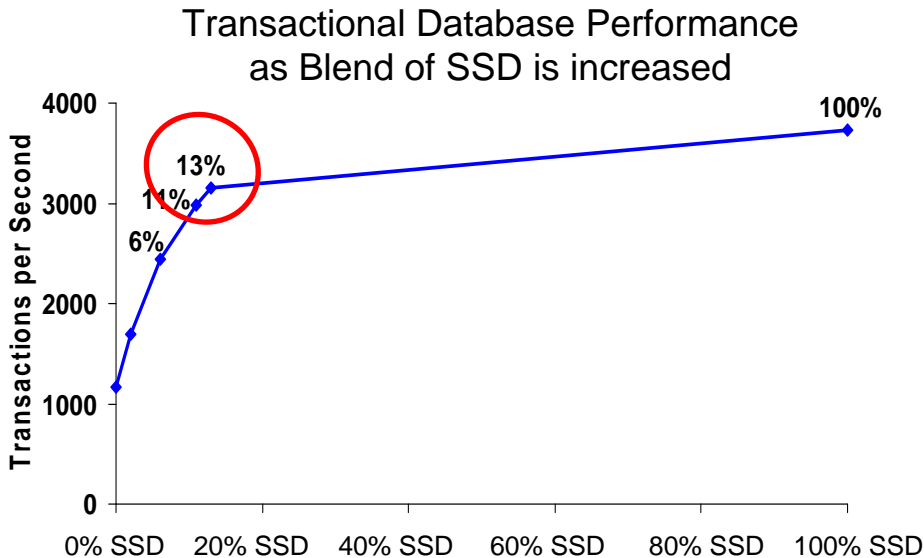
- **Automated** hotspot detection and migration of data between SSD and HDD
  - ▶ Transparent to applications, **no code changes** required
- Easy Tier maximizes SSD performance gains while minimizing costs
  - ▶ Increase performance by up to **300%**
  - ▶ Relocating just 5% of data to SSDs can reduce response time by 78%
- **No charge feature** – Microcode update to DS8700



# Small Amounts Of Optimally Managed SSD Can Improve Storage Price/Performance

Just 13% blend of SSD to HDD achieves 171% performance gain

13% blend of SSD to HDD achieves lowest cost of storage per transaction per second



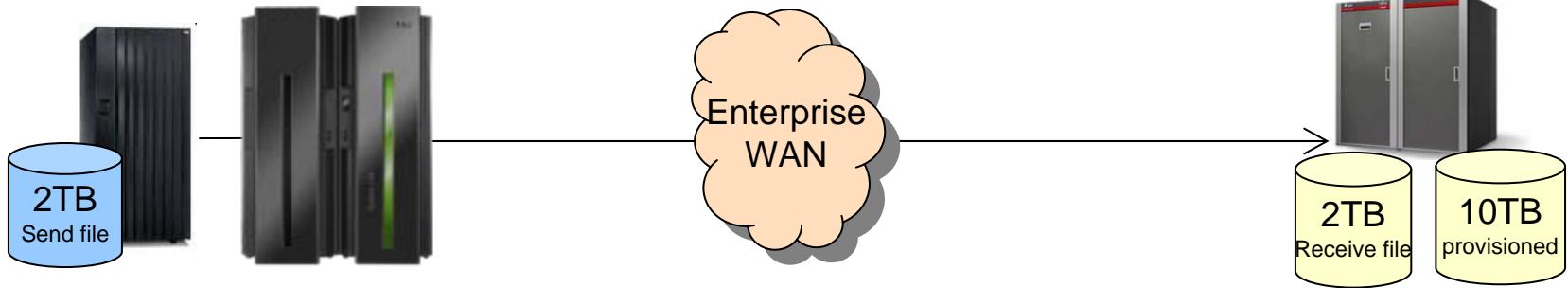
**Easy Tier achieves 78% of the maximum SSD performance potential with just 13% SSD**

Source: IBM Internal Study of Benchmark Factory transactional database workload performance as Easy Tier migrates data to SSD. The performance data contained herein was obtained in a controlled, isolated environment. Actual results that may be obtained in other operating environments may vary.

# Duplicating Data Off The Mainframe Is Costly

## The Cost Of Duplicating 2TB To Data Mart

Data Mart Server



Cost of storage - send file \$12.33/GB x 2048 GB	\$25,252
---	----------

Storage acquisition cost  
**\$246,436**

Cost of storage - receive file \$18/GB x 2048 GB	\$36,864
---	----------

Cost of storage - data mart \$18/GB x 10,240 GB	\$184,320
--	-----------

System z Storage Admin \$5.88/GB/yr x 2048 GB	\$12,042
--	----------

Annual storage admin cost  
**\$122,511**

Distributed Storage Admin \$8.99/GB/yr x 12,288 GB	\$110,469
---	-----------

System z CPU extract \$1.38/GB x 2048 GB	\$2,826
---	---------

On Premises Network \$0.0024/GB x 2048 GB x 4 hops	\$20
---	------

Distributed CPU cost load \$0.39/GB x 2048 GB	\$799
--	-------

System z CPU cost FTP \$0.58/GB x 2048 GB	\$1,188
--	---------

Off Premises Network \$0.29/GB x 2048 GB x 2 hops	\$1,188
--	---------

Distributed CPU cost FTP \$0.05/GB x 2048 GB	\$96
---	------

System z extract labor \$9.33/job	\$9
--------------------------------------	-----

Distributed load labor \$14.00/job	\$14
---------------------------------------	------

System z FTP labor \$5.88/job	\$6
----------------------------------	-----

Cost Per Transfer  
**\$6,146**

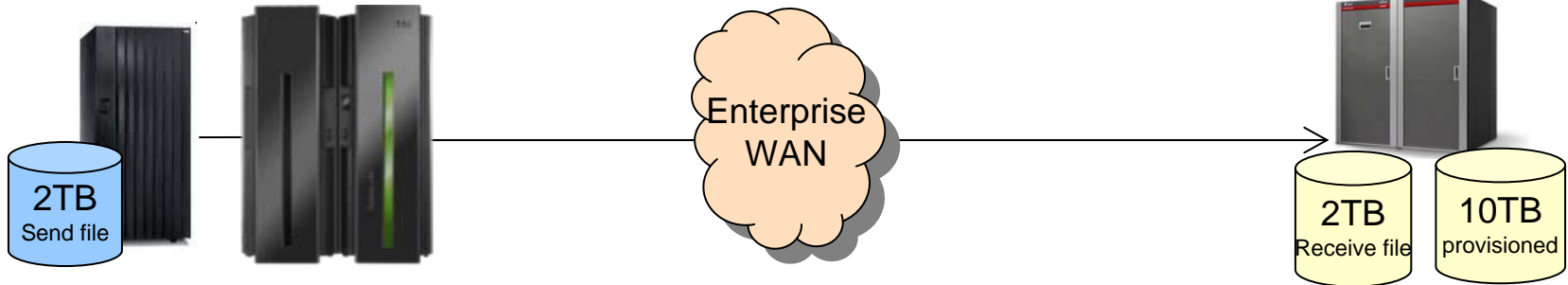
Cost of running Data Mart  
analysis jobs not included



# Transfer Costs Add Up Over One Year

## The Cost Of Duplicating A 2TB Data Mart

Data Mart Server



Cost of storage - send file	\$25,252
\$12.33/GB x 2048 GB	

Storage acquisition cost  
**\$246,436**

Cost of storage - receive file	\$36,864
\$18/GB x 2048 GB	
Cost of storage - data mart	\$184,320
\$18/GB x 10,240 GB	

System z Storage Admin	\$12,042
\$5.88/GB/yr x 2048 GB	

Annual storage admin cost  
**\$122,511**

Distributed Storage Admin	\$110,469
\$8.99/GB/yr x 12,288 GB	

System z CPU extract	\$1.03M
\$1.38/GB x 2048 GB x 365	
System z CPU cost FTP	\$434K
\$0.58/GB x 2048 GB x 365	
System z extract labor	\$3.3K
\$9.33/job x 365	
System z FTP labor	\$2.2K
\$5.88/job x 365	

On Premises Network	\$7.1K
\$0.0024/GB x 2048 GB x 4 hops x 365	
Off Premises Network	\$434K
\$0.29/GB x 2048 GB x 2 hops x 365	

Annual Transfer Costs  
**\$2,243,290**

Distributed CPU cost load	\$292K
\$0.39/GB x 2048 GB x 365	
Distributed CPU cost FTP	\$35K
\$0.05/GB x 2048 GB x 365	
Distributed load labor	\$5.1K
\$14.00/job x 365	

Cost of running Data Mart analysis jobs not included

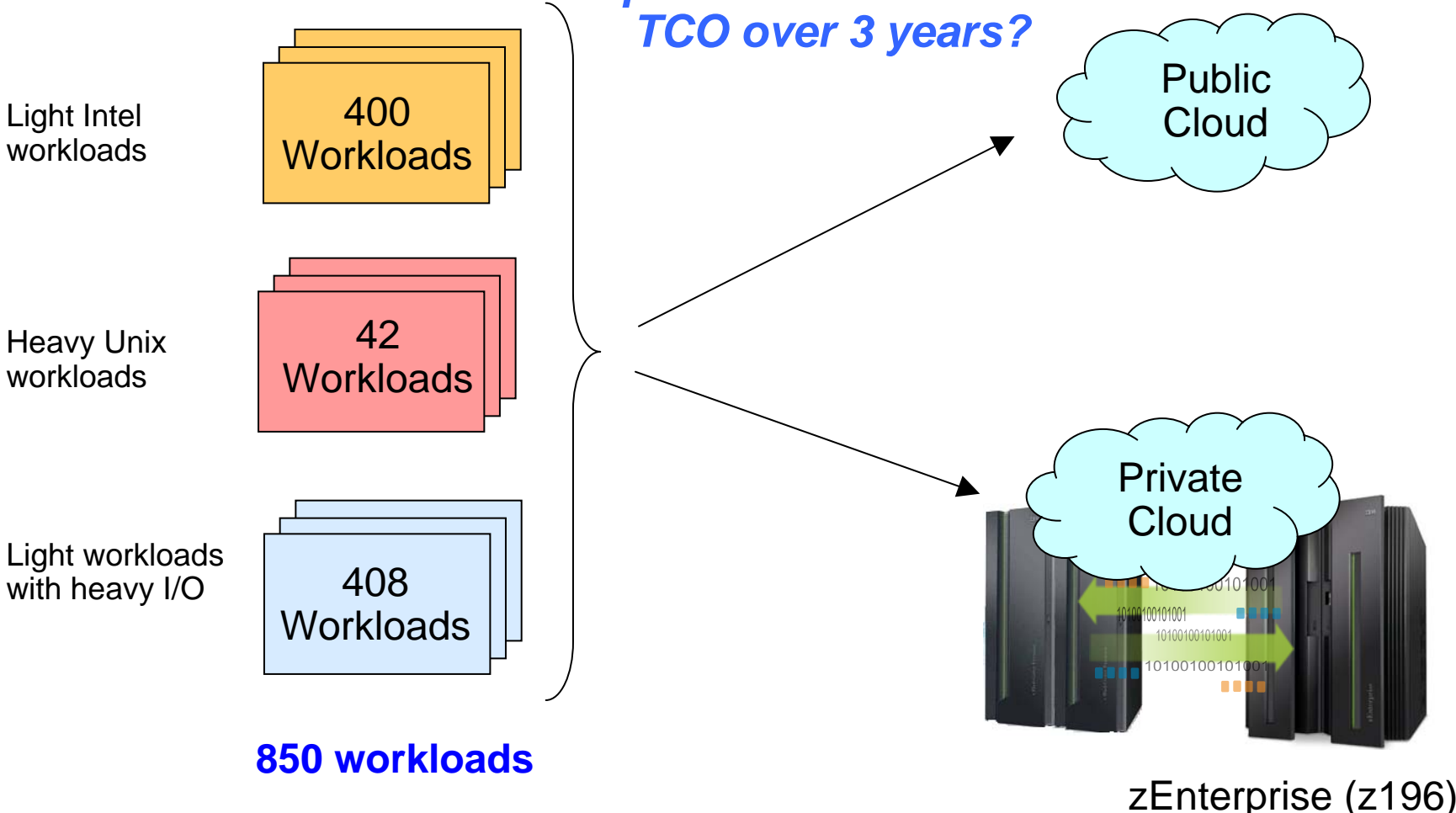
# Optimized For Private Clouds

- Large scale virtualization
  - ▶ Elastic growth
  - ▶ Workload management
- Fit for purpose strategy
  - ▶ Multi-architecture minimizes migration costs
  - ▶ Assign workloads to best fit environment
- Integrated Service Management
  - ▶ zManager
  - ▶ Tivoli Application Management for zEnterprise
  - ▶ Tivoli Asset and Financial Management for zEnterprise
  - ▶ Tivoli Application Resilience for zEnterprise
  - ▶ Tivoli Security for zEnterprise
- Achieves lowest overall cost per workload

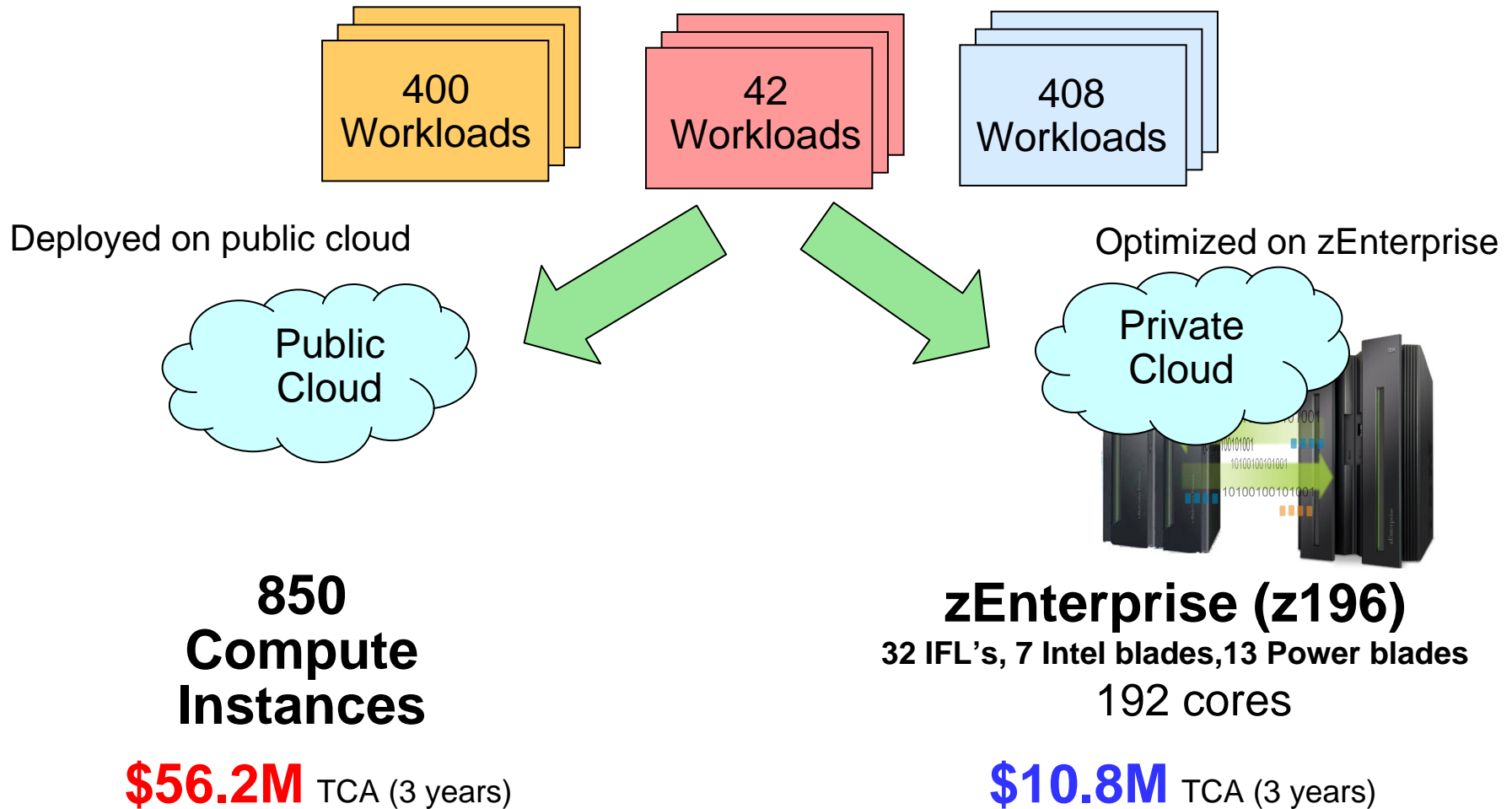


# Public vs. Private Cloud: Which Option Costs Less For Delivering Mixed Workloads?

*Which option provides the lowest TCO over 3 years?*



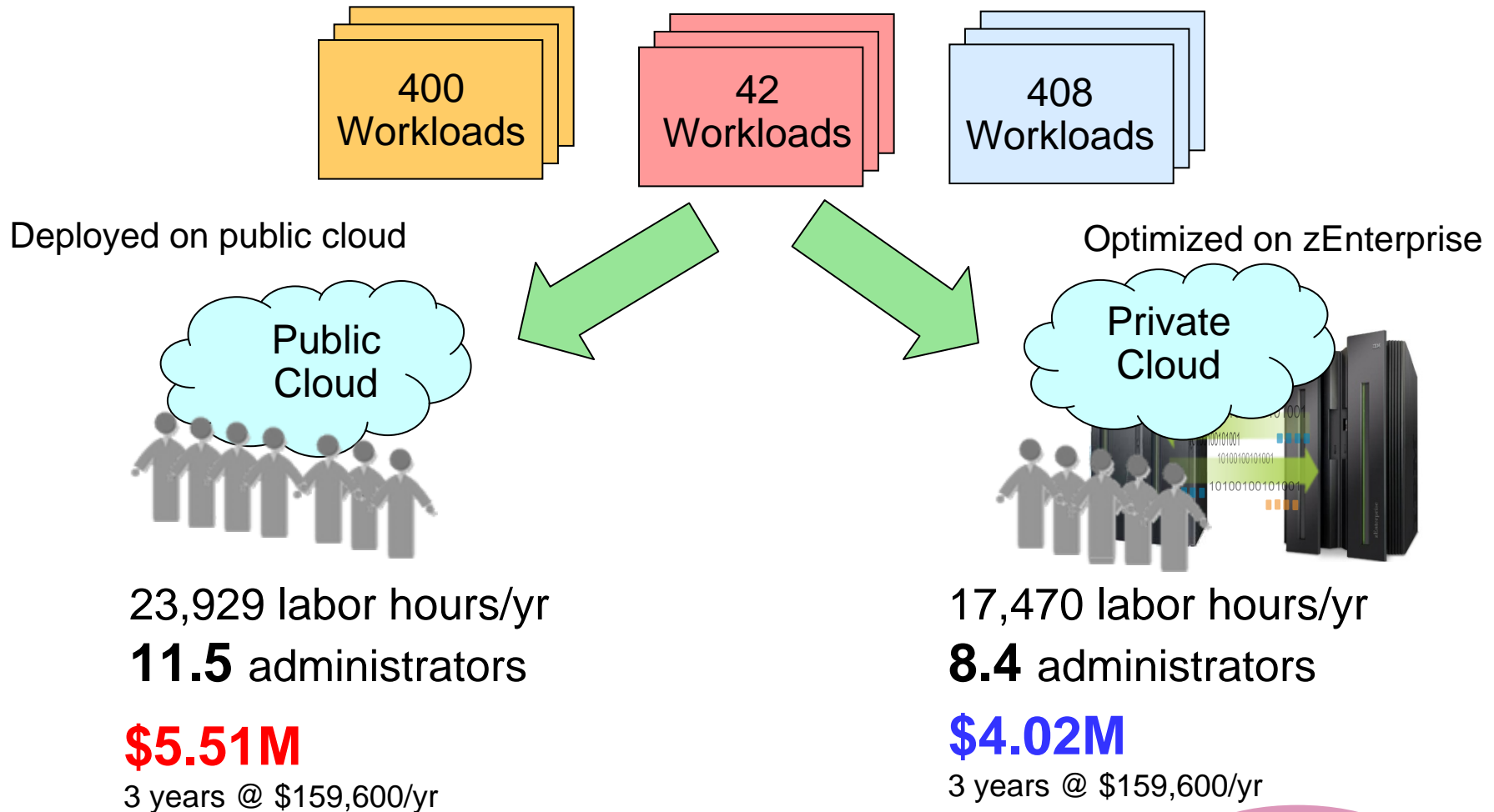
# Compare Cost Of Acquisition For 3 Years



81% less

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

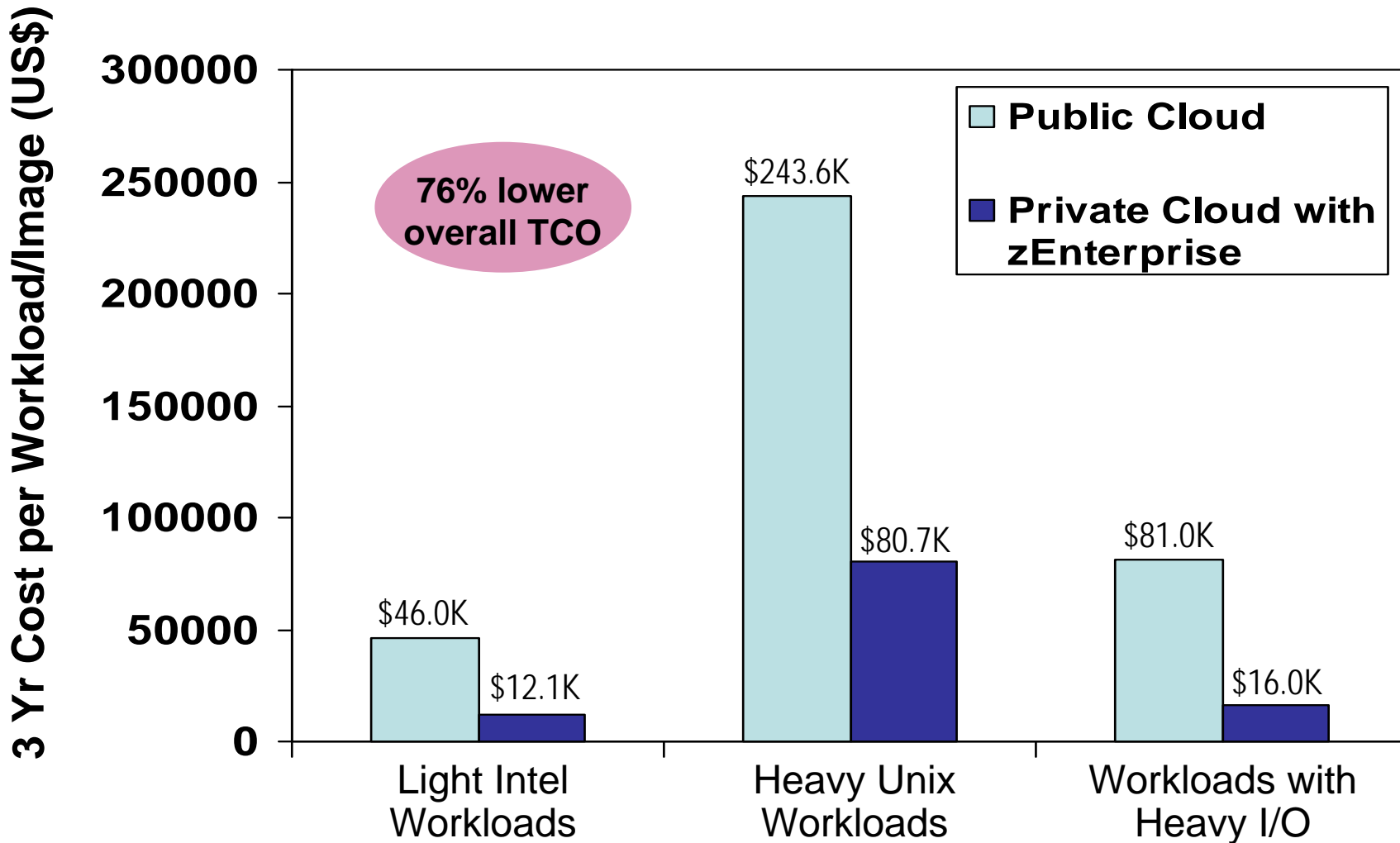
# Compare Labor Costs For 3 Years



**27% less**

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

# Private Cloud On zEnterprise Dramatically Reduces Costs



Source: IBM internal study. zEnterprise configurations needed to support the three workload types were derived from IBM benchmarks. Public cloud sizing needed to support the three workload types was calculated based on compute capacity of public cloud services. 3 yr TCO for public cloud based on pricing info available by the service provider. 3 yr TCO for zEnterprise includes hardware acquisition, maintenance, software acquisition, S&S and labor. US pricing and will vary by country.

# Financial Charge Back May Not Be Optimized For Accuracy!

## Two Commercial Claims Processing Systems

### HP Servers + ISV



Production Servers

HP 9000 Superdome rp4440

HP Integrity rx6600



Dev/Test Servers

HP 9000 Superdome rp5470

HP Integrity rx6600

Claims per year **327,652**

Buy

Which system  
costs less for  
future growth?

Calculate  
cost per  
workload

### IBM System z CICS/DB2



Total MIPS 11,302

MIPS Used for commercial  
claims processing  
production/dev/test **2418**

Claims per year **4,056,000**

Build

# Allocated Annual Costs For Two Systems

	Mainframe	Distributed
Hardware	1,302,205	87,806
Hardware Maint	315,548	
Software IBM MLC	4,842,384	
Software Non IBM OTC	647,843	196,468
Software Non IBM MLC	5,027,936	
Storage	877,158	
Network	418,755	
Support Staff	2,324,623	257,289
Platform + Staff Total	15,756,452	541,563
Platform + Staff Claims Allocation	3,371,880	541,563
Billing Center	1,611,650	
Call Center	2,920,090	
Development	1,907,382	
Total	9,811,002	541,563
Claims Processed	4,056,000	327,652
\$ Per Claim	<b>2.42</b>	<b>1.65</b>

Provided by customer  
finance department



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Mainframe costs easily identified, distributed costs difficult to identify

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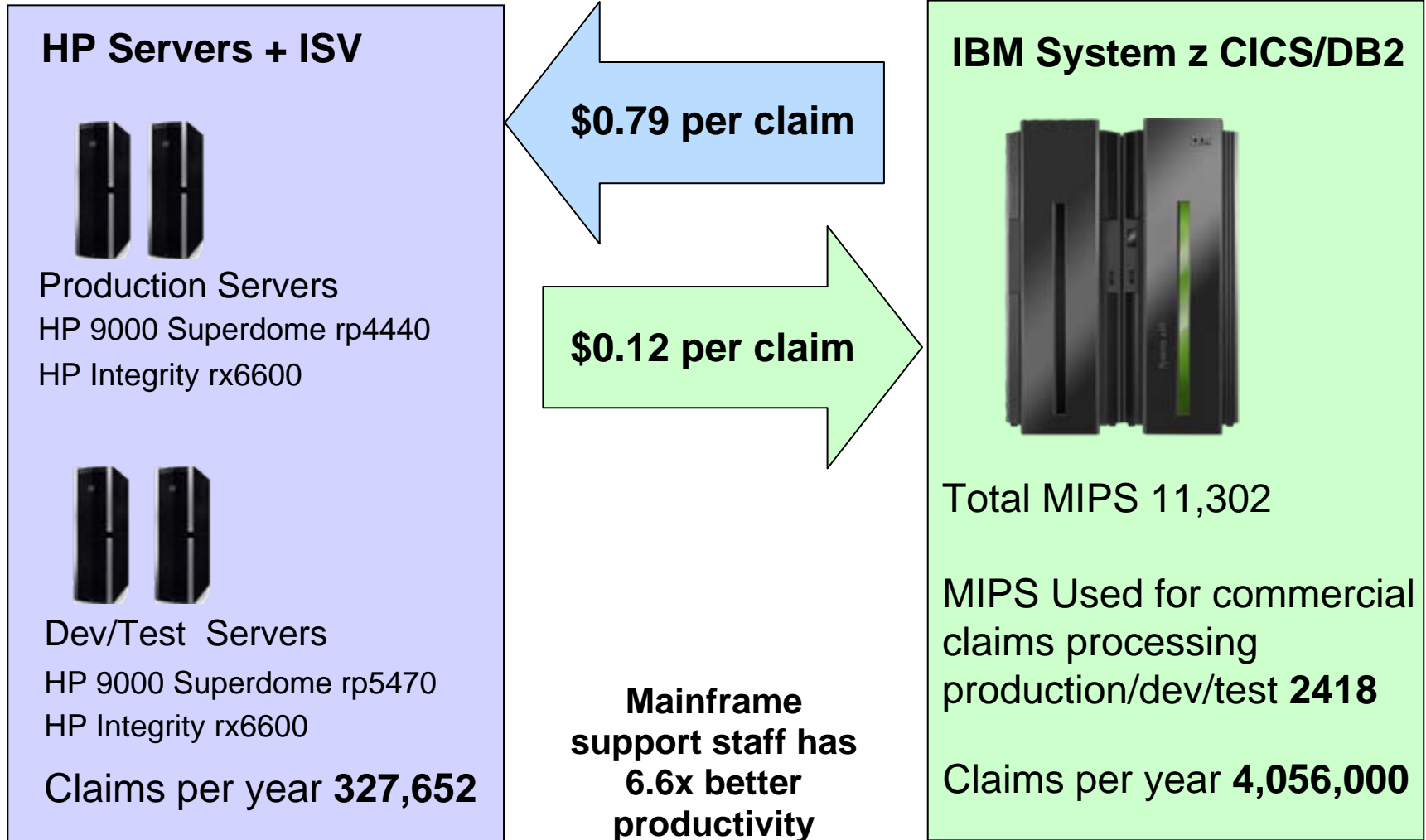
Development still required to customize packaged software for each new contract

# True Costs Per Workload

	Mainframe	Distributed
Hardware	1,302,205	87,806
Hardware Maint	315,548	
Software IBM MLC	4,842,384	
Software Non IBM OTC	647,843	196,468
Software Non IBM MLC	5,027,936	
Storage	877,158	?
Network	418,755	?
Support Staff	2,324,623	257,289
Platform + Staff Total	15,756,452	541,563
Platform + Staff Claims Allocation	3,371,880	541,563
Billing Center	same	same
Call Center	same	same
Development	1,907,382	193,271
Total	5,279,262	734,834
Claims Processed	4,056,000	327,652
\$ Per Claim	<b>1.30</b>	<b>2.24</b>

Mainframe has lower cost per workload

# A Note On Support Staff Annual Costs



# IBM Global Financing Can Help Enable Improved System z Economics

## New clients

- Accelerate migration by reducing upfront migration costs; improve cash flow breakeven point
- Bundle all costs into predictable monthly payments
- **Buyback/disposal of older equipment\***

\* Note: Offering availability may vary by country. Please check with your local IBM Global Financing representative for details.

## Clients on lease

- Affordable upgrades for little or no change in payments per MIP
- Lower TCA; improved ROI over outright purchase
- Reduced obsolescence risk

## Clients who purchase

- Unlock cash in base machine to finance upgrade
- Flexibility to meet future capacity needs, affordably
- Reduced obsolescence risk

# zEnterprise Economics

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- **Optimizations to deliver lowest cost per workload for**
  - ▶ **Service Oriented Architecture workloads**
  - ▶ **Web processing front ends**
  - ▶ **Transactional core workloads**
  - ▶ **Workloads with large data**
  - ▶ **Private clouds**
- **Charge back accounting must report accurate costs per workload**