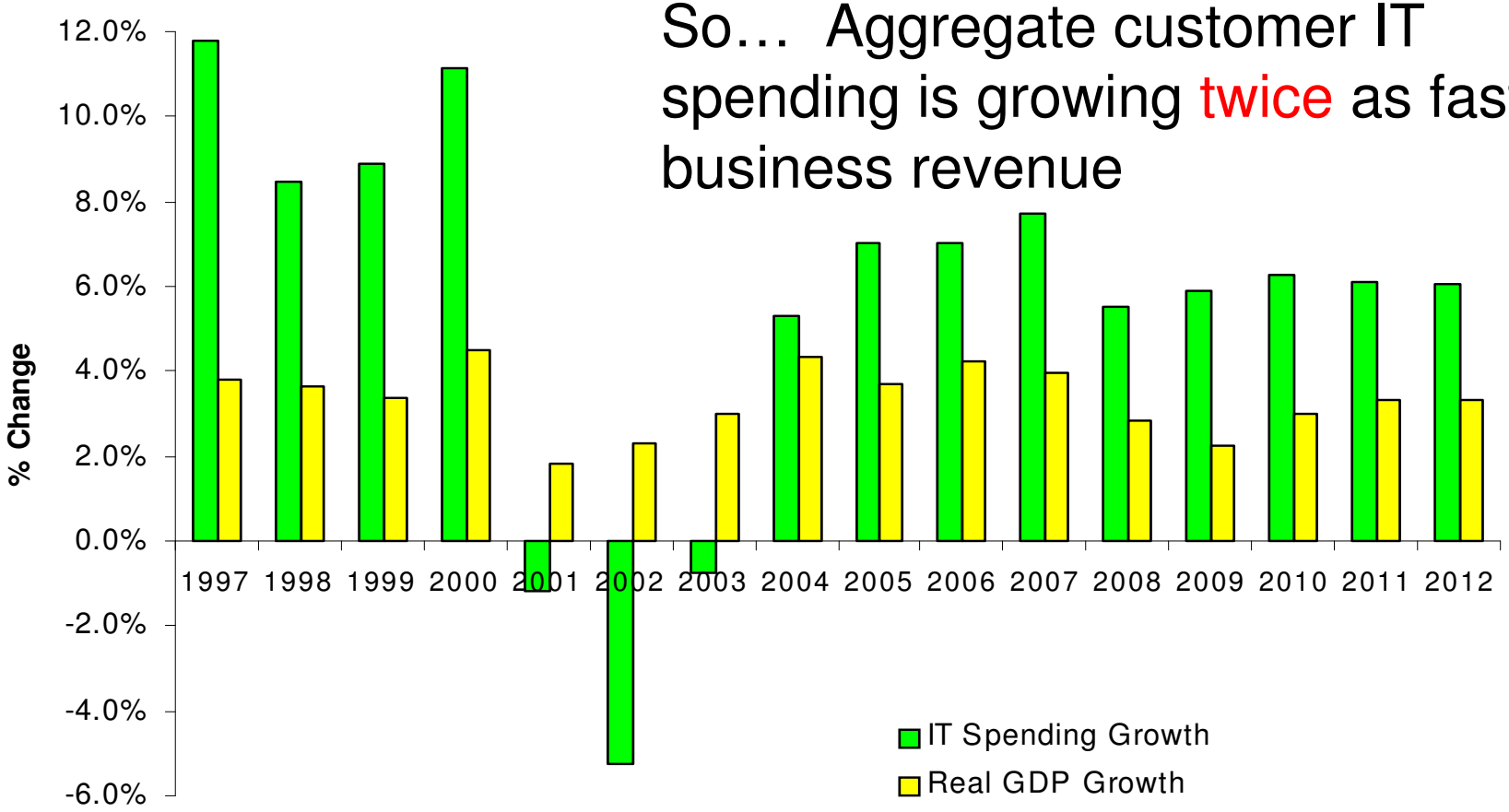
Recent Results From TCO Studies and Experiences

Dr. John J. Shedletsky
Vice President,
Competitive Technology

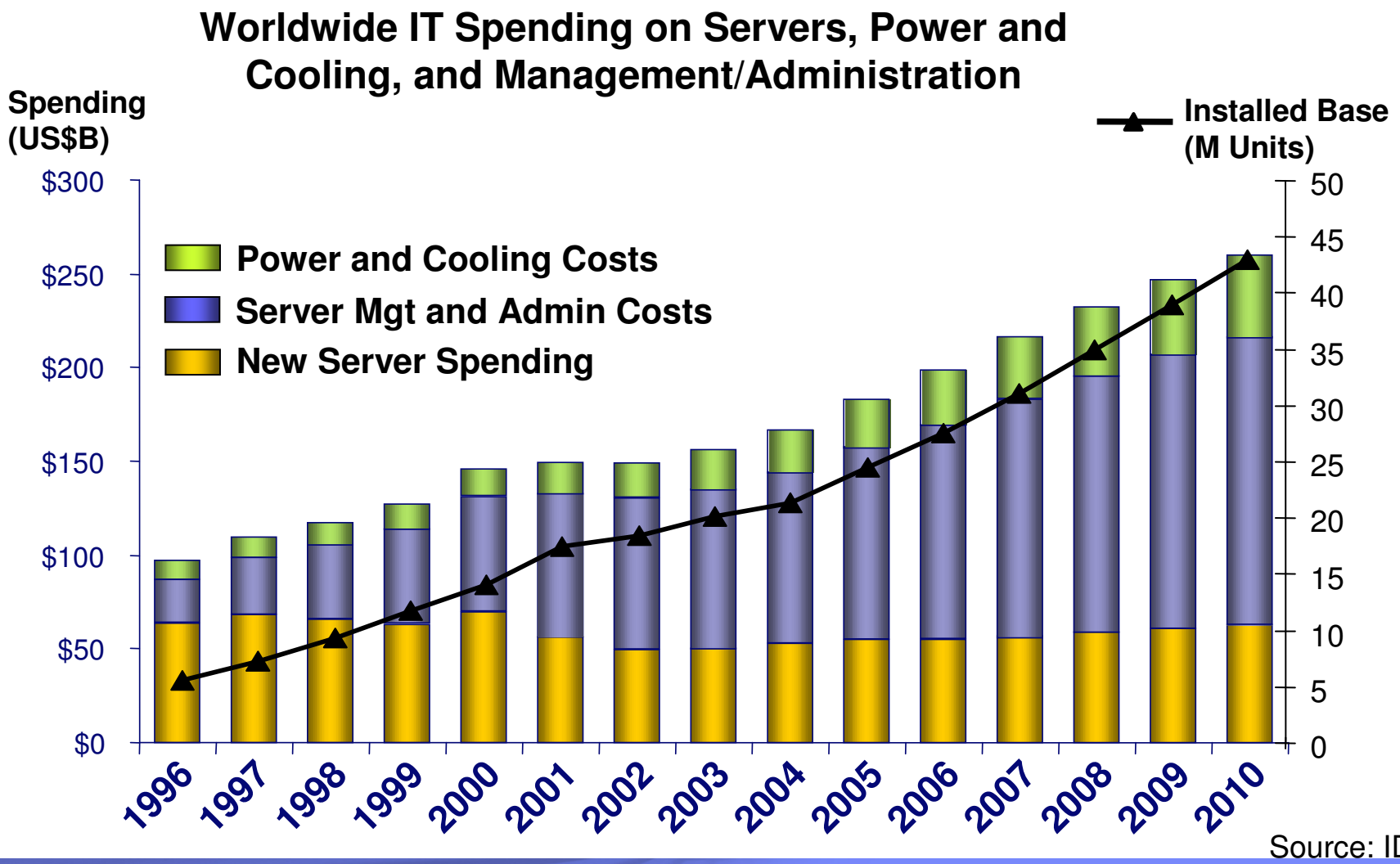
Top Down Analysis: IT Spending Growth

IT Spending is Growing twice as fast as GDP Growth Worldwide



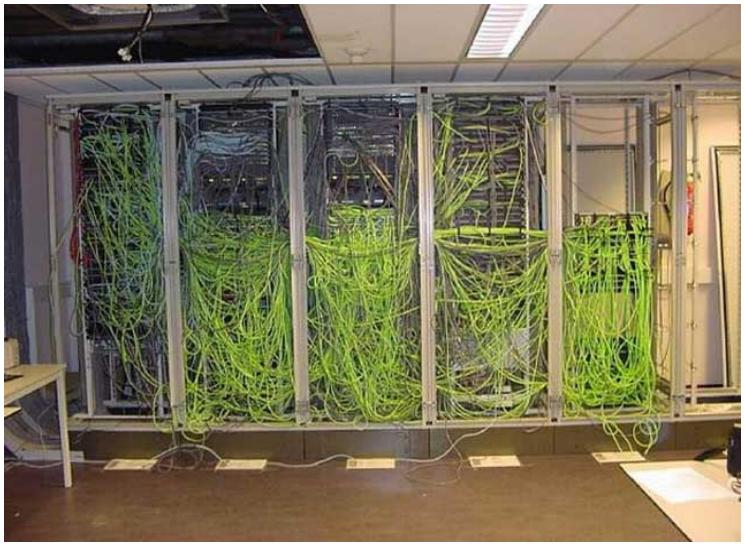
EIU Real GDP FORECASTS- % change on previous year and Total IT Spending – IDC estimates

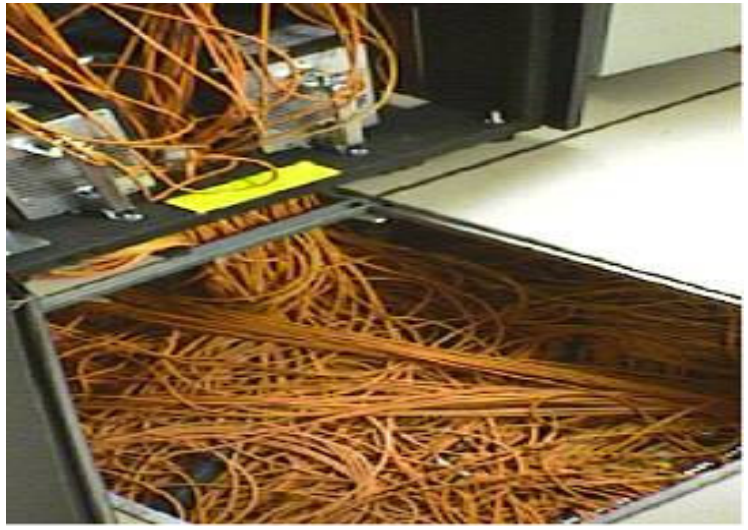
Rising Operational Costs For Distributed Servers Are A Contributing Factor



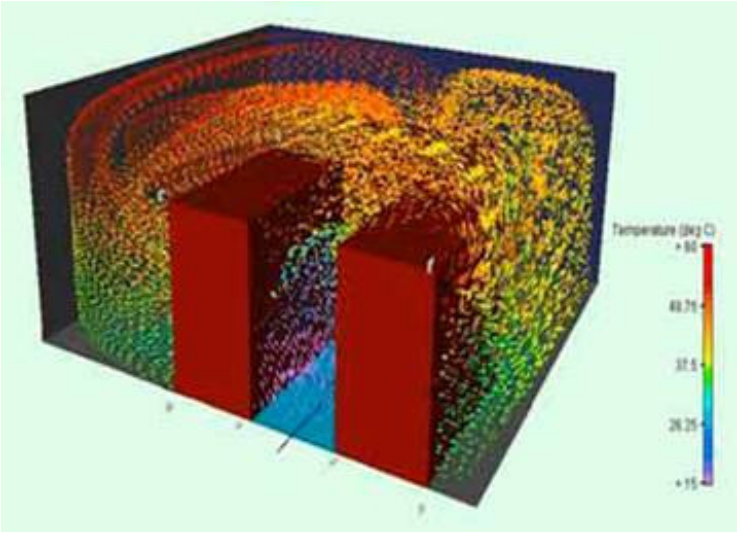
Source: IDC, 2007

Complexity

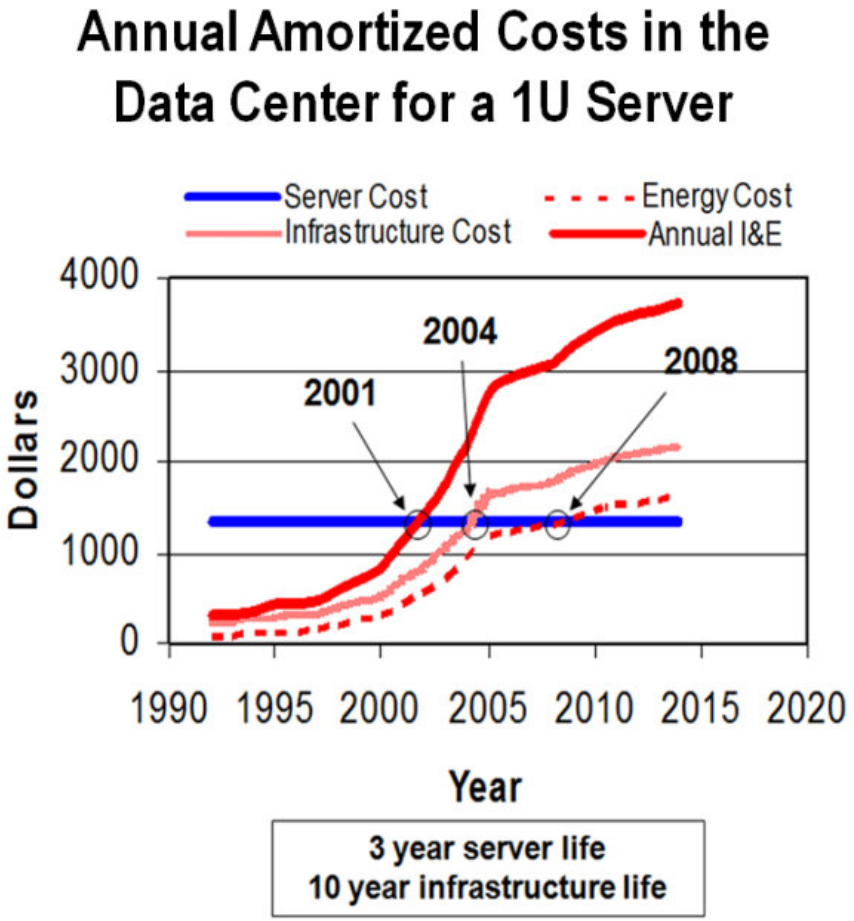




- **Distributed scale out produces complexity**
  - Networking
  - Synchronization of data silos
  - Cooling design



Even Microsoft Recognizes The Problem



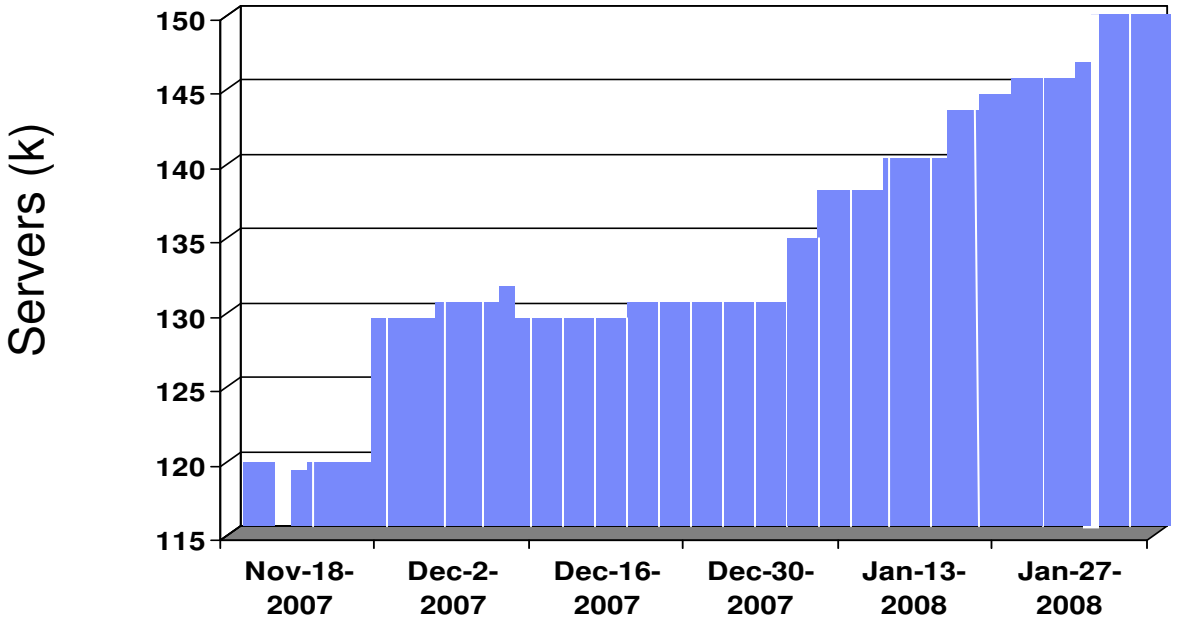
http://www.electronics-cooling.com/articles/2007/feb/a3/

Server power growth rate is from ASHRAE.

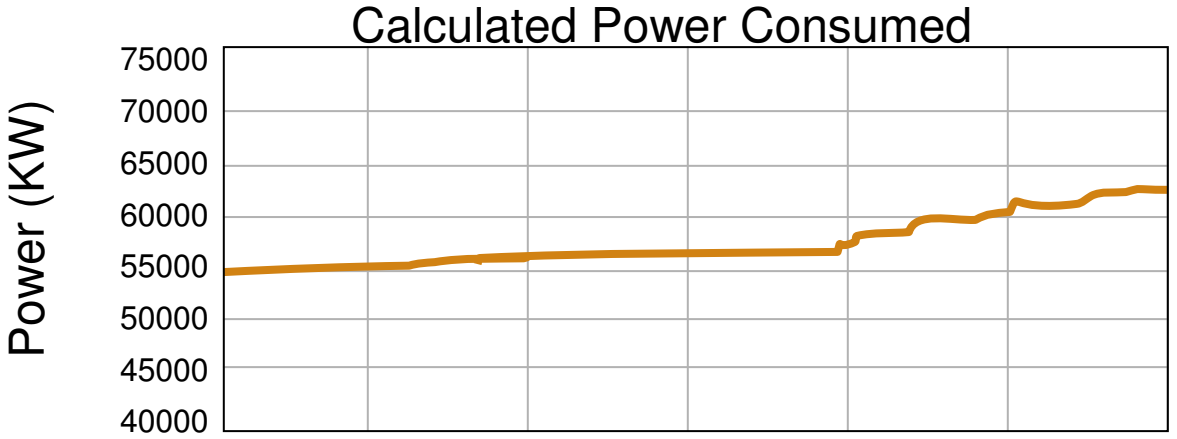
Chart from Microsoft Conference On The Data Center

- **Key Messages:**
  - The combined cost of the Infrastructure and Energy (I&E) exceeded the cost of the servers in 2001
  - Infrastructure costs alone have already exceeded the cost of the server in 2004
  - Energy costs alone will exceed the cost of the servers in 2008

15 Microsoft Data Centers Today



148,000 servers



63 Megawatts

And it's still not enough …

Source: Promotional Video from Microsoft's Environmental Sustainability Group

Microsoft Abandons HP Commodity Servers

- Plans to build 24 massive 500,000 square foot facilities (equals 285 acres)
  - Intended to support Microsoft's web-based software delivery (SaaS) efforts
  - Boulder, Des Moines, Dublin, Northlake, Quincy, Russia, San Antonio…
- Build **custom designed servers** designed specifically for energy efficiency
  - Migrate from HP servers
- Utilize blades and **shipping container** approach
- The Chicago center will
  - House up to 300,000 servers
  - 150-200 shipping containers of data center gear
  - Consume 120 -198 megawatts

Source: Data Center World conference in Las Vegas April 2008

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**

Microsoft working on these

Needed: Something that works on these

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

Source: IBM internal study

Challenge

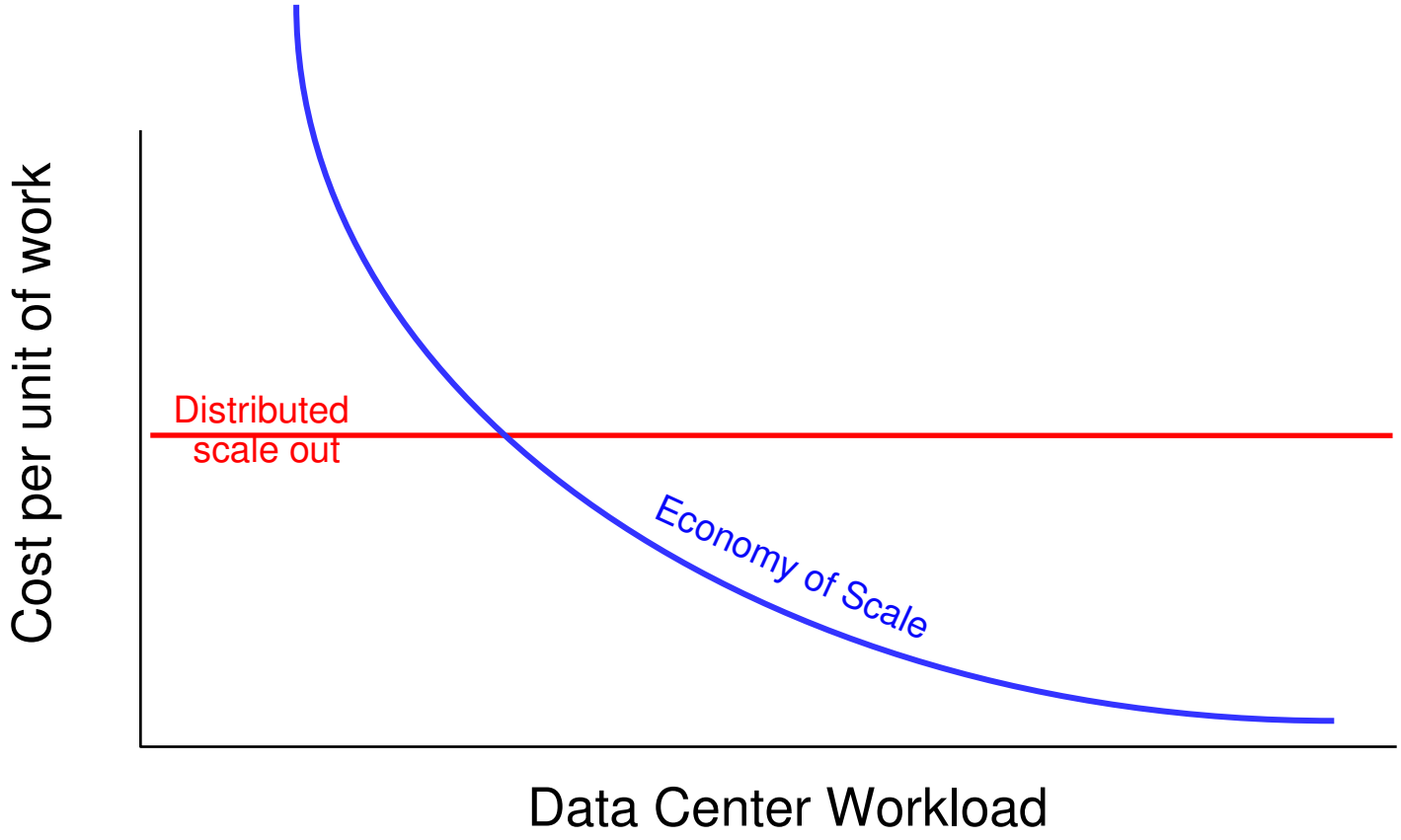
- **How can enterprise IT deliver essential computing services, while keeping cost growth in line with business revenue growth?**

Answer:

Economy of Scale

- Deliver workload at lower cost per unit of work

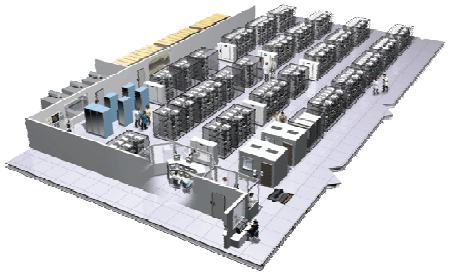
Economy Of Scale – Cost Per Unit Of Work Goes Down As Workload Drives Up Utilization



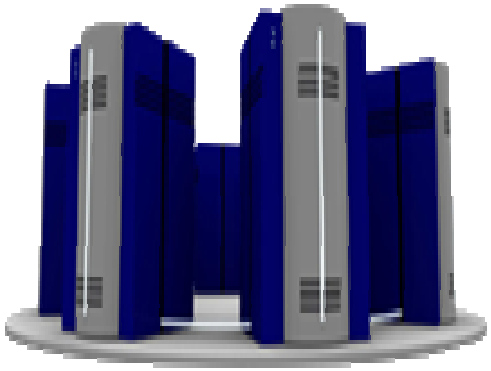
The New Enterprise Data Center

Lowest cost per unit of work
Handle all workloads
Virtualization of resources
Structured management

Evolution of
service delivery



NEDC



Scale Out
Mixed Environment

Dedicated resources

Most Data Centers Are Not Green Field Projects

- **Typical Decision Scenarios:**
  - Large transactional workloads and database
    - Scale may compel platform choice
  - Adding new workload to an existing System z
    - The rule of three
  - Server consolidation to Linux on IFLs
    - Consolidation Math
  - Offloading projects
    - Proliferation of cores defeats distributed price advantages

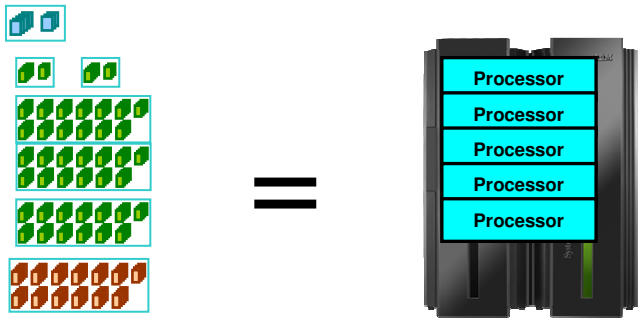
TCO Case Studies – Help With Decision Scenarios

- **The IBM Software Group z evangelist team conducts free TCO evaluation engagements with customers**
- **Topics addressed**
  - Compare Total Cost of Acquistion/Ownership
- **36 projects since 2007**
  - Usually one or two days

- **Contact Craig Bender** **csbender@us.ibm.com**

TCO Top Down Methodology

1. **Establish Equivalent Configurations**



2. **Price out TCA**

3. **Add cost of labor and environmentals**

Most Data Centers Are Not Green Field Projects

- **Typical Decision Scenarios:**
  - Large transactional workloads and database
    - Scale may compel platform choice
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    - Consolidation Math
  - Offloading projects
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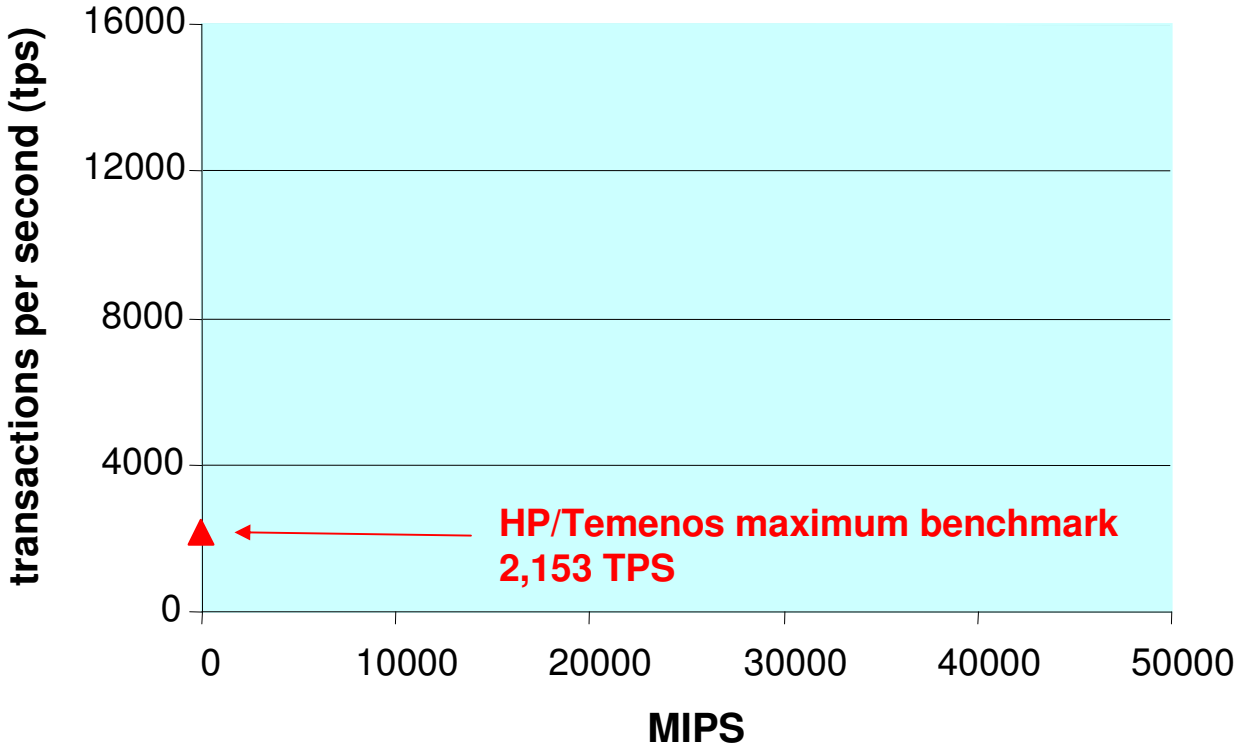
HP Largest Scale Online Banking Benchmark

- HP/Temenos **
  - **HP Itanium**
  - **Temenos T24 (Java)**
  - **2,153** Transactions/second
  - **13** Million Accounts
  - Largest banking benchmark performance claimed by HP



SOURCE:*http://www.enterprisenetworksandservers.com/monthly/art.php?2976 **Source**: InfoSizing FNS BANCS Scalability on IBM System z – Report Date: September 20, 2006

SOURCE:**TEMENOS BENCHMARKS; http://h71028.www7.hp.com/enterprise/downloads/TemenosBenchmark.pdf

System z With DB2 Scales Further Than Best HP Superdome Banking Benchmark

- **Asian Bank**
  - **IBM System z9 and DB2**
  - **TCS BaNCS (Cobol)**
  - **15,353** Transactions/second
  - **50** Million Accounts
  - IBM benchmark for customer

- Bank of China **
  - **IBM System z9 and DB2**
  - **TCS BaNCS (Cobol)**
  - **8024*** ** Transactions/second
  - **380** Million Accounts
  - IBM benchmark for customer

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  - **2,153** Transactions/second
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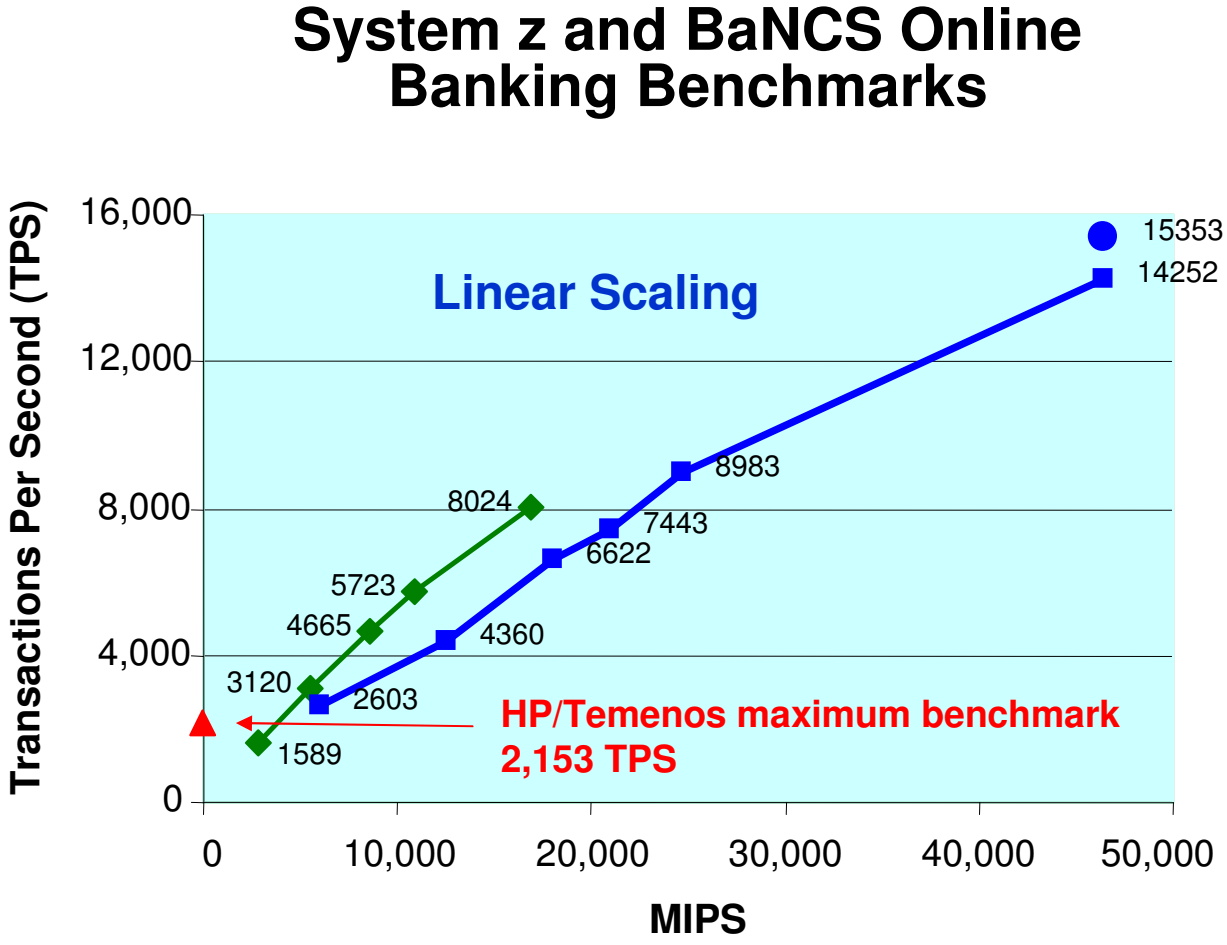


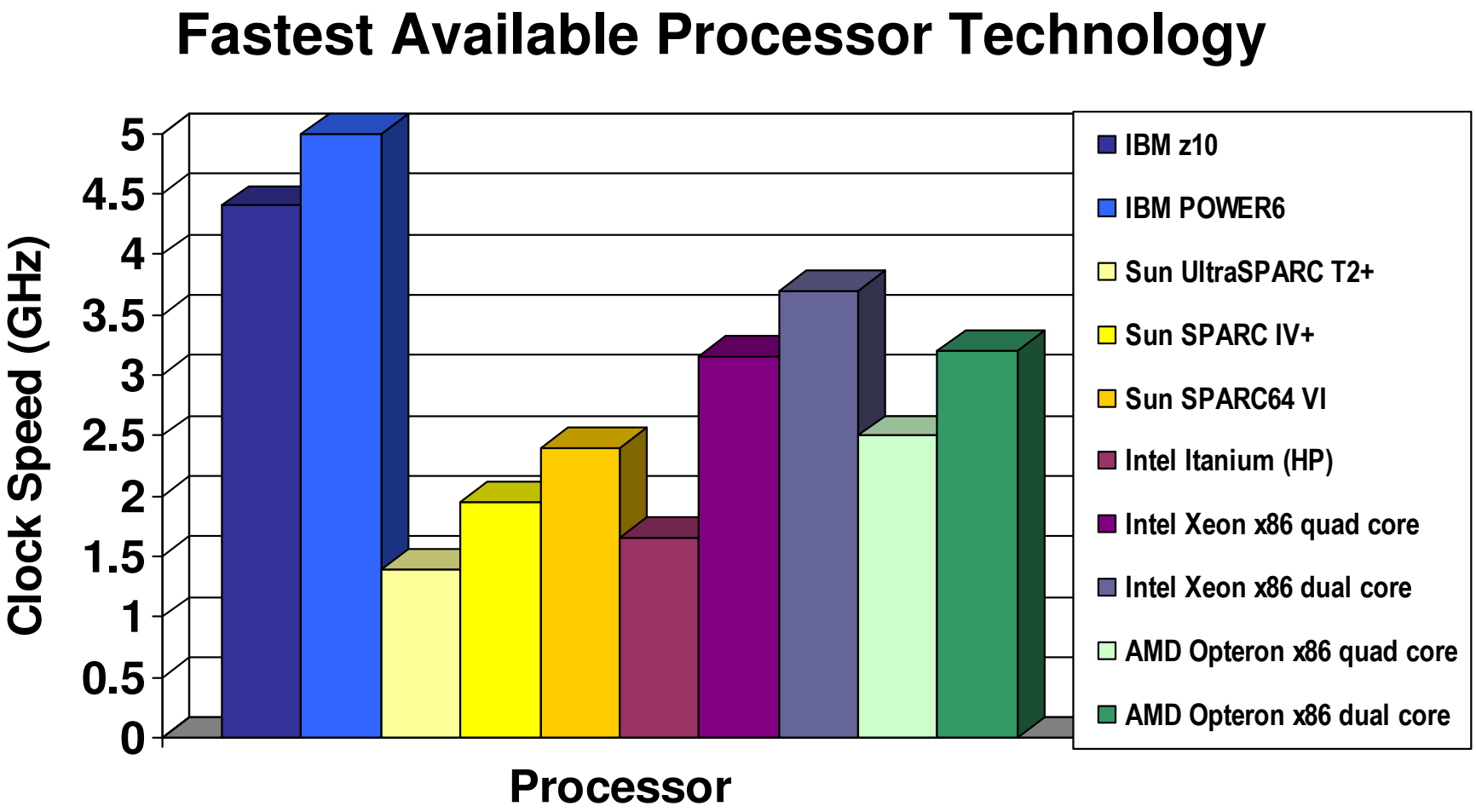
* **SOURCE**: TEMENOS BENCHMARKS; http://h71028.www7.hp.com/enterprise/downloads/TemenosBenchmark.pdf
** **SOURCE**:http://www.enterprisenetworksandservers.com/monthly/art.php?2976 **Source**: InfoSizing FNS BANCS Scalability on IBM System z – Report Date: September 20, 2006
*** Standard benchmark configuration reached 8024 tps, a modified prototype reached 9445 tps

Case Studies: Lessons Learned

- **Unique parallel sysplex design enables this scale**
  - Specialized hardware for clustering up to 32 systems
  - Exploitation by operating system and software subsystems
  - Enables large transaction processing workloads against a single data base
  - ***May be the only practical solution for large transaction workloads***

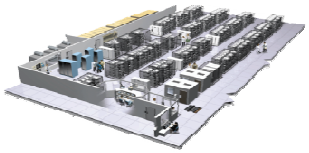
- **New system z10 extends scale further**
  - Quad core 4.4 GHz processors, up to 77 in a frame (30,361 general purpose MIPS in a frame)
  - More I/O bandwidth (up to 384 GBps)

System z10 And Power Systems Clock Speeds



Merger Of Two Asian Credit Card Service Companies

Company A
5M accounts
HP/Informix/Tmax



Offloaded to HP
2 years ago

Upgraded z900's to z9 EC

System z $205M vs.
HP/Oracle/Tmax $252M
Scalability, Full Disaster Recovery

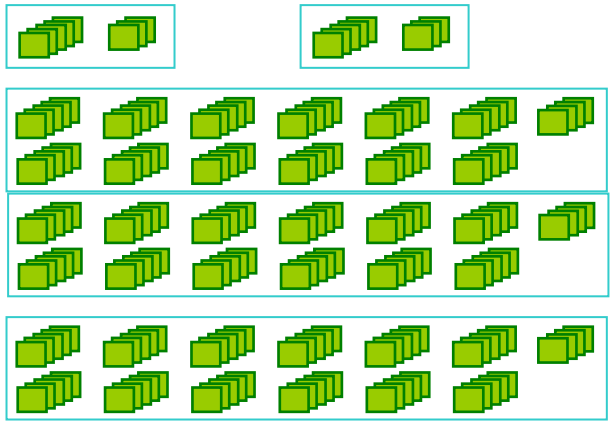
A acquires B
$50B annual revenue
Transaction volume growth 13%
Platform decision?

Company B
10M accounts
CICS/DB2

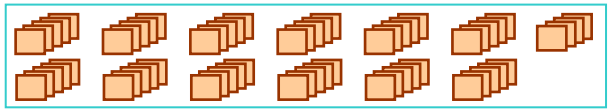
Compare The Processors Needed To Achieve 2,200 Transactions Per Second (with System z10)

Online Injector -1x HP RX7620

Temenos T24 Servers:
2x HP RX7620
3x HP Superdome

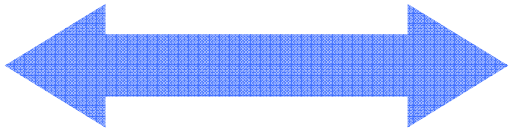


Oracle 10g – 1x HP Superdome



5 z10 processors

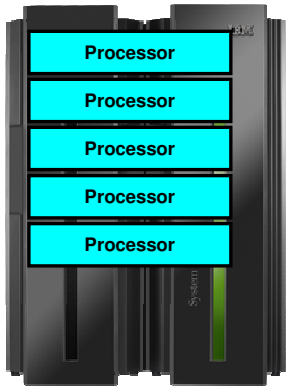
(3,906 MIPS)



280 processors

(457,762 Performance Units)

TCS BaNCS
1x z10 2097-705

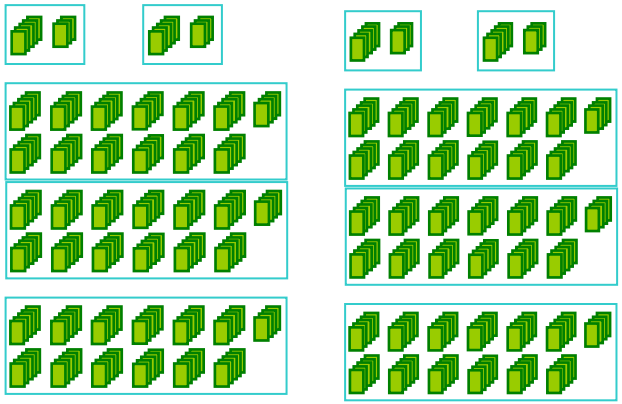


117 Performance Units per MIP

Compare The Processors Needed To Achieve 2,200 Transactions Per Second (With Dev/QA)

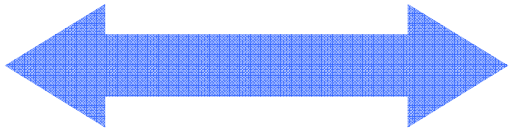
Online Injector: 2x HP RX7620

Temenos T24 Servers:
4x HP RX7620
6x HP 9000 Superdome



7 processors

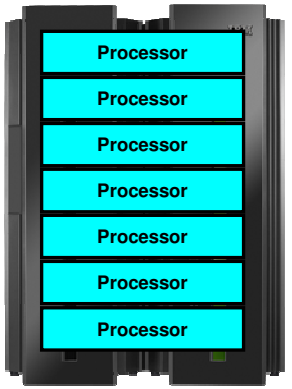
(4,906 MIPS)



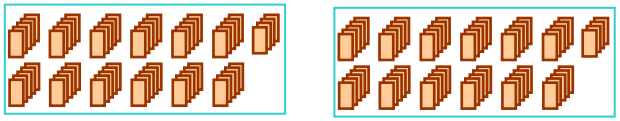
560 processors

(915,524 Performance Units)

TCS BaNCS and DB2
1x z10 2097-707



Oracle 10g: 2x HP 9000 Superdome



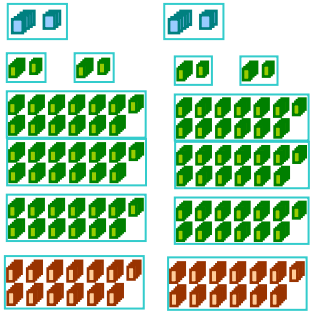
187 Performance Units per MIP

HP Integrity rx7620 - (10U) 1.5GHz 6MB (8ch/8co)

HP 9000 Superdomes - 32W 1GHz 32MB (32ch/64co)

NOTE: Double Distributed Servers, add 1000 MIPS to System z for Dev/QA

Compare The 3-Year Green Field Acquisition Costs Of The Platforms



	HP Superdome Servers with Temenos T24	**IBM z10 with TCS BaNCS**
Servers	14 (560 cores)	1 (7 cores)
OS, Database	HP-UX, Oracle	z/OS, DB2
3 Year TCO	**$43.3M**	**$18.2M** Costs 58% Less
	Scalability Not Demonstrated	*Excellent Scalability*

Note: Cost of packaged application software not included

Core Banking Benchmarks
Total Cost Of Ownership Breakdown

Mainframe Cost

	OTC	Annual
Hardware		
z10 machine w/ 7 GP and 32GB memory	$8,681,500	$365,602
Software		
z/OS, CICS, DB2, MQ		$2,981,076
TOTAL	$8,681,500	$2,981,076 (Y1) $3,346,677 (Y2+)

Distributed Cost

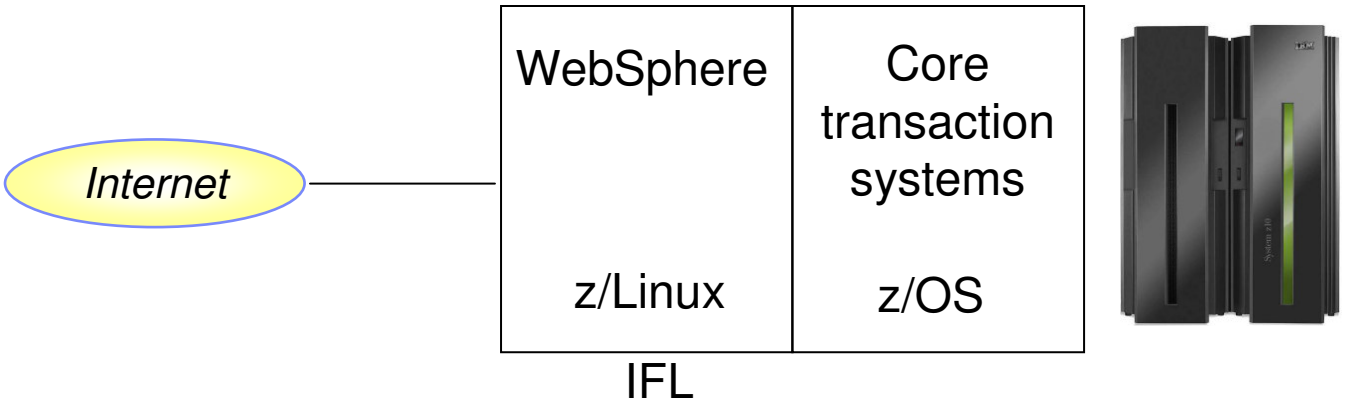
	OTC	Annual
Hardware		
8x HP Superdome	$17,170,280	$8,077,872 (Y1)
6x HP rx7640	$1,871,748	$385,800 (Y1)
Software		
UNIX	$992,448	$628,352 (Y1)
Oracle	$5,320,000	$1,170,400
WebSphere	$3,472,000	$694,400 (after Y1)
Messaging, security, print etc. software	$331,200	$66,240 (after Y1)
TOTAL	$29,157,676	$10,262,424 (Y1) $1,931,040 (Y2+)

Most Data Centers Are Not Green Field Projects

- **Typical Decision Scenarios:**
  - Large transactional workloads and database
    - Scale may compel platform choice
  - Adding new workload to an existing System z
    - The rule of three
  - Server consolidation to Linux on IFLs
    - Consolidation Math
  - Offloading projects
    - Proliferation of cores defeats distributed price advantages

Asian Bank Adds New Workload To Mainframe

- **Extend channel for internet banking**
- **Upgrade IMS and CICS for built-in SOA web service support**
- **Add WebSphere front end, run on z/Linux IFL's**
- **Increase recovery site capability to 100%**



Deploy WAS Application on Mainframe z/OS vs. HP Servers

Existing Mainframe

Existing z10:
2 GP 1,720 MIPS
DB2 and utilities
With 20TB storage

Existing Disaster Recovery Site

Existing:
1 GP processor for hot disaster switch-over
1 "dark" DR processor
With 20TB storage

Add 3 LPARs for New Web Application w 1.28 TB storage

Prod

1,624 MIPS additional workload

Incremental:
1 zAAP 920 MIPS WAS (85%)
1 GP 541 MIPS DB2
163 MIPS WAS (15%)
2 GB memory

And Add Disaster Recovery w 1.28 TB storage

Prod

3 year cost of acquisition $3.13M

Capacity Backup:
1 GP
1 zAAP

Or Add HP Integrity Superdome 9140 Server w 1.67 TB storage

Prod

201,977 Performance Units*

And Add Disaster Recovery w 1.67 TB storage

Prod

3 year cost of acquisition $5.74M

HP DR solution is used in software and hardware

**Production Performance Units required = 1,624 x 122 = 198,128*

WAS Application Incremental Cost Breakdown

Mainframe Incremental Hardware

OTC		ANNUAL	
GP	$1,358,000	Processor Maintenance * (For year 2, 3)	$90,142
zAAP	$125,000		
DR Processors	$27,000		
Memory (2 GB)	$12,000	Storage Maintenance (For year 2, 3)	$5,272
IBM Storage (1.28TBx2)	$141,750		
TOTAL	$1,663,750	TOTAL	$95,413 (year 2, 3)

Mainframe Incremental Software

OTC		ANNUAL	
DB2 Utilities	$346,565	Utilities S&S	$49,931
WAS	$97,170	WAS S&S	$19,434
		DB2 MLCx12	$107,088
		z/OS MLCx12	$52,296
		QMF MLCx12	$47,724
TOTAL	$443,735	TOTAL	$276,473

Distributed Incremental Hardware

OTC		ANNUAL	
HP Integrity Superdome 9140 Server	$1,341,121	Server Maintenance (Prepaid in year 1 for 3 years)	$154,974
DR Hardware	$804,673		
HP storage (1.67TBx2)	$749,805	Storage Maintenance $44,400	
TOTAL	$2,895,599	TOTAL	$509,322 (year 1) $44,400 (year 2,3)

Distributed Incremental Software

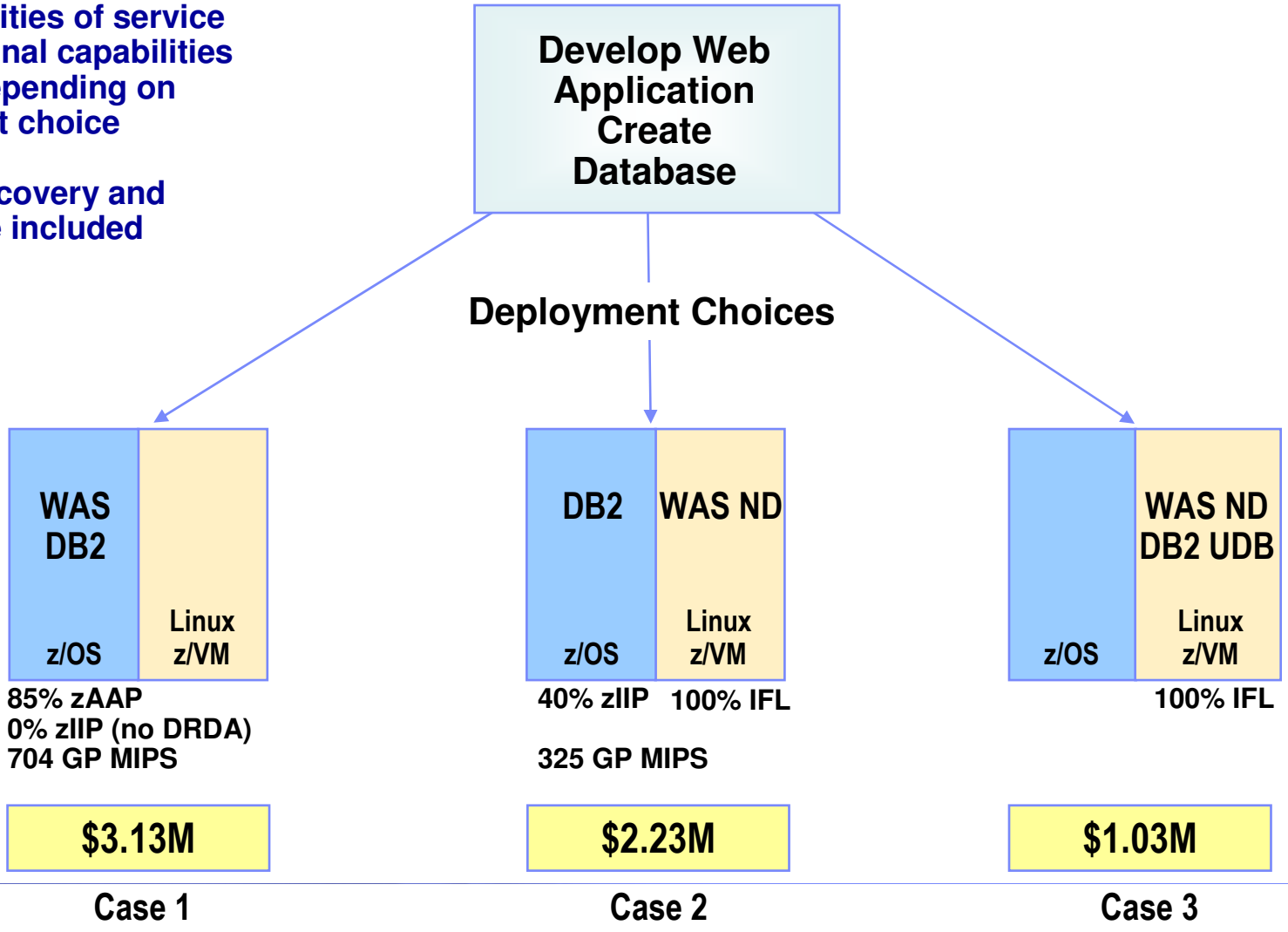
OTC		ANNUAL	
Oracle EE & Utilities	$615,000	Oracle S&S	$135,300
WAS ND	$573,500	WAS ND Maint $114,700 (Year 2, 3)	
Unix	$132,720	Unix S&S (prepaid in year 1 for 3 years)	$96,843
TOTAL	$1,321,220	TOTAL	$425,828 (year 1) $250,000 (year 2, 3)

** Mainframe Processor Maintenance includes the maintenance for general purpose processors and specialty engines*

Other Mainframe Deployment Options Can Reduce the Cost of the WebSphere Application Even Further

Note: Qualities of service and functional capabilities will vary depending on deployment choice

Disaster recovery and storage are included



Deploy Data Base Server On Mainframe vs. HP Servers

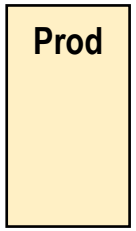
Existing Mainframe

Existing z10:
2 GP 1,720 MIPS
DB2 and utilities
With 20TB storage

Existing Disaster Recovery Site

Existing:
1 GP processor for hot disaster switch-over
1 "dark" DR processors
With 20TB storage

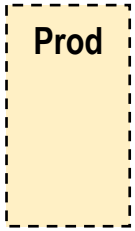
Add 1 LPAR for New SAP Data Server w 1TB Storage



2,300 MIPS additional workload

Incremental:
2 GP 1,380 MIPS (60%)
1 zIIP 920 MIPS (40%)
1 GB memory

And Add Disaster Recovery w 1TB Storage



3 year cost of acquisition $5.07 M

Capacity Backup:
1 GP
1 zIIP

Or Add HP Integrity Superdome 9140N Servers w 1.55 TB storage

Prod

201,977 Performance Units*

And Add Disaster Recovery w 1.55 TB storage

Prod

3 year cost of acquisition $6.68 M

HP DR solution is used in software and hardware

**Production Performance Units required = 2,300 x 87 = 200,100*

Deploy Data Base Server On Mainframe vs. HP Servers

Mainframe Incremental Hardware

OTC		ANNUAL	
1 GP 1 zIIP Processor	$2,604,00 $125,000	Processor Maintenance * (For year 2, 3)	$156,785
DR Processors Memory (1GB)	$27,000 6,000		
IBM Storage (1TB x2)	$141,750	Storage Maintenance (For year 2, 3)	$5,272
TOTAL	$2,903,750	TOTAL	$162,057 (year 2, 3)

Mainframe Incremental Software

OTC		ANNUAL	
DB2 Utilities	$568,585	DB2 Utilities S&S	$81,811
		DB2 MLC x12	$171,672
		QMF MLCx12	$76,728
		z/OS MLC x12	$92,952
TOTAL	$568,585	TOTAL	$423,163

Distributed Incremental Hardware

OTC		ANNUAL	
HP Processors	$1,341,121	Processor Maintenance (prepaid in year 1 for 3 years)	$464,922
DR Hardware	$804,673		
HP storage (1.55TBx2)	$749,805	Storage Maintenance	$44,400
TOTAL	$2,895,599	TOTAL	$509,322 (year 1) $ 44,400 (year 2, 3)

Distributed Incremental Software

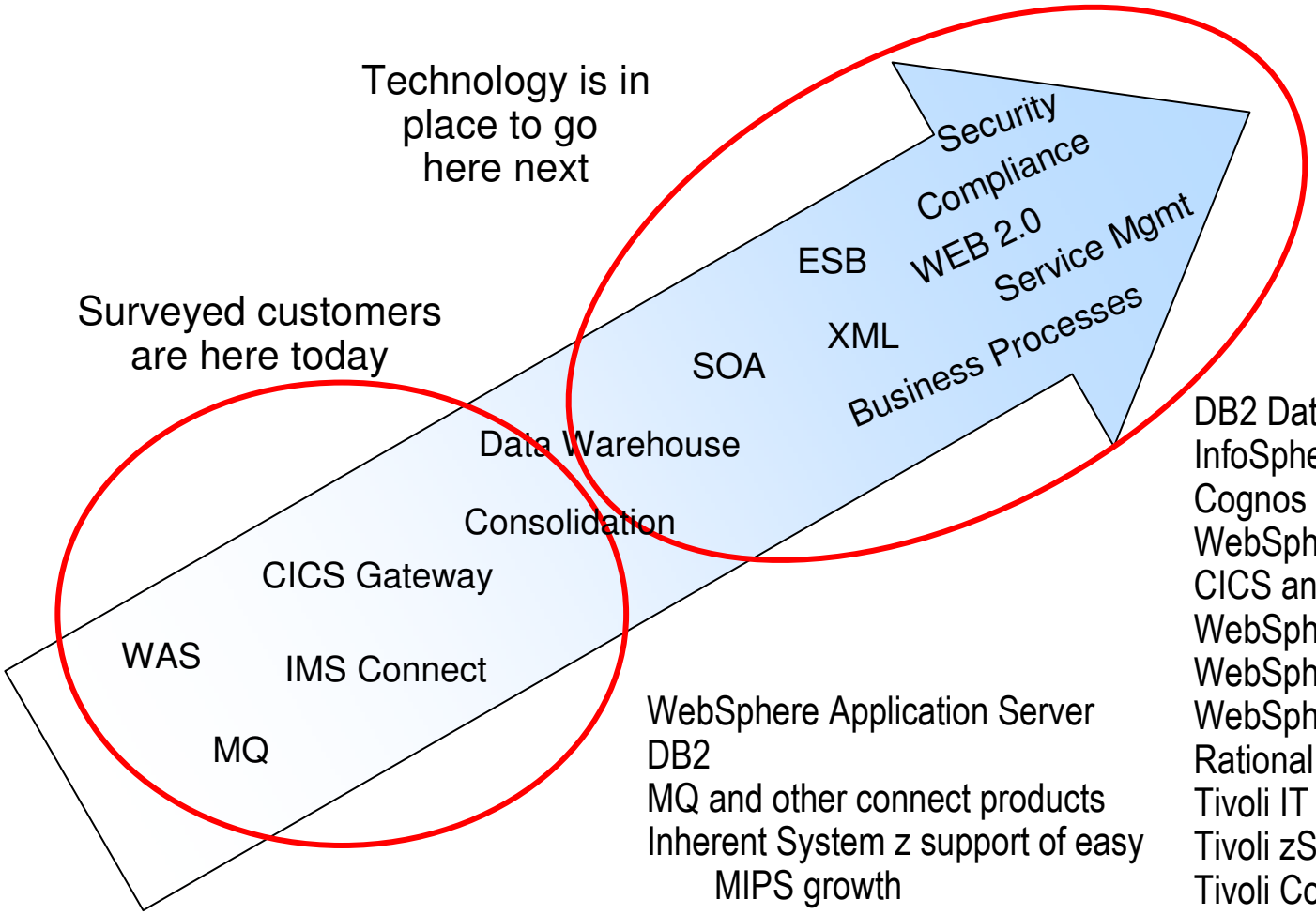
OTC		ANNUAL	
Oracle EE & Utilities	$1,752,750	Oracle S&S	$385,605
Unix	$132,720	Unix S&S (Prepaid in year 1 for 3 years)	$48,421
TOTAL	$1,885,470	TOTAL	$530,869 (year 1) $385,605 (year 2, 3)

** Mainframe Processor Maintenance includes the maintenance for general purpose processors and specialty engines*

Case Study: European Retailer Saves Money by Running SAP Applications on zLinux

- **Cost study to replace existing SAP application running on Solaris servers**
  - CASE 1: Applications and data bases on distributed
    - 5 year TCO €15.0M
  - CASE 2: Applications on distributed, data base on z/OS
    - 5 year TCO €12.6M
  - CASE 3: Applications on zLinux, data base on z/OS
    - 5 year **TCO €11.1M**
    - Better workload management and virtualization
    - Co-location benefit of SAP applications and data bases on same System z
- **All cases incremental cost of additional Hardware and Software**

New Workloads On The Mainframe



WebSphere Application Server
DB2
MQ and other connect products
Inherent System z support of easy MIPS growth

DB2 DataWarehouse
InfoSphere Information Server
Cognos
WebSphere Studio Asset Analyzer
CICS and IMS native web services
WebSphere Process Server
WebSphere Portal Server
WebSphere Message Brokerr
Rational Developer for System z
Tivoli IT Service Management products
Tivoli zSecure
Tivoli Compliance Insight Manager
IBM Mashup Center

Case Studies Demonstrate Consistent TCA Advantage For Adding New Workload

Scenarios	Cost of Distributed vs. z	Distributed Cost Ratio	Cores vs. z Processors	Core Ratio
Deploy New Applications on Mainframe				
– **WebSphere Application**	**$5.7M vs $3.1M**	**1.8x**	**112 vs 4**	**28 : 1**
– **SAP Database Server**	**$6.7M vs $5.1M**	**1.3x**	**112 vs 6**	**19 : 1**
– **Data Warehouse**	**$7.5M vs $5.0M**	**1.5x**	**96 vs 6**	**16 : 1**
– **Data Warehouse Analytics**	**$20.8M vs $8.9M**	**2.4x**	**192 vs 10**	**19 : 1**
– **Communications Backbone**	**$5.6M vs $4.3M**	**1.3x**	**64 vs 4**	**16 : 1**
– **SOA Solution**	**$12.3M vs $4.0M**	**3.1x**	**112 vs 4**	**28 : 1**
– **SOA Solution vs Sun**	**$26.2M vs $4.0M**	**6.5x**	**240 vs 4**	**60 : 1**
– **Major Retailer**	**$8.3M vs $7.0M**	**1.2x**	**22 vs 5**	**4.4 : 1**
		2.4x		**24 : 1**

Distributed deployment costs 2.4 times as much
Co-location performance benefits, better quality of service

TCA = Total Cost of Acquisition (HW, SW, plus 3 years of annual charges)

Remember The Rule Of Three

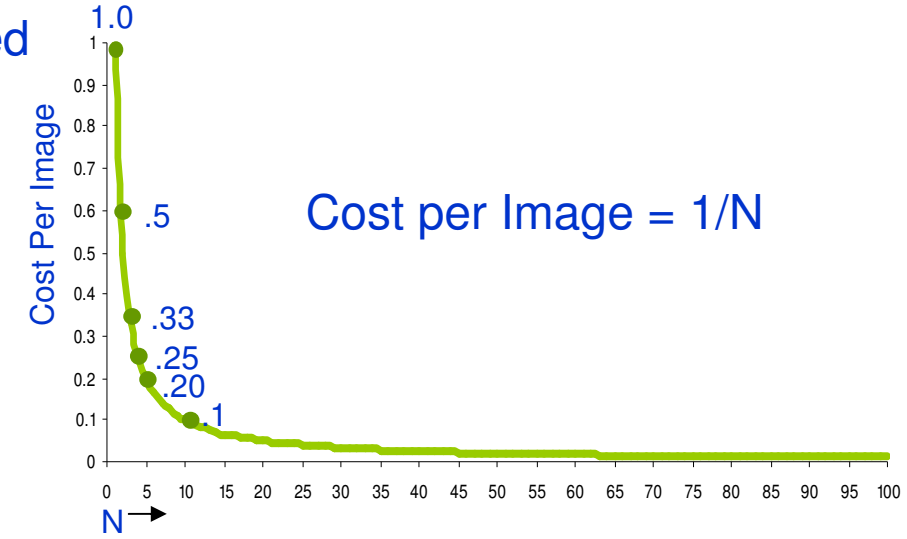
- **The cost of deploying a new application will usually be less on a mainframe if:**
  1. **It is an incremental workload on an existing mainframe**
  2. **It can make use of a specialty processor**
  3. **Disaster recovery is required**

Most Data Centers Are Not Green Field Projects

- **Typical Decision Scenarios:**
  - Large transactional workloads and database
    - Scale may compel platform choice
  - Adding new workload to an existing System z
    - The rule of three
  - Server consolidation to Linux on IFLs
    - Consolidation Math
  - Offloading projects
    - Proliferation of cores defeats distributed price advantages

Cost Equation – Consolidate "N" Workload Images On One Server With Shared Resources

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



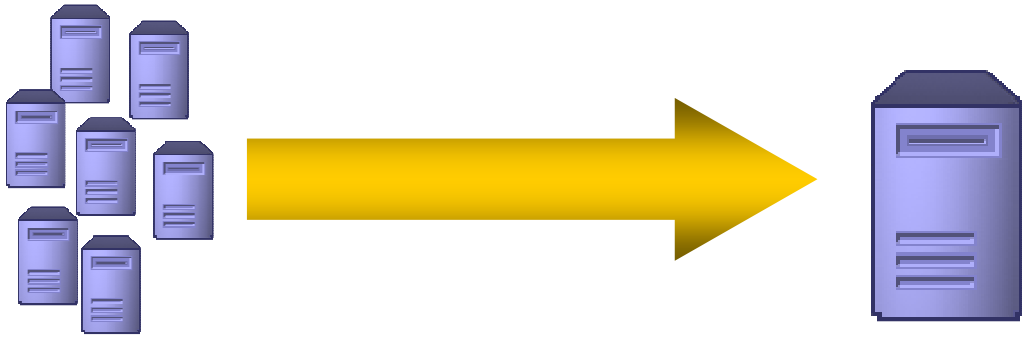
Cost per Image = 1/N

- 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

Consolidation Math

What is the theoretical maximum number of servers that can be consolidated?



Ratios

$P_R = P_B / P_A$

$U_R = U_B / U_A$

$C_R = C_B / C_A$

N Servers

P_A – Processor Power

U_A – Utilization

C_A – Cores Per Server

One Server

P_B – Processor Power

U_B – Utilization

C_B – Cores Per Server

Processor Performance Ratio

Processor Utilization Ratio

Cores per Frame Ratio

$$N \leq (P_R)\ (U_R)\ (C_R)$$

Implementation variations from average and practical considerations will constrain this theoretical number

Identify Consolidation Opportunities

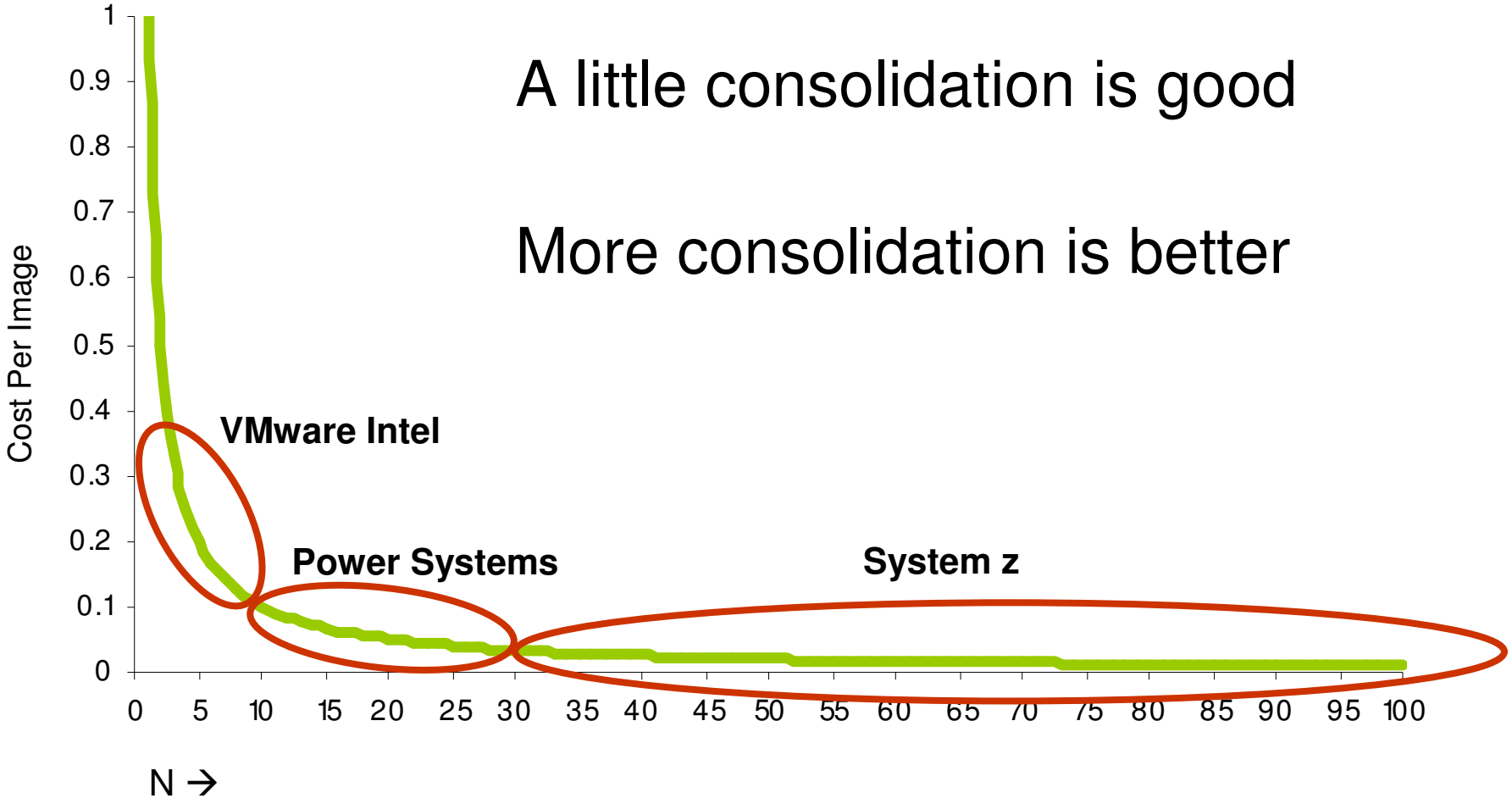
The more servers you can consolidate, the more money you will save

$$N \leq (P_R)\ (U_R)\ (C_R)$$

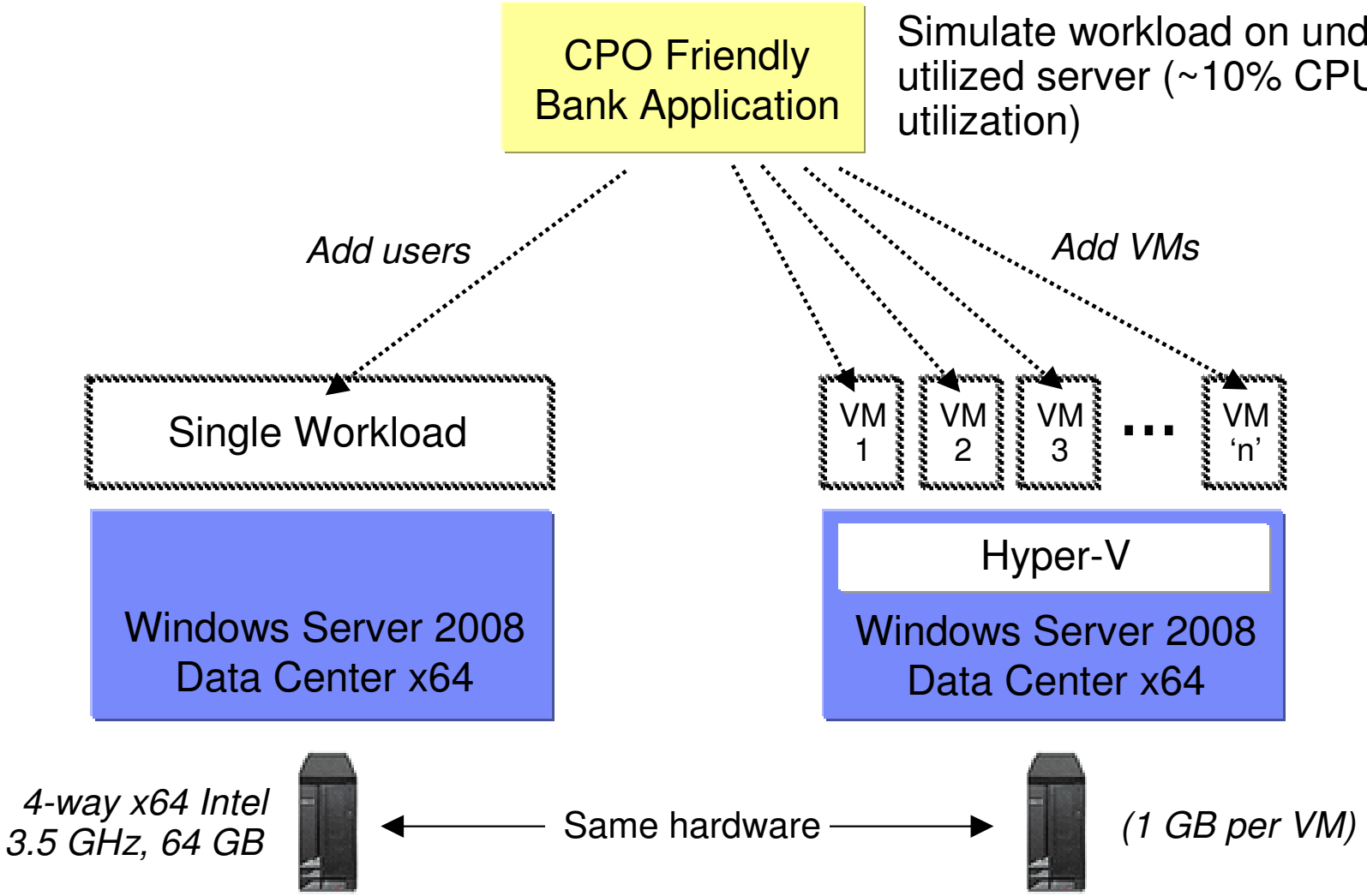
Servers that are candidates to be consolidated	Servers with low utilization	Servers with a low number of cores
Older servers with slower processor		
Servers that are best consolidation platforms	Servers that can achieve sustained high utilization	Servers with a high number of cores
New servers with faster processor		

	Performance Ratio	Utilization Ratio	Core Ratio
Typical Ratios	**1.0 - 3.0**	**10 - 20**	**1- 64**

Observed Consolidation Ratios

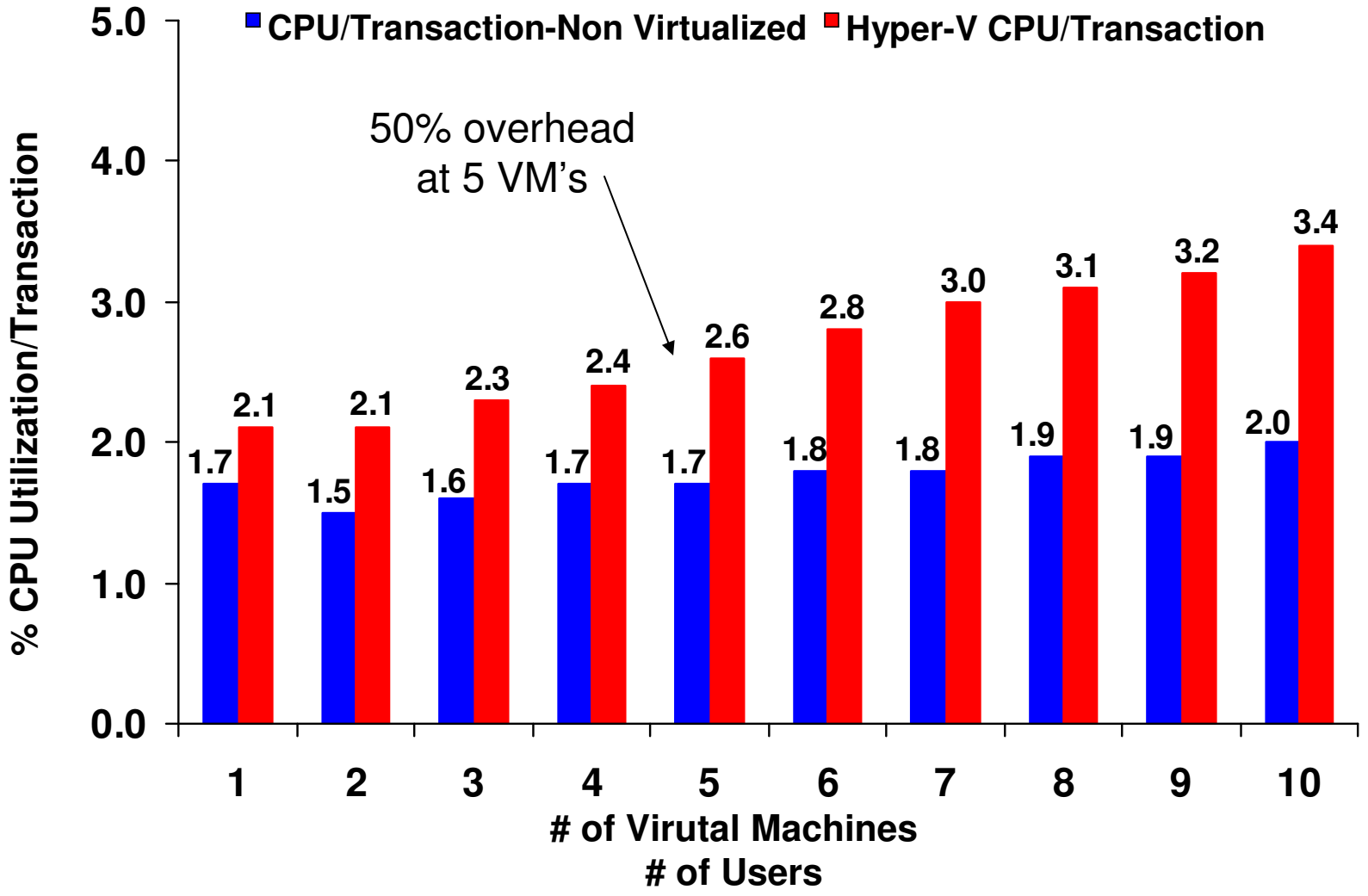


Hyper-V Benchmark



Microsoft Hyper-V Overhead Limits Effective Consolidation

Percent of processor utilization per transaction, with and without Hyper-V



Case Study: Québec Government Runs Oracle At IFL Prices

- **Running 292 server instances on one z9-EC with 5 IFLs**
  - 200 Oracle, 80 WebSphere, 12 WebSphere messaging
  - Reduced cost of hardware and software by 30%
    - Saved $800,000 in licensing cost in the first year
  - Used RACF for consistent security
  - Each administrator can manage 100 consolidated Linux images
  - Fast provisioning
    - Create new Linux server in 30 min (vs. 1 week – 3 months)
    - Clone Oracle DB instance in 30-45 min (vs. 10 – 14 hours)
  - Inherited benefits of z platform – workload management, availability, disaster recovery, I/O bandwidth

Consolidation Case Study:
Consolidate 292 Oracle Servers Onto 3 System z IFL's

Existing Mainframe

Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation

Add three processors:
3 IFLs

Or maintain existing 292 server farm for Oracle data servers

70% Cost Reduction

3 year TCO $9.06M

Annual operating cost $0.67M

Breakeven in first year

3 year TCO $30.13M

Annual operating cost $10.04 M

Case Study: Consolidate On Mainframe vs. Keeping Dedicated Servers

Mainframe Incremental Hardware

OTC		ANNUAL	
3 IFL Processors	$375,000	Processor [2] Maintenance	$52,524
		Power/Space [1]	$47,073
Conn. + Disk Acquisition	$639,033	Conn. + Disk Maintenance [1]	$87,480
RAM (190GB)	$1,140,000	System Admin [1]	$386,518
Migration	$4,920,492	On-Premise Network Maintenance [1]	$8,935
TOTAL	$7,074,525	TOTAL	$582,530 (year 2, 3)

Mainframe Software

OTC		ANNUAL	
z/VM	$67,500	z/VM [2]	$16,890
		Oracle S&S [2]	$26,400
		Linux S&S [1]	$45,000
TOTAL	$67,500	TOTAL	$88,290 (year 2, 3)

Dedicated Hardware

OTC		ANNUAL	
Sunk Cost	$0	Disk Maintenance [1]	$59,276
		Server maintenance [1]	$226,884
		Off-Premise Network	$299,008
		Power/Floorspace [1]	$501,656
		System Admin [1]	$5,944,828
		On-Premise Network Maintenance [1]	$62,196
TOTAL	$0	TOTAL	$7,093,848

Dedicated Software

OTC		ANNUAL	
Sunk Costs	$0	Oracle S&S [1]	$2,569,600
		Linux S&S [1]	$379,308
TOTAL	$0	TOTAL	$2,948,908

1 – Needs three years maintenance, 2 – Needs two years maintenance

TCO Case Studies Demonstrate Consistent Savings In Annual Operations Costs

Scenarios	Cost of Distributed vs. z	Distributed Cost Ratio	Cores vs. z Processors	Core Ratio
Linux Consolidation				
– **Nationwide**			**1350 → 34**	**40 → 1**
– **Quebec Govt**			**292 → 5**	**58 → 1**
– **Hannaford**			**150 → 1**	**150 → 1**
– **Brokerage Firm (Power)**	**$12.7M vs $7.8M**	**1.6x**	**112 → 1**	**112 → 1**
– **Brokerage Firm (Floor)**	**$25.5M vs $10.7M**	**2.4x**	**180 → 2**	**90 → 1**
– **Major Bank**	**$46.9M vs $19.9M**	**2.4x**	**520 → 14**	**37 → 1**
		2.1x		**81 : 1**

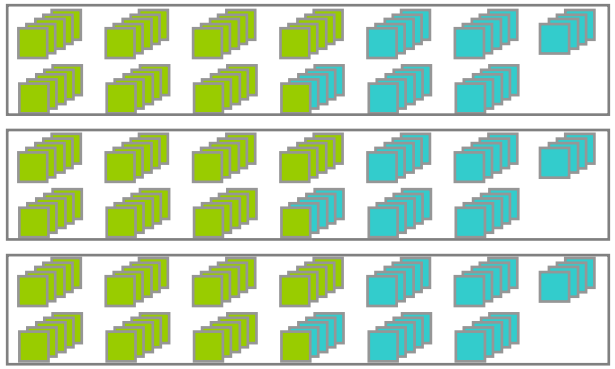
Lower annual costs pay back initial migration investment quickly
Core consolidation ratio varies with situation

Most Data Centers Are Not Green Field Projects

- **Typical Decision Scenarios:**
  - Large transactional workloads and database
    - Scale may compel platform choice
  - Adding new workload to an existing System z
    - The rule of three
  - Server consolidation to Linux on IFLs
    - Consolidation Math
  - Offloading projects
    - Proliferation of cores defeats distributed price advantages

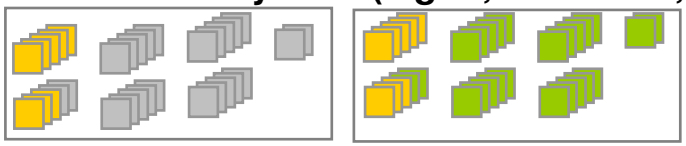
Asian Financial Company Offload Project

3x HP 64-way Production Application and DB



1x HP 64-way Dev&Test / Batch

2x HP 32-way PL/1 (Mgmt, Dev&Test, and Batch)

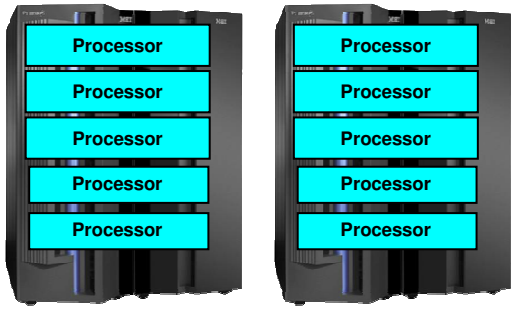


$118.8M

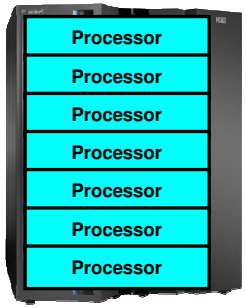
17 processors (6,700 MIPS)

320 Unix processors (816,002 Performance Units)

2x z990 5-way (production)



z990 7-way (production + test)



$53.1M

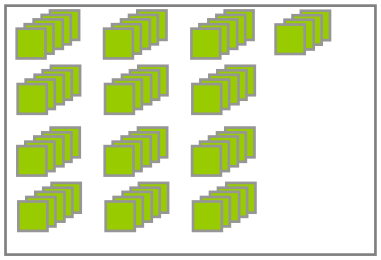
Plus:
2x HP 16-way servers : external, HP rx8620
3x IBM P570 servers : Web Appl server

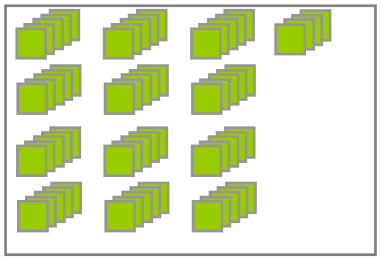
122 Performance Units per MIP

No disaster recovery

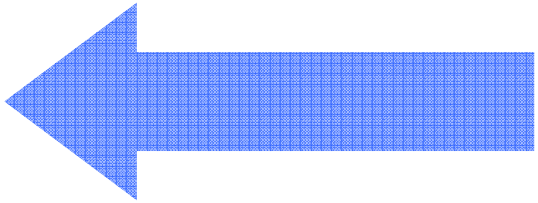
North American Financial Company Offload Project

2x 64-way Production Application And Development





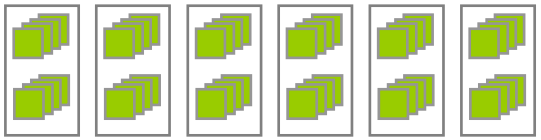
6 processors (1,660 MIPS)



176 Unix processors (800,072 Performance Units)

2x z900 3-way

6x 8-way Production Application And Development

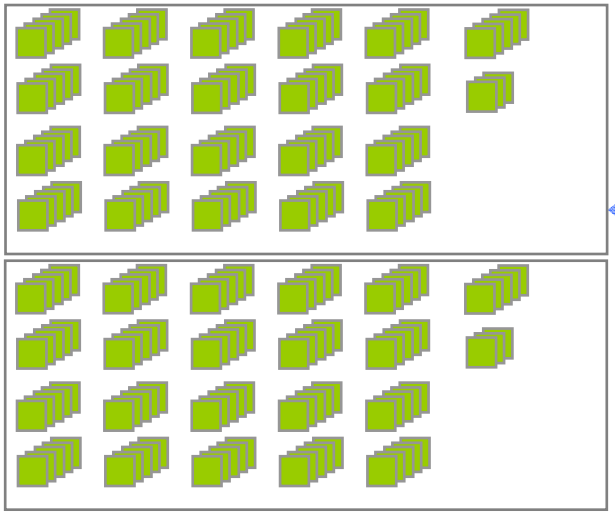


482 Performance Units per MIP

No separate QA/Test Environment

North American Financial Company Offload Project
5 Year TCA Comparison If HP Servers Are Used

2x HP 108-way Production Application And Development

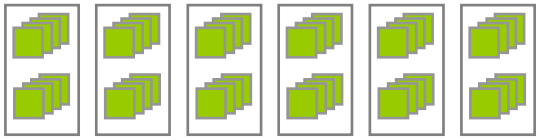


6 processors (1,660 MIPS)

2x z900 3-way

264 Unix processors (802,798 Performance Units)

6x HP 8-way Production Application And Development



$76.3M

$20.7M

482 Performance Units per MIP

No separate QA/Test Environment

North American Financial Company
Five Year Total Cost of Ownership Breakdown

Mainframe Cost

	OTC	Annual
Hardware 6 Processors Maintenance		$503,000
Software z/OS, CICS, COBOL, DB2 ISV		$2,600,000 $1,000,000
Migration Labor		$0
Power and Facilities		$33,987
TOTAL		$4,136,987

Distributed Cost

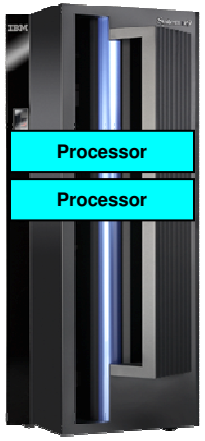
	OTC	Annual
Hardware 2x HP Superdomes 6x HP DL 585 Hardware Refresh Y3	 $4,939,830 $135,070 $5,074,900	Not Paid Y1,2,3 $509,444 $3,150
Software Transaction Processing Oracle ISV	 $916,800 $12,960,000 $13,209,960	Not Paid Y1 $229,200 $2,851,200 $2,784,241
Migration Labor		$600,000 Paid Y1,2,3
Power and Facilities		$67,865
Parallel Running		$4,136,987 Paid Y1,2,3
TOTAL	$37,236,560	4,804,852 Y1 10,669,493 Y2,3 6,445,100, Y4,5

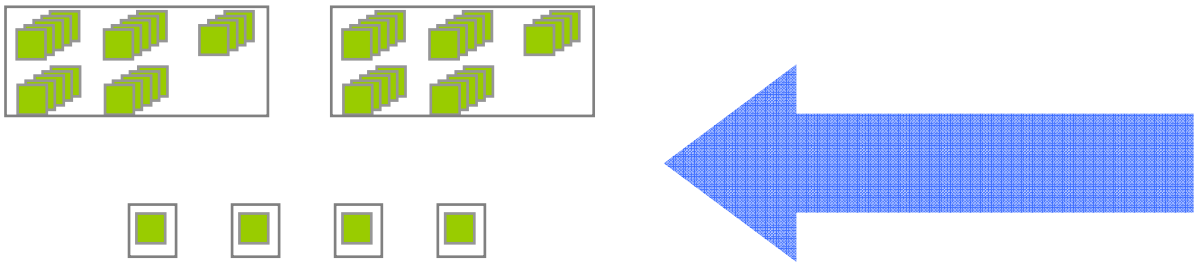
European Financial Services Offload Project

- 2x 24-way Production / Dev / Test / Education
  Application, DB, Security, Print and Monitoring
- 4x 1-way Admin / Provisioning / Batch Scheduling

z890 2-way Production / Dev / Test / Education
App, DB, Security, Print, Admin & Monitoring

2 processors (332 MIPS)





52 Unix processors (222,292 Performance Units)

$17.9M

$4.9M

Plus:
2x HP SAN Servers (existing)
Many (existing) Windows servers

670 Performance Units per MIP

No disaster recovery

European Financial Services
Four Year Total Cost Of Acquisition Breakdown

Mainframe Cost

	OTC	Annual
2 GP Growth MIPS	SUNK COST $280,000	$3,505 (avg, Incl. growth)
Software z/OS, CICS, COBOL, HLASM IDMS		$552,048 (avg, incl. growth) $552,048
Migration Labor		$0
Power and facilities		$43,014
TOTAL	$280,000	$1,150,615

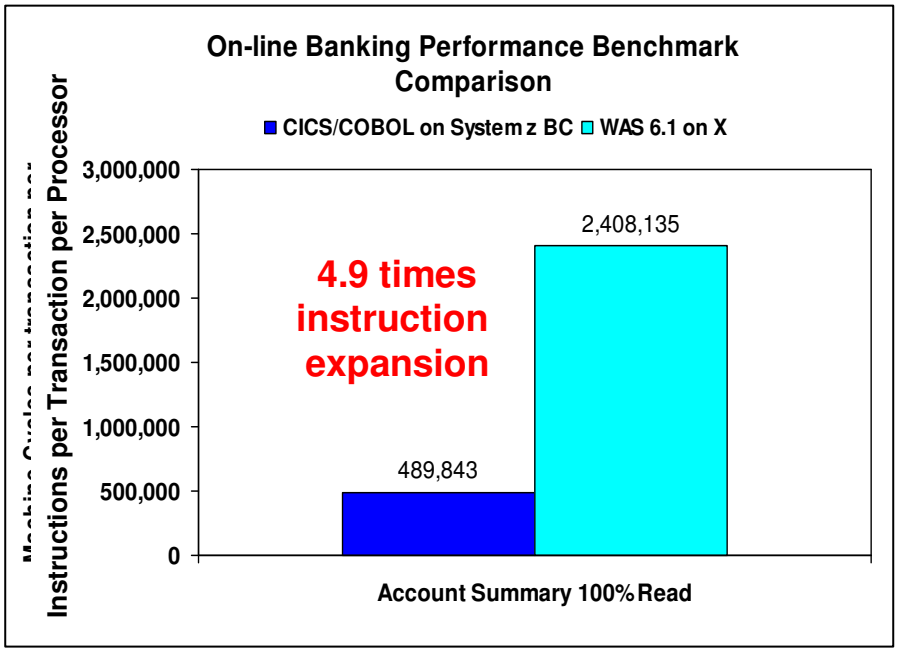
Distributed Cost

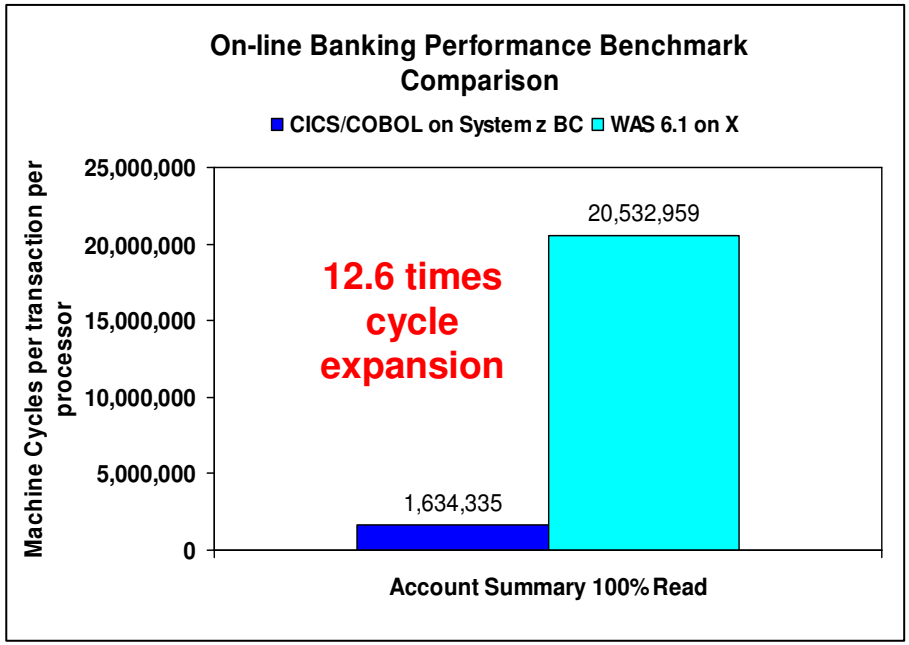
	OTC	Annual
2x HP Superdome	$2,506,892	$0 (paid up front)
4x HP rx2660	$30,192	$0 (paid up front)
Hardware Refresh	$2,537,084	$0
Software		Not paid Y1
Transaction SW	$389,640	$66,300
Oracle DB	$816,000	$149,600
Monitoring	$475,326	$89,400
Msg, secy, print etc.	$963,360	$162,000
Migration Labor		$1,170,000 Y1 $1,560,000 Y2,3 $390,000 Y4
Power and facilities		$145,764
Parallel Running Y1-3	$160,460	$1,109,166
TOTAL	$7,878,954	$2,424,930 (Y1) $3,282,230 (Y2,3) $1,003,064 (Y4)

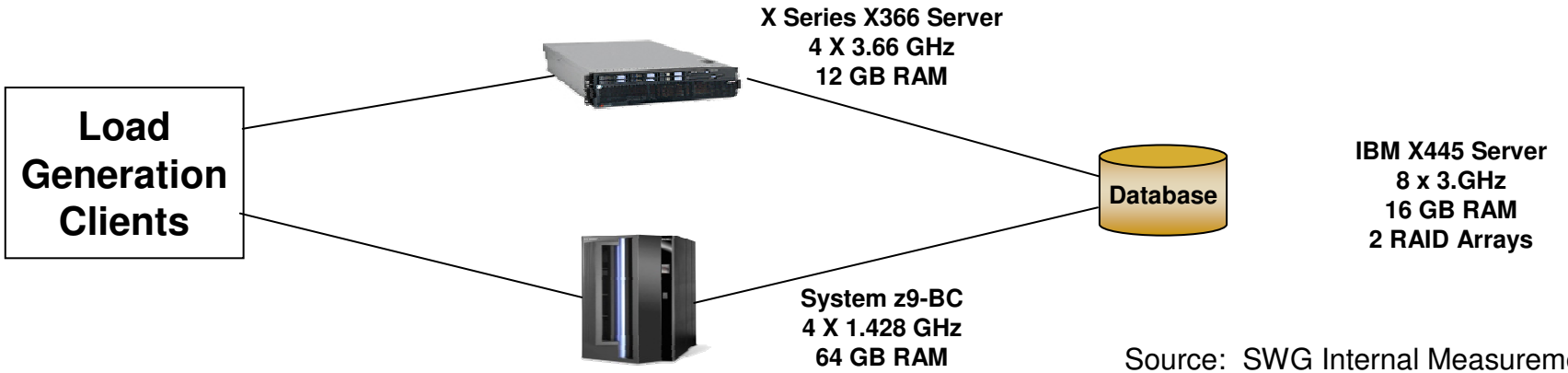
European Government Organization – Data Base Expansion

- **Migration of existing IMS hierarchical database required a redesign and reimplementation of the database and the application**
  - Hierarchical to relational database migration was estimated to result in a 2-3x database and processing expansion
- **Offload projected to cost 1.9x more over 5 years**
  - €386M vs. €204M

Benchmark - Code Expansion When Moving From CICS/Cobol To Java On Wintel (Higher Is Worse)







Source: SWG Internal Measurements

TCO Case Studies – Core Proliferation Defeats Offload Savings

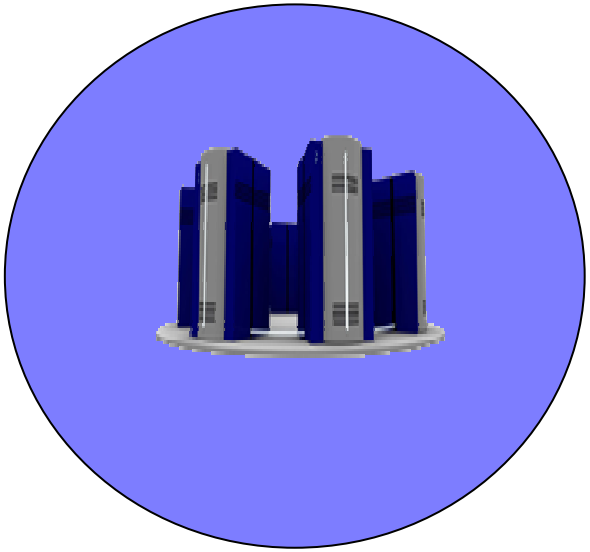
Scenarios	Cost of Distributed vs. z	Distributed Cost Ratio	Cores vs. z Processors	Core Ratio	Performance Units per MIP
Offloading cases					
– **Banking Benchmark**	**$43.3M vs $18.2M**	**2.4x**	**560 vs 7**	**80 : 1**	**187:1**
– **NA financial company**	**$84.7M vs $24.2M**	**3.5x**	**264 vs 6**	**44 : 1**	**482:1**
– **European financial**	**$17.9M vs $4.9M**	**3.7x**	**52 vs 2**	**26 : 1**	**670:1**
– **Asian financial company**	**$119 M vs $53 M**	**2.2x**	**408 vs 17**	**24 : 1**	**122:1**
Offloading studies					
– **European agency**	**€386M vs €204 M**	**1.9x**	**568 vs 30**	**19 : 1**	**185:1**
– **Restaurant chain**	**$56.3M vs $23.3M**	**2.4x**	**32 vs 4**	**8 : 1**	**116:1**
Offloading studies pending					
– **US Utility**	**$13.4M vs $6.2M**	**2.2x**	**112 vs 3**	**37 : 1**	
– **US Manufacturer**	**$64.0M vs $43.3M**	**1.5x**	**96 vs 6**	**16 : 1**	
		2.5x		**32 : 1**	**294:1**

Core proliferation
The rule of 21and 60

Some Large Core Processing Workloads Can Only Run Efficiently On The Mainframe

Preserve And Grow This!

Analyze Offload Promises

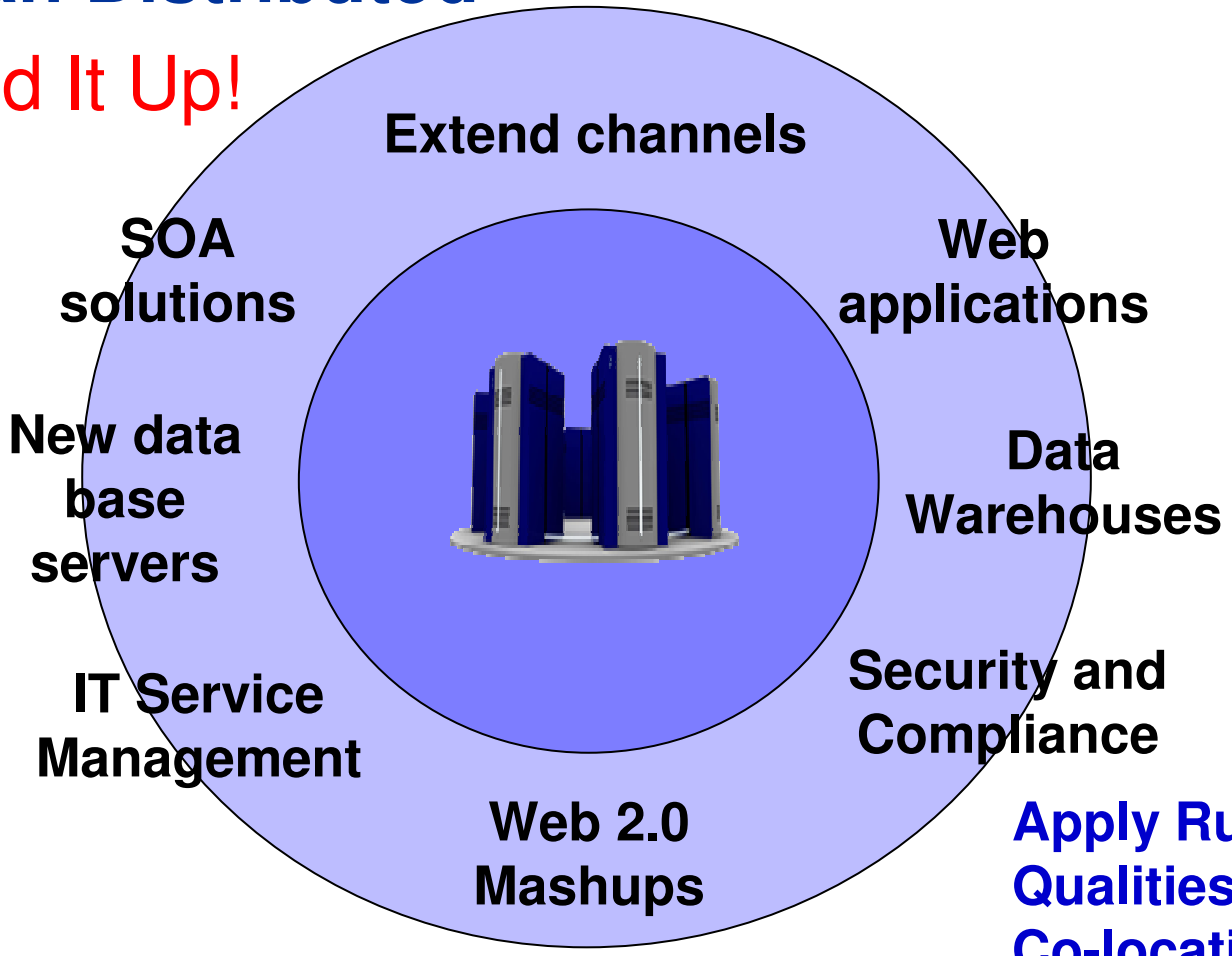


Banks
Financial Services
Reservations
Transaction Accounts
Batch Workloads…

No effective alternative on distributed

An Existing Mainframe Can Be Incrementally Extended To Run New Workloads At A Lower Cost Than Distributed

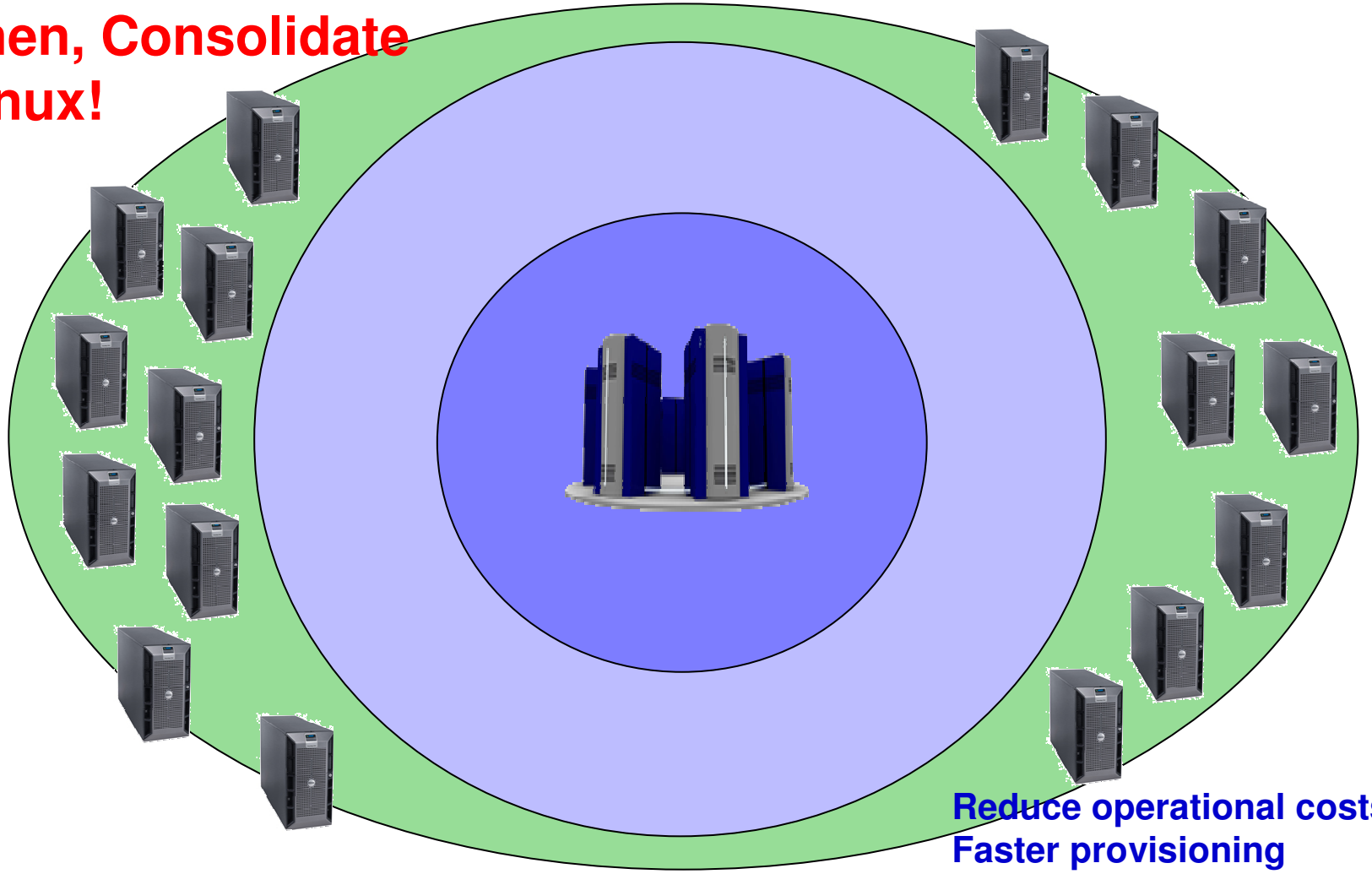
Next, Build It Up!



Apply Rule Of 3
Qualities of service
Co-location
Lower cost

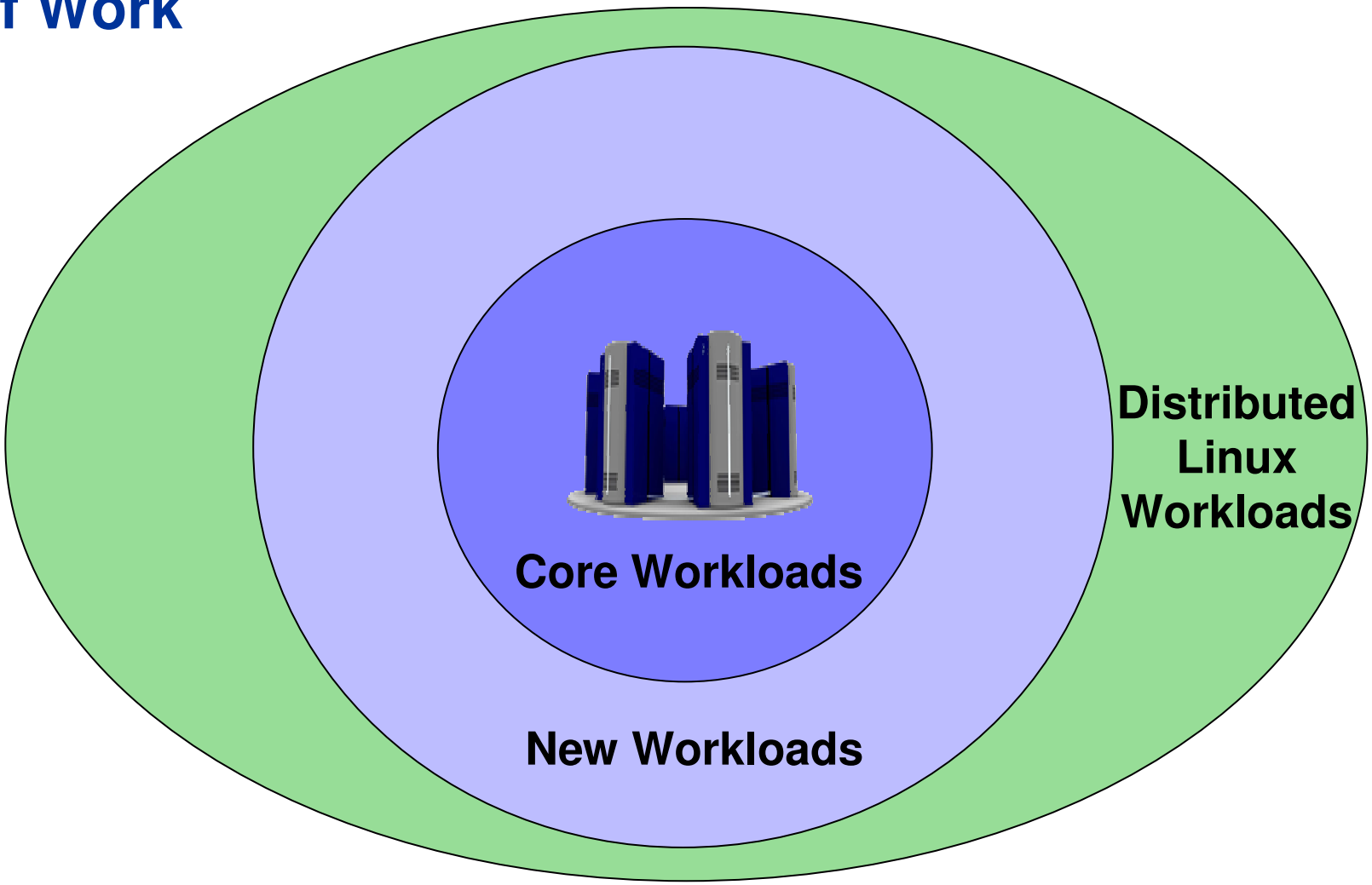
Distributed Linux Workloads Can Be Consolidated To Cut Operating Costs

Then, Consolidate Linux!



Reduce operational costs
Faster provisioning
Biggest leverage to cut power

A Fully Leveraged System z = Lowest Cost Per Unit Of Work



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