Extending Your Mainframe For More Business Value

Consolidate Workloads
To Reduce Costs

Distributed Server Sprawl

Our Data Centers are full of distributed servers and our costs are out of control!

Consolidating your workloads on the mainframe can solve this problem

Service Oriented Finance CIO

IBM

Distributed Server Sprawl Uses...

- **Lots of hardware**
  - ► Lots of floorspace
  - ► Lots of power
  - ► Lots of networking

- **Lots of software licenses**

- **Lots of people to manage the systems**

- **Consequences**
  - ► Low Utilization of Hardware Resources
  - ► Complexity
  - ► Increased time to respond to business requirements
  - ► Difficulty integrating information from various systems
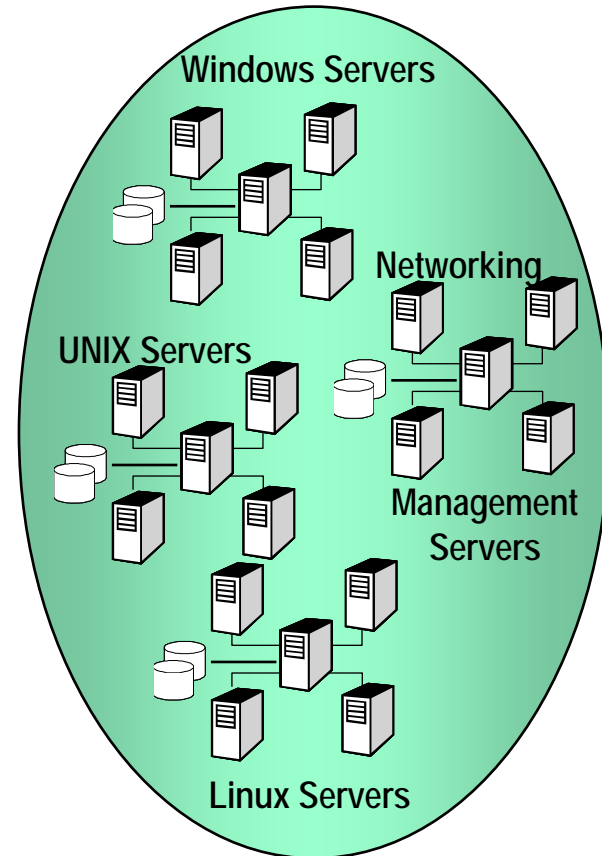
Server Utilization At A Large Financial Institution

Average Server Utilization by Class
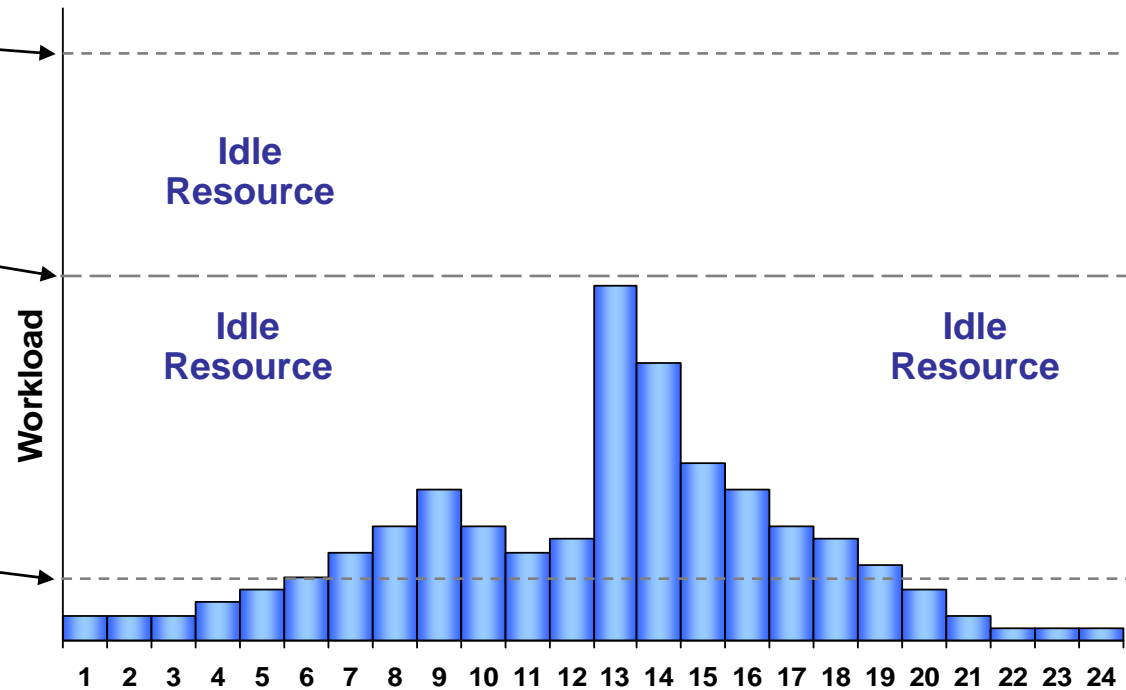**Jan-08**
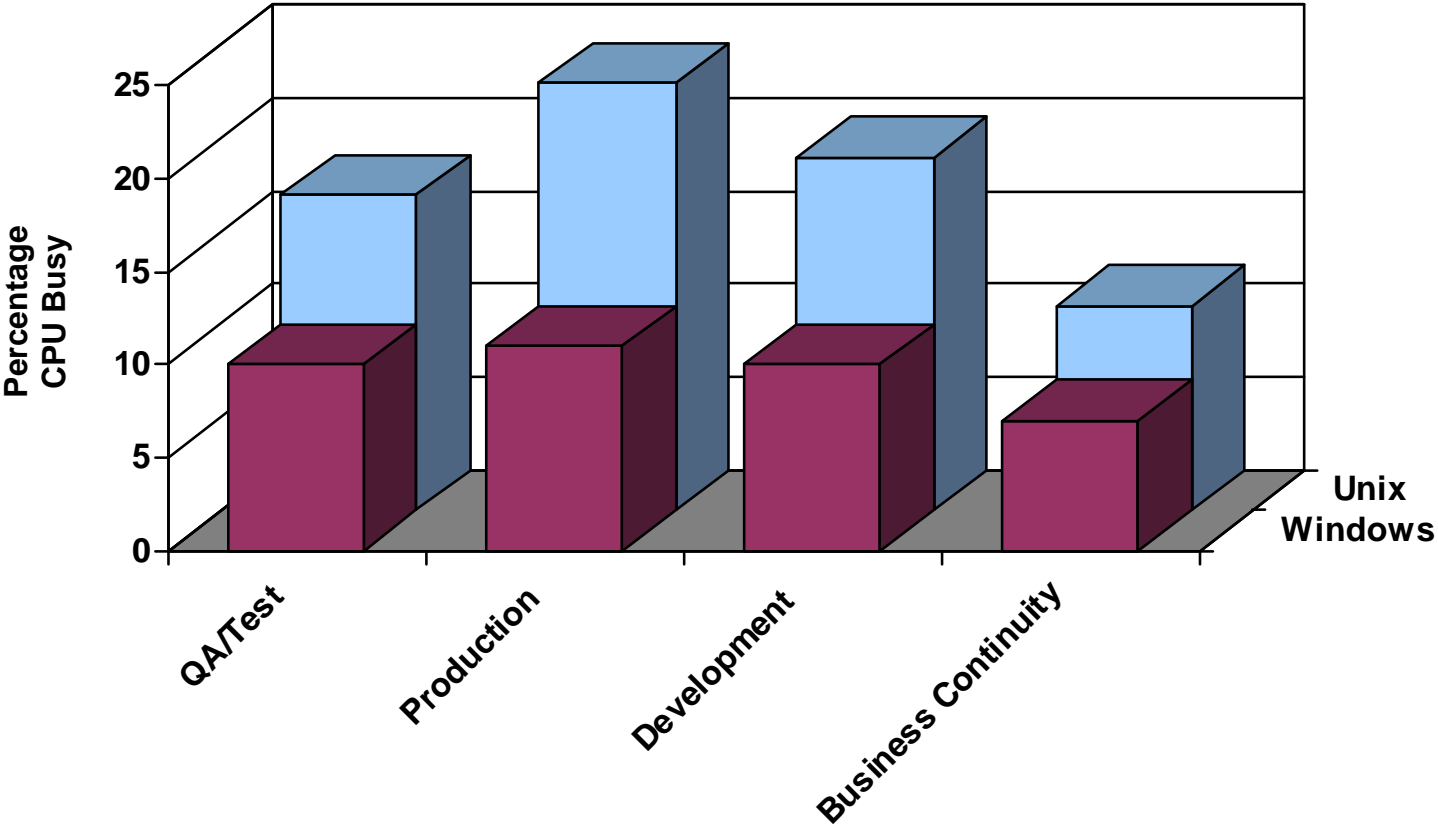
Utilization Of Distributed Servers

Provision for
expected growth

Provision capacity
for peak workload

**Idle
Resource**

**Idle
Resource**

**Idle
Resource**

Workload

Average
utilization

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
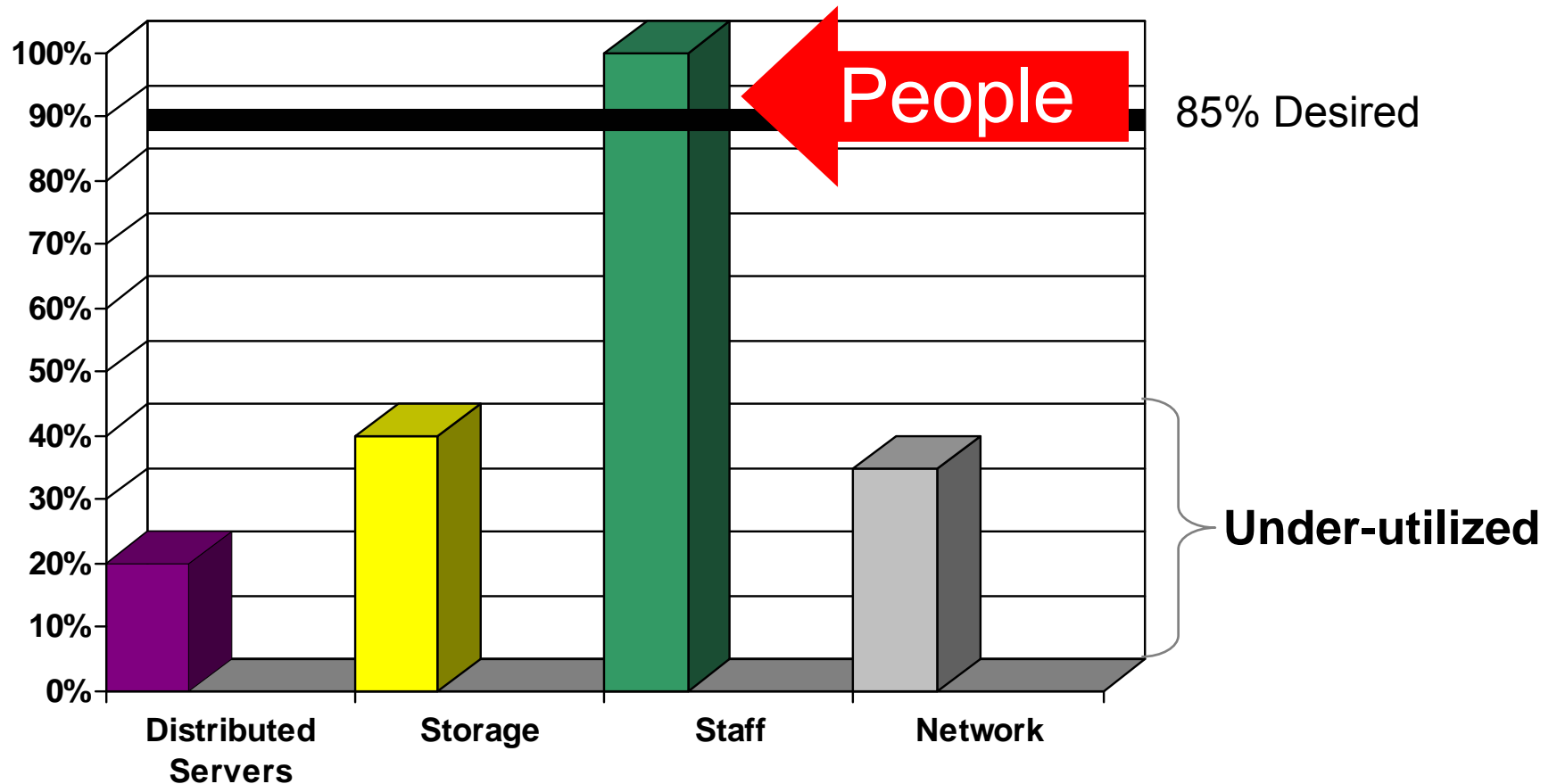
Server dedicated to
one application

▶ Typical utilization of Windows Servers <5%

▶ Typical utilization of UNIX Servers 15 – 20%

▶ Typical utilization of System z Servers 70 – 100%

Distributed Result:
Only One Resource Is Highly Utilized!

Sources: IBM & Industry Studies

IBM Consolidation Experience: Annual Costs Per Distributed Server

Annual Operations Cost Per Server
(Averaged over 3,917 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

$34,447!
No wonder I don't have any money left over for new projects

Service Oriented Finance CIO

The largest cost component was labor for administration 7.8 servers per headcount @ $160K/yr/headcount

Economics Of Consolidation

- Consolidating workload means running multiple workloads on the mainframe at the same time

- Consolidation achieves greater utilization of assets which minimizes cost per unit of work

- Same principal was applied by Henry Ford at the dawn of the industry era
  - ▶ It still applies today

- Workload consolidation on a mainframe squeezes out cost to achieve maximum efficiency
  - ▶ And return on investment

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Dramatic Virtualization –
How It Looks In z/Architecture

**Logical Partitions Share Processors,
Common Cache Structures, and I/O**

Workload Manager allocates resources as needed by service classes

Application	Application	Application	Application	Application	Application	Application	Application	DB2	DB2	DB2	Linux Image / Linux Image / Linux Image
z/OS		**z/OS**			**z/OS**			**z/OS**			**z/VM**

Internal networking via secure high speed Hipersockets

Shared access to all disk data and to external networks

All Data

Intelligent Resource Director dynamically allocates processors to partitions and network connections

Eligible workload automatically dispatched to zIIP and zAAP specialty processors

Multiple Workloads On A Single Server Requires Business Oriented Workload Management

- **Mainframe hardware provides:**
  - ▶ Hypervisor assigns processor resources to logical partitions
  - ▶ Intelligent Resource Director supervises this assignment
 - ▶ Virtualized I/O Subsystem

- **z/OS provides:**
  - ▶ Workload Manager assigns resources within a z/OS image according to service level agreements
  - ▶ Also performs this function across a cluster of z/OS images

- **z/VM provides:**
  - ▶ Virtual Machine Resource Manager
  - ▶ Complete mainframe virtualization (including memory)

- **All of these facilities provide**
  - ▶ Business workload oriented goal or velocity definitions
 - ▶ Autonomic and continuous management to those definitions

The Real World Result – High Utilization On A Mainframe Via Workload Layering

Run consolidated workloads simultaneously
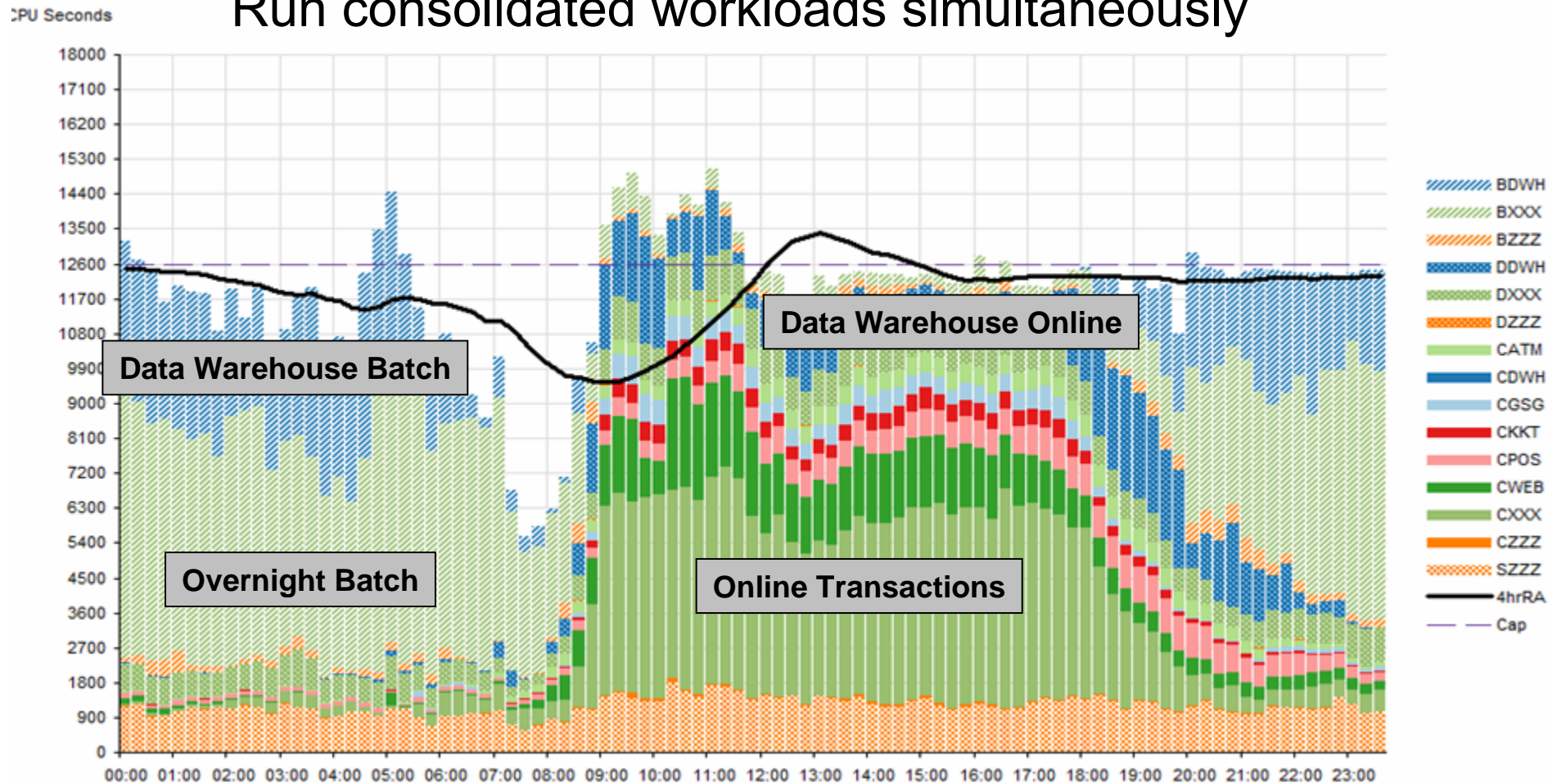
Workload of a highly utilized (>90%) mainframe - Illustration of 4-hour rolling average, and softcap
Full daily operational mix of batch, data warehouse and OLTP transaction from ATM, Web, PoS etc
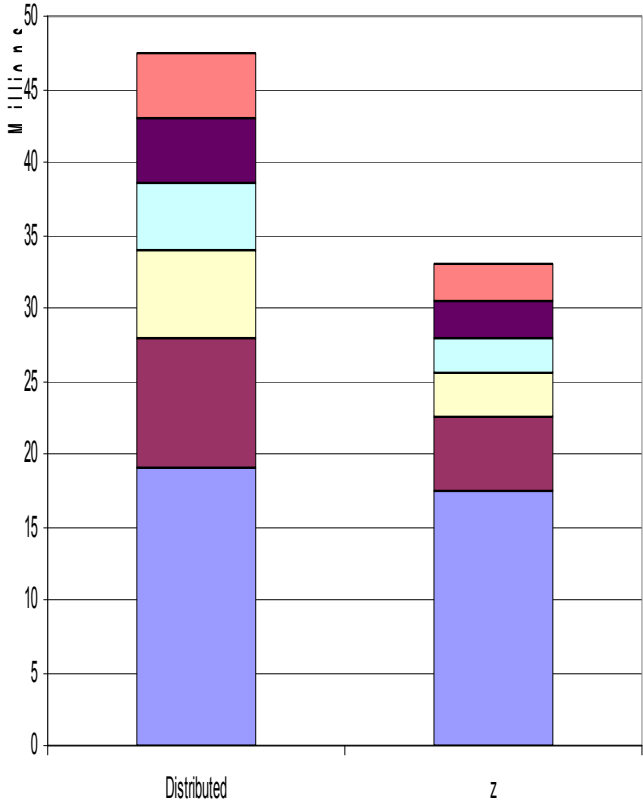
The Importance Of The Mainframe's 'Workload Layering' Capability
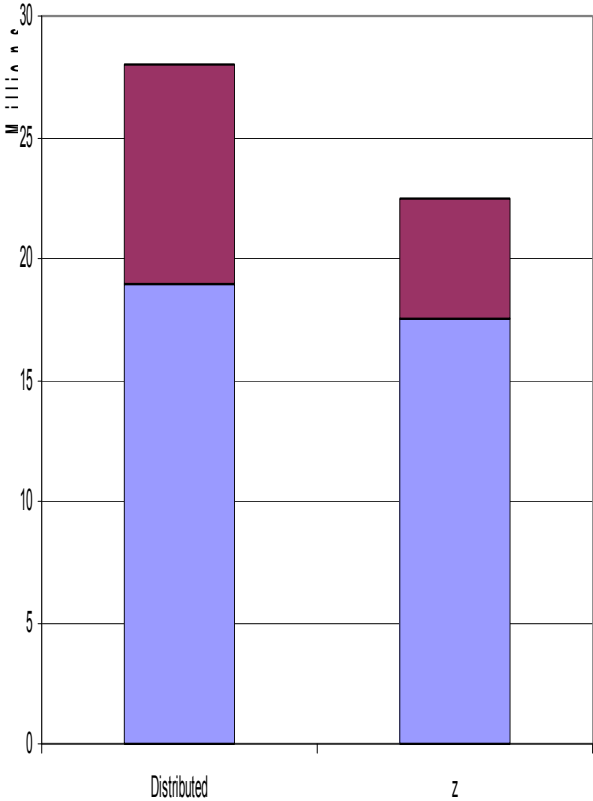
2 Core Applications
Core Banking, then Credit Card
z is ~80% of total distributed cost
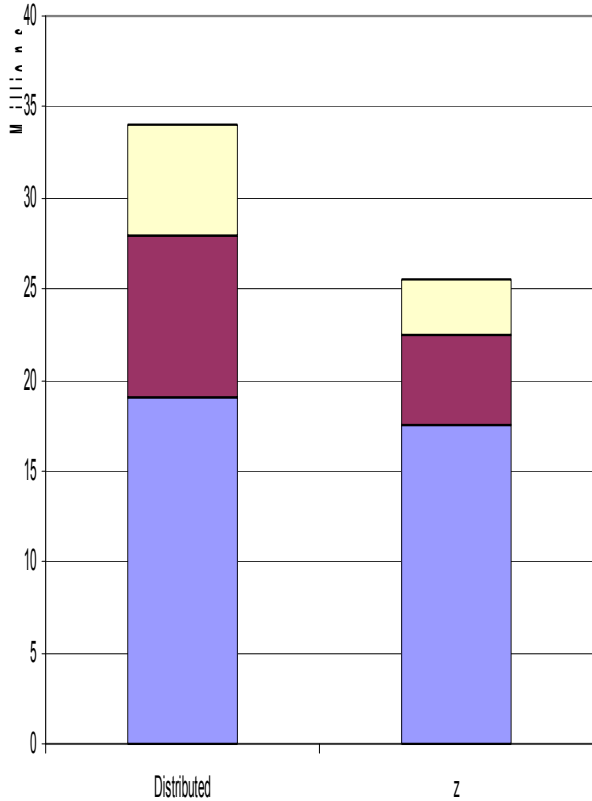
3 Core Applications
Core Banking, Credit Card, DW
z is ~75% of total distributed cost

6 Core Applications
Core Banking, Credit Card, DW
then 3 JavaEE/DBMs apps
z is ~69% of total distributed cost

Adding more core applications to z platform reduces both cost and complexity

Example Workloads That Can Be Consolidated On A Mainframe

What	Where	Specialty Processor	How
Growth of Existing Mainframe Workload	z/OS	--	Capacity on demand
New CICS or IMS Applications	z/OS	--	Develop
Data Warehouse	z/OS	zIIP	Deploy
SAP Database Server	z/OS	zIIP	Deploy
WebSphere Application Server	z/OS	zAAP	Deploy
WebSphere Portal Server	z/OS	zAAP	Deploy
WebSphere Process Server	z/OS	zAAP	Deploy
.NET Applications	z/OS	zAAP	Mainsoft
Domino	z/OS	--	Deploy

More Example Workloads That Can Be Consolidated On A Mainframe

What	Where	Specialty Processor	How
Linux Applications	Linux on z/VM	IFL	Recompile
Linux Middleware - IBM Brands (DB2, WebSphere, Lotus, Rational, Tivoli) - Oracle Database - etc.	Linux on z/VM	IFL	Rehost
Linux Packaged Applications - SAP - Oracle - etc.	Linux on z/VM	IFL	Rehost
.NET Applications	Linux on z/VM	IFL	Mono, Mainsoft
Open Solaris Applications	Open Solaris on z/VM	IFL	Sine Nomine

Linux On z/VM

We've seen some examples of incremental growth on z/OS

▶ Extend new access channels with WebSphere

▶ New data workloads with DB2

▶ Business insight with DB2 and Information Server

▶ Communications backbone with IBM Enterprise Service Bus

Now let's look at some examples of roll-up consolidation to Linux on z/VM

IBM

Nationwide Saves $16+ Million With Linux On
On Your Side System z

- **Problems:**
  - High TCO including data center power and floor space scarcity
    - New facility would cost $10M+
  - Long server provisioning process

- *Solution:*
  - **350** servers virtualized with **15** z990 IFLs – **23 to 1 consolidation**
    - 12 mission critical applications with 100,000+ users/day

  - 50% reduction in Web hosting monthly costs
  - 80% reduction in floor space and power conservation
  - 50% reduction in hardware and OS support efforts
    - Significant savings on middleware costs
  - Significantly faster provisioning speed (months → days)
  - Mainframe high availability and disaster recovery

Vastly improved TCO, Speed & Simplification

Nationwide® On Your Side™ Saves $16+ Million With Linux On System z

Update (February 2008):

- **$16M savings realized a year earlier than planned**
  - ▶ In 2 years not 3

- **Up to 18 mission critical applications**
 - ▶ Added more WebSphere, Portal, and DB2

- **Upgraded from z990 to z9 IFL's**

- **483** virtual servers with 1,350 JVM's running on **34** z9 IFL's
  - ▶ So, workloads that would have required **1,350** physical servers are running on **34** z9 IFL's – **40 to 1 consolidation**

Improved TCO, Speed and Simplification

Hannaford Supermarket Chain Goes Real Time With System z

- Northeastern United States supermarket chain with sister chains in the Southeast US

- Reduced costs, while improving inventory management, customer and partner satisfaction

- Consolidated **~280** store servers on to a mainframe
  - ▶ z/OS inventory system links to computer-assisted ordering system
  - ▶ zLinux runs 35 applications used by corporate, retail and vendor partners on 100 virtual servers (**4** IFLs – **25:1** consolidation)
  - ▶ Significant labor, hw, sw, environmental savings

280 servers

2 System z servers
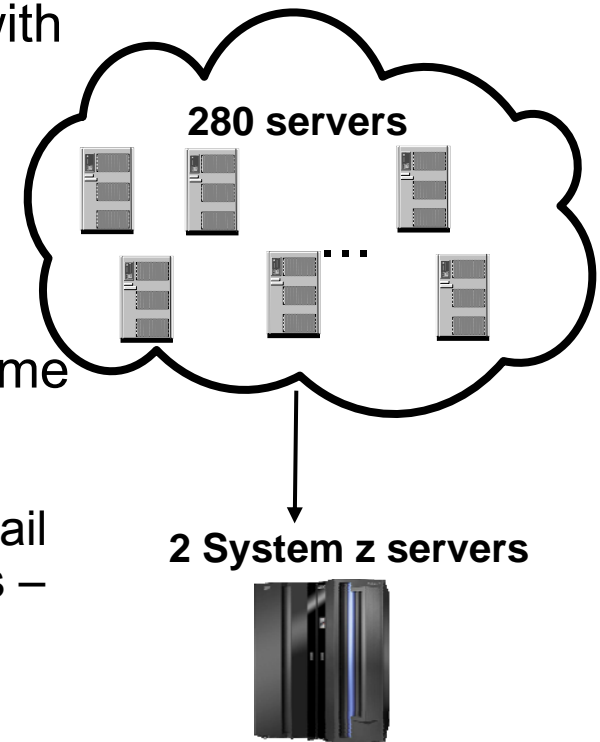
"The only way we'd consider consolidating critical data from hundreds of servers onto one system was by choosing an IBM mainframe for its legendary reliability and availability,"

**Bill Homa, senior vice president and CIO of Hannaford**

More on Hannaford: http://www-03.ibm.com/systems/z/testimonials/customer.html

Case Study: Québec Government Runs Oracle At IFL Prices

- **Running 292 server instances on a z9-EC with 5 IFL's**
  - ▶ 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 (up from 30)
  - ▶ Easy migration
    - − 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

Network Sprawl Is Another Legacy Of Unconsolidated Servers
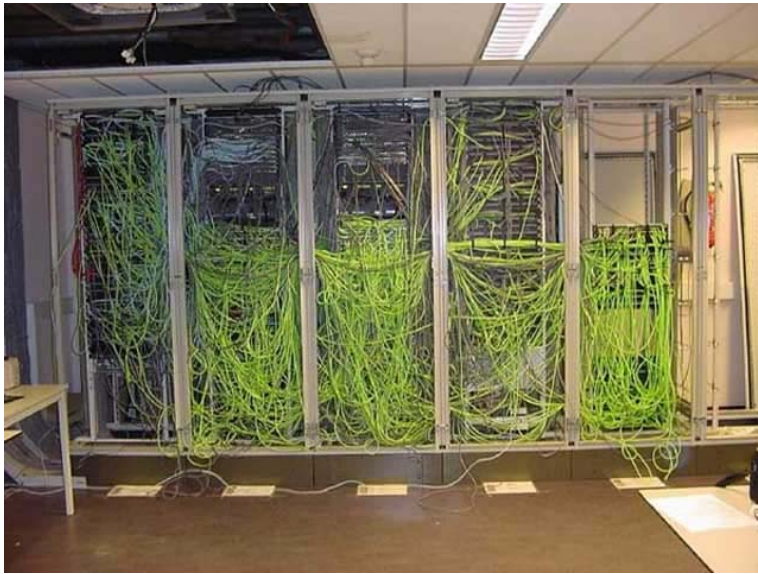
- Unconsolidated servers lead to high maintenance cabling

- Raised floors cleanup the appearance on the rack
  - ▶ Have the same issues, just buried under the floor
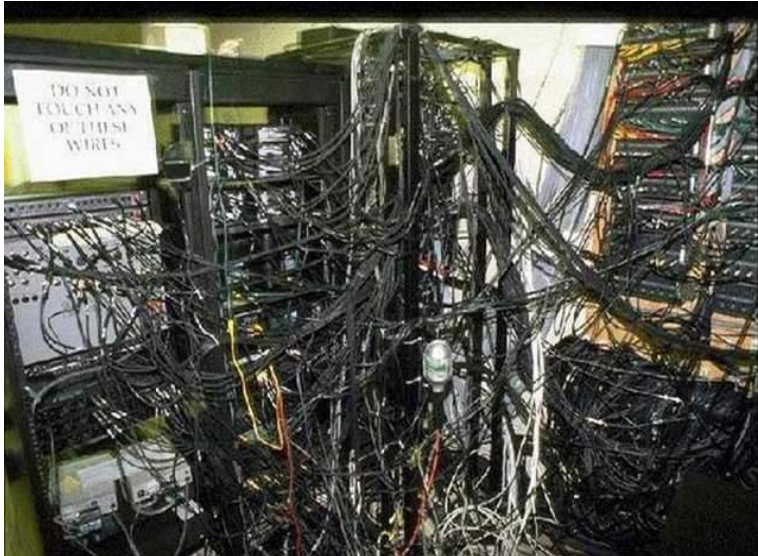
# Even When Done Right, It Is Hard To Service

- Even when properly organized administrators have to deal with a large number of cables
  - ▶ A single rack can have over 100 cables

- One misplaced connector or label can cause havoc in the whole network

- Once cables are strapped together, it is very hard to make changes

Case Study: Network Costs Before Consolidation (292 Servers To 1 System z10)

3560E-24TD	8
3560E-24TD	17
3560E-12D	6
50 Ft UTP Cable	584
10GB Eth Fiber Cable	60

Hardware Acquisition $356K
Network Annual Costs $361K

Backbone

network

Over 600 Cables
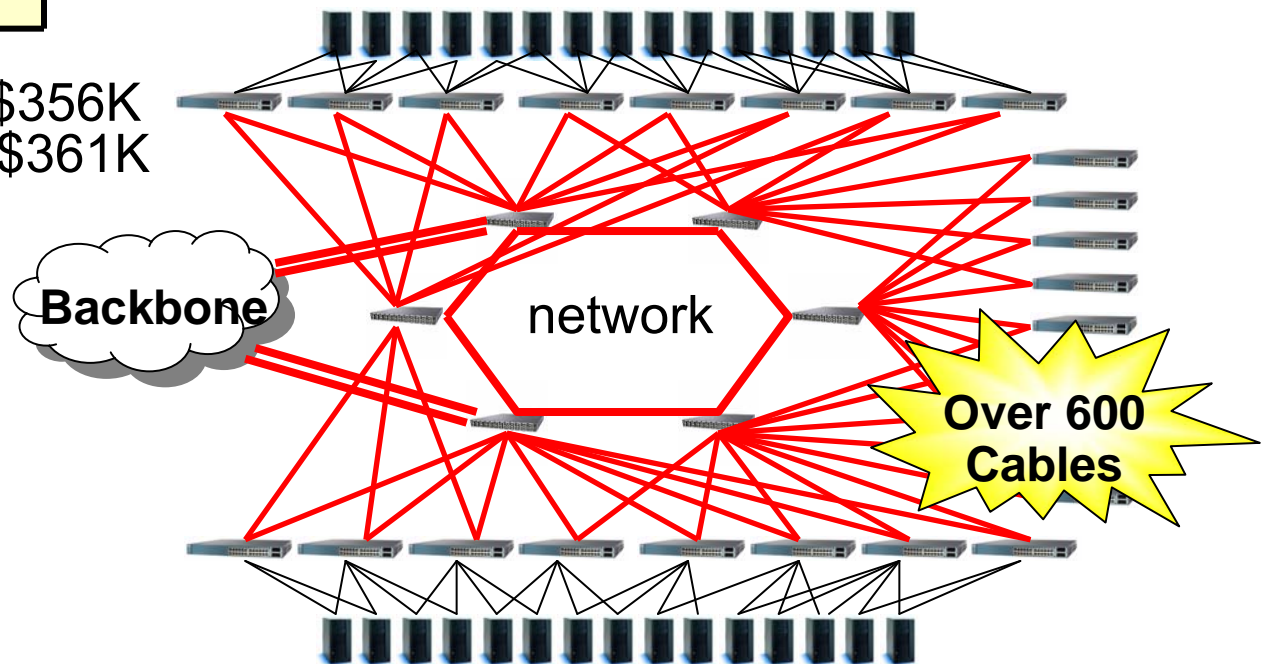
The diagram only shows **30** of **292** servers

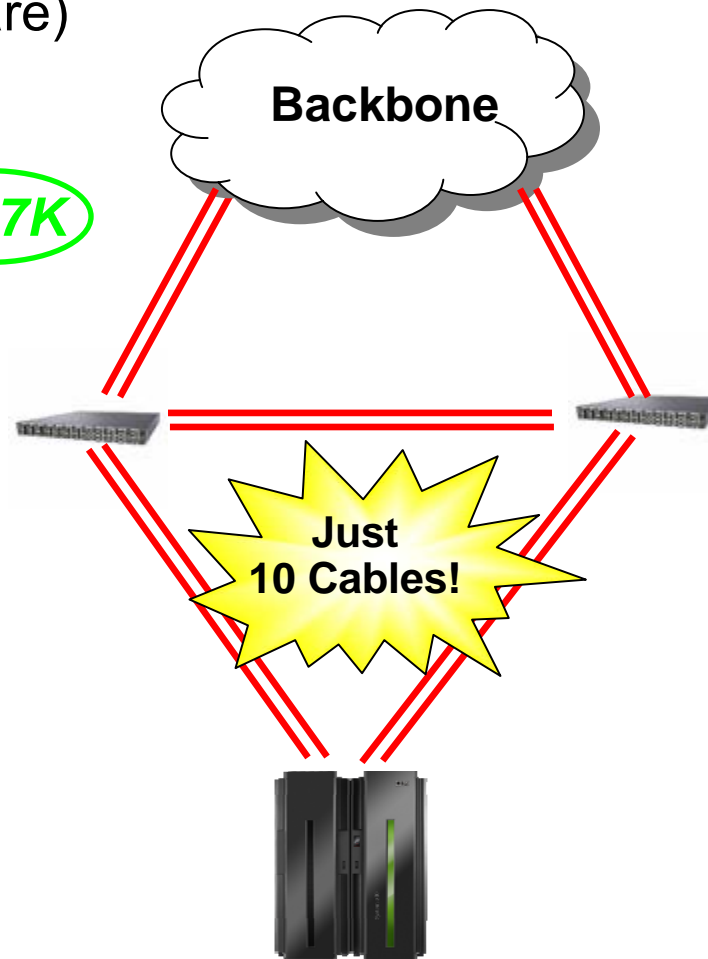# Case Study: Network Costs After Consolidation (292 Servers To 1 System z10)

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

Network Annual Cost "After" $4.1K

Network Cost Annual Savings *$357K*

Easier to manage & troubleshoot

Better performance

Backbone

**Just
10 Cables!**

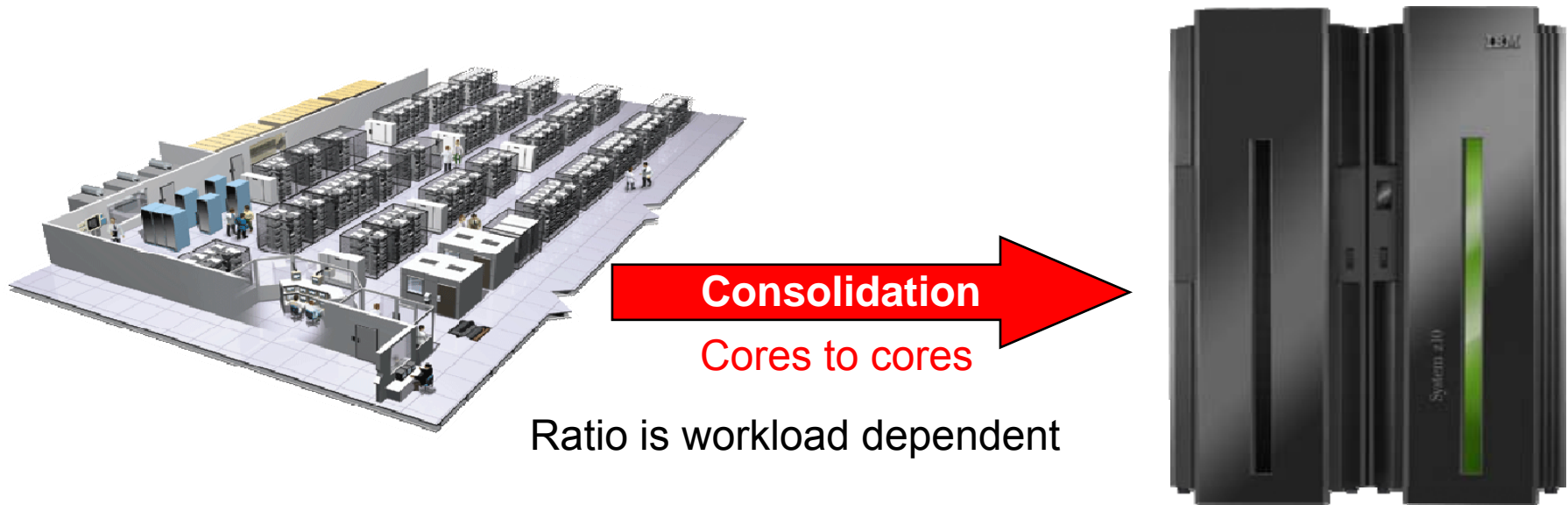# Benefits Of Consolidation On The Mainframe

- Less hardware

- Fewer software licenses

- Less costly to manage

- Consumes less power and floor space

- Responsiveness to the business via faster provisioning

- Inherit the benefits of the mainframe platform
  - High reliability
  - I/O bandwidth
  - Consistent security
  - Systematic disaster recovery

- Lower annual costs!

Windows Servers

Linux Servers

How Many IFLs Will Be Required?

Consolidation
Cores to cores

Ratio is workload dependent

Some recent examples:

Major Brokerage House	112 to 1 (z9)
A Major US Bank	37 to 1 (z9)
Hannaford	25 to 1 (z9)
Nationwide	40 to 1 (z9)
Nexxar	80 to 1 (z9-BC)
Major Brokerage House	90 to 1 (z9)

Case Study: Consolidate To Mainframe vs. Keeping Distributed Servers (External Costs Only)

Existing Mainframe

Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation

Appl

Linux

z/VM

Add three processors:
3 IFLs

Or maintain existing 292 server farm for Oracle data servers

100 → 1

3 year TCO $6.94 M

Annual operating cost $0.15 M

Breakeven 2 yrs

3 year TCO $9.92 M

Annual operating cost $3.31 M

Case Study: Consolidate To Mainframe vs. Keeping Distributed Servers (External Costs Only)

Mainframe Incremental Hardware

OTC		ANNUAL	
3 IFL Processors @ 125,000	$375,000	Processor [2] Maintenance * (For year 2, 3)	$52,524
Migration	$4,920,492	Disk Maintenance	$1,287
RAM (190GB)	$1,235,000	Off-premise Network	$3,603
TOTAL	**$6,530,492**	**TOTAL**	**$57,414 (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)**

Distributed Hardware

OTC		ANNUAL	
Sunk Costs	$0		$0
		Disk Maintenance	$59,276
		Off-premise Network	$299,008
TOTAL	**$0**	**TOTAL**	**$358,284**

Distributed Software

| OTC		ANNUAL	
Sunk Costs	$0	Oracle S&S [1]	$2,569,600
		Linux S&S [1]	$379,308
		(Prepaid in year 1 for 3 year)	
TOTAL	**$0**	**TOTAL**	**$2,948,908**

Mainframe Processor Maintenance after year 1
1 – Needs three years maintenance
2 – Needs two years maintenance

Case Study: Consolidate To Mainframe vs. Keeping Distributed Servers (External Costs Only)

- **Rehosting Risks**
  - ▶ Minimal migration to/from Linux
  - ▶ Leverage existing distributed expertise for new hardware platform

Comparative cost case
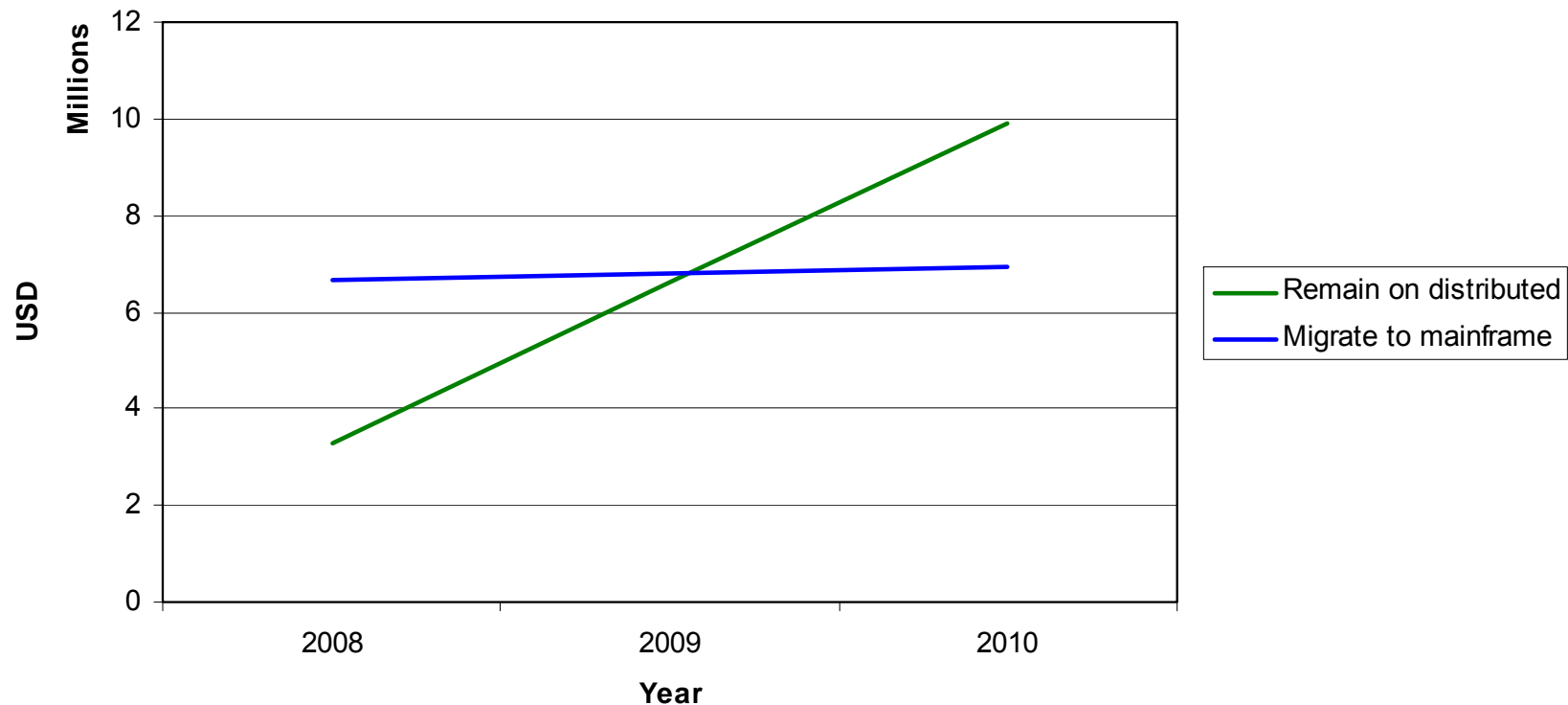
292 Oracle DBs to 3 IFLs on Existing Mainframe

IBM Internal Project To Consolidate Over 3,000 Servers

- **IBM expects substantial operational annual savings by consolidating 3,917 distributed servers to about 30 mainframes**
  - ▶ 86% savings in system administration cost
  - ▶ 85% savings in floor space
  - ▶ 81% savings in power
  - ▶ 57% savings in network management

- **$81M savings per year including**
  - ▶ Operational savings above
  - ▶ Hardware and software maintenance

Mainframe Labor Costs Per MIP Declining

- IBM Survey five years ago, average MIPS per person
  - **50** for z/OS

- Typical MIPS per person today
  - **150 to 700** for z/OS (1,300 to 2,000 for zLinux)

- A major bank went from 128 MIPS/person to 597 MIPS/person in 8 years with no extra people

- Gartner showed the MIPS/person doubling in 3 years at another site

- An outsourcer stated they doubled MIPS with only 20% increase in headcount

Case Study: Consolidate On Mainframe vs. Keeping Distributed Servers (All Operating Costs Considered)

Existing Mainframe

Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation

Appl

Linux

z/VM

Add three processors:
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Or maintain existing 292 server farm for Oracle data servers

3 year TCO $7.01M

Annual operating cost $0.17M

Breakeven in first year

3 year TCO $30.13M

Annual operating cost $10.04 M

Case Study: Consolidate On Mainframe vs. Keeping Distributed Servers (All Operating Costs Considered)

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Migration	$4,920,492	Off-Premise Network [1]	$3,603
		Power/Floorspace [1]	$2,250
RAM (190GB)	$1,235,000	System Admin [1]	$21,603
		On-Premise Network Maintenance [1]	$498
TOTAL	$6,530,492	TOTAL	$81,765

Mainframe Software

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z/VM	$67,500	z/VM [2]	$16,890
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Distributed Hardware

OTC		ANNUAL	
Sunk Cost	$0	Disk Maintenance [1]	$59,276
		Server maintenance [1]	$226,884
		Off-Premise Network [1]	$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

Distributed Software

OTC		ANNUAL	
Sunk Costs	$0	Oracle S&S [1]	$2,569,600
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Case Study: Consolidate On Mainframe vs. Keeping Distributed Servers (All Operating Costs Considered)

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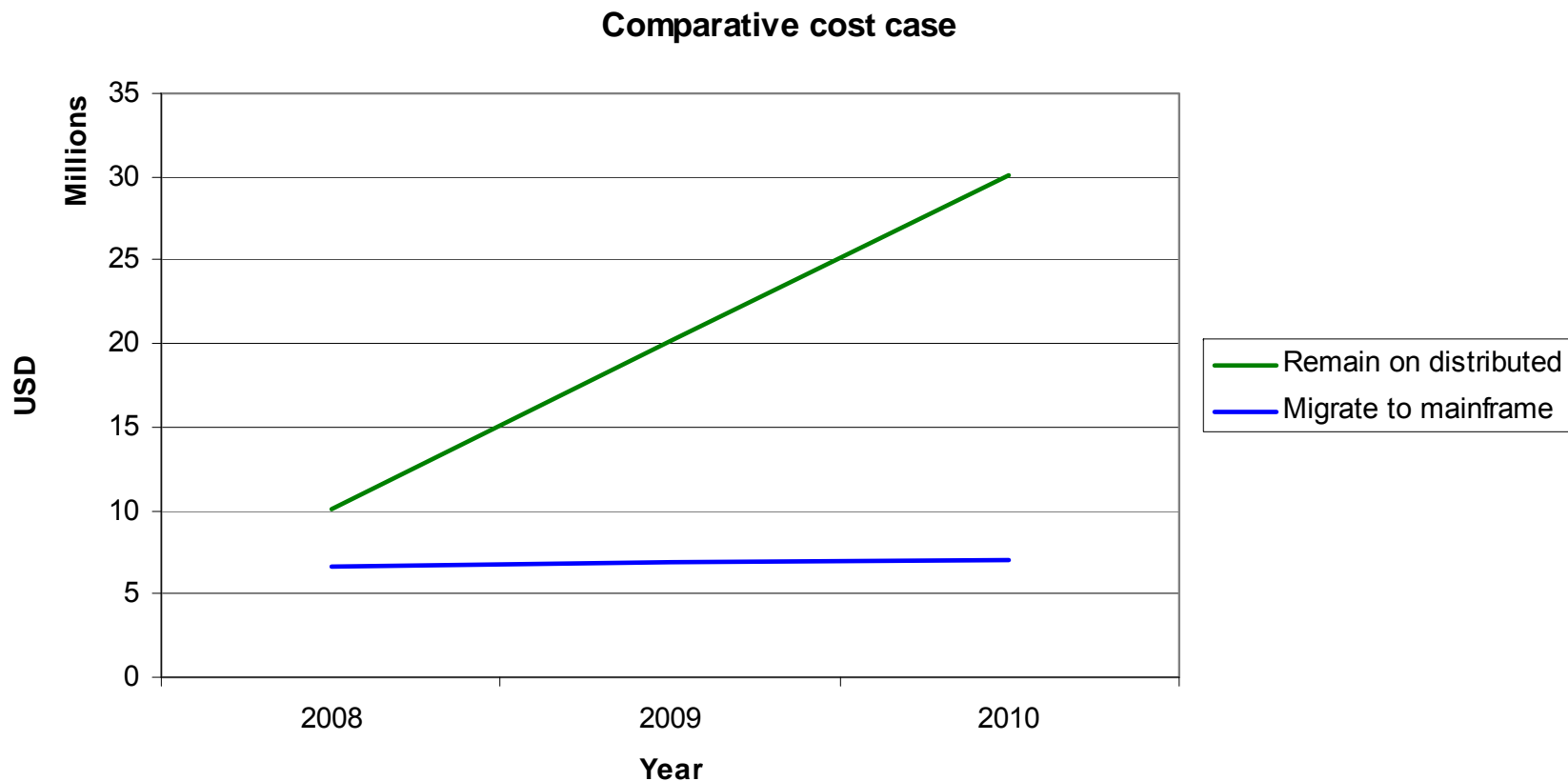
292 Oracle DBs to 3 IFLs on Existing Mainframe

DEMO: Fast Linux Provisioning

- Another benefit of virtualization is speed of provisioning
  - ▶ No additional resources required, no purchase necessary!

- Coupled with standardization, reduces complexity

- Need a new machine? Let's see how fast we can get one...

What About Using VMWare On Intel?

- VMWare lacks the consolidation efficiency of z/VM
- Less efficient use of memory and storage
- Less efficient use of processors

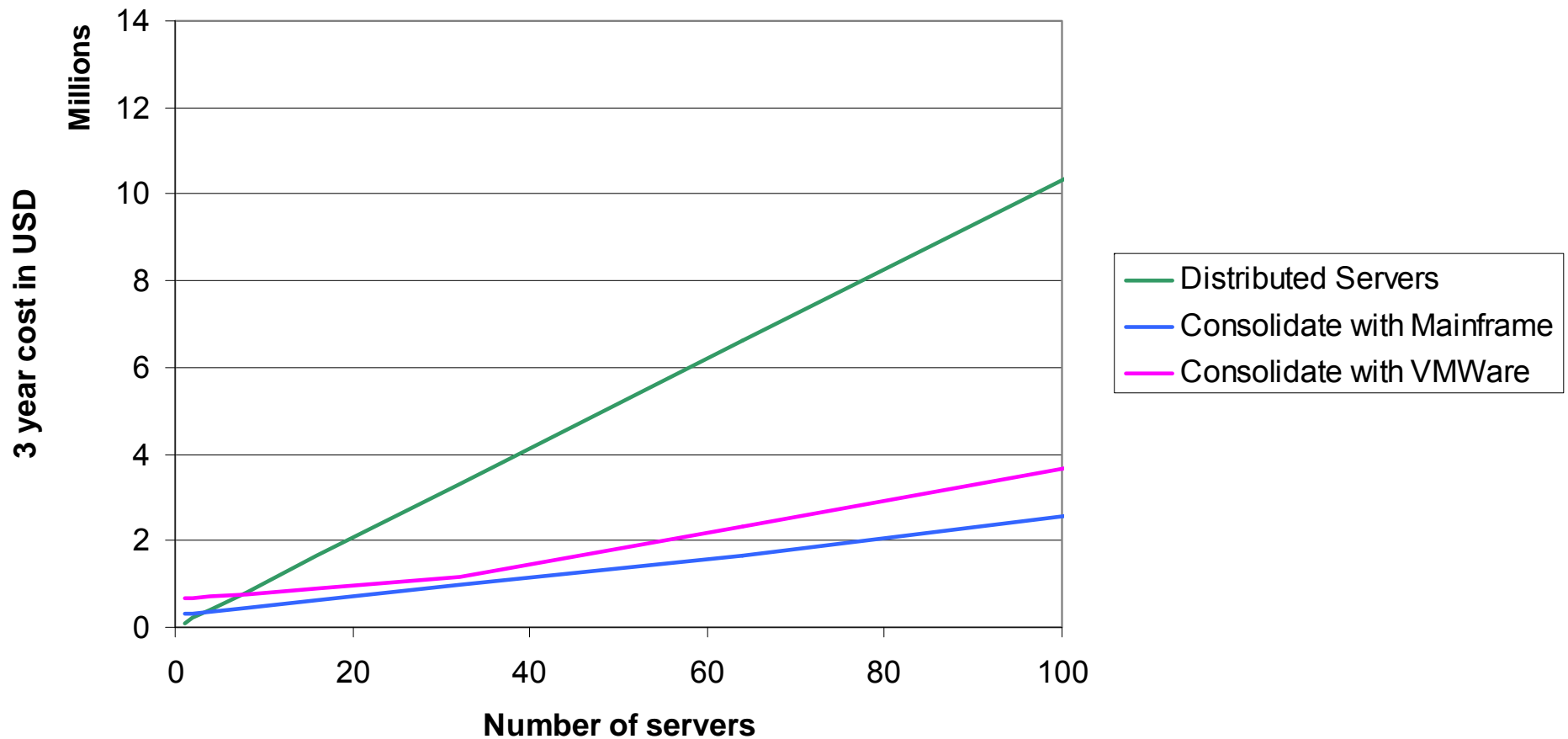|	z/VM	VMWare
Maximum memory per virtual Linux server	**More than 256GB**	16GB
Maximum CPU's per virtual Linux server	**Up to 64**	Up to 4
Maximum "Active virtual memory" supported	**Up to 8TB**	16,384MB
Maximum virtual CPU's per core	**Thousands**	Up to 8
Maximum real memory	**Up to 256GB**	Up to 64GB
Maximum virtual servers per machine	**Thousands**	128

Result: Consolidation On z/VM Saves The Most Money

Comparison of consolidation options
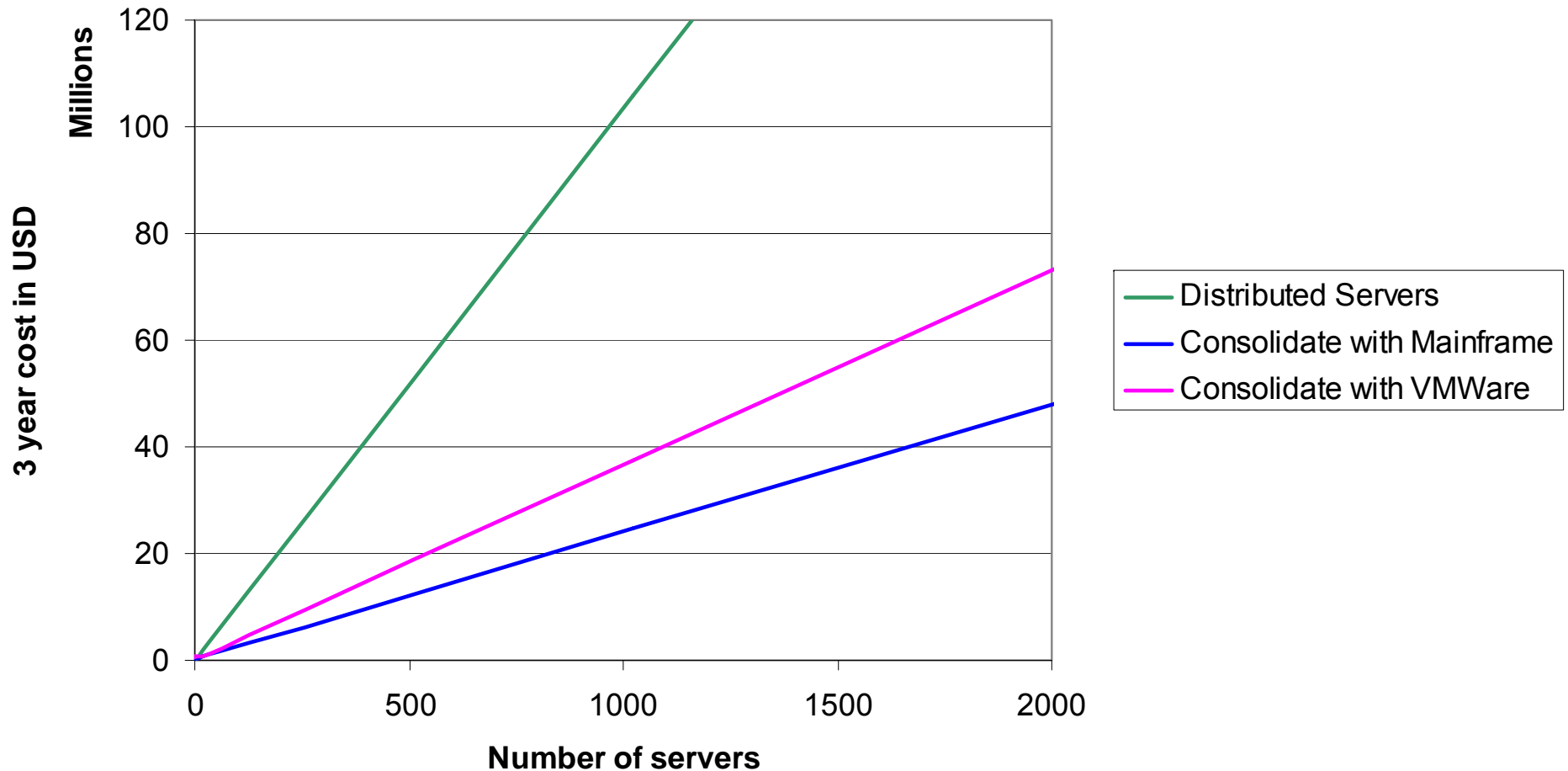
Cost of Different Linux Consolidation Solutions (Zoom On 0-100 Servers)

Comparison of Consolidation TCO

Legend:
- Distributed Servers
- Consolidate with Mainframe
- Consolidate with VMWare

Y-axis: 3 year cost in USD (Millions), scale 0 to 14

X-axis: Number of servers, scale 0 to 100

Do YOU Need To Consolidate?

- I/T department whose budget is consumed by operating cost?

- Contemplating new data centers due to power or floor space constraints?

- Need a systematic site failover plan for **all** applications and data?

- Quality of service issues?

- Lots of UNIX or Linux servers?

- Lots of small database servers scattered around (including Oracle)?

Service Oriented Finance Did A Roll-up Consolidation Of Linux Servers

I saved a lot of money by consolidating our Linux servers onto System z!

Service Oriented Finance CIO