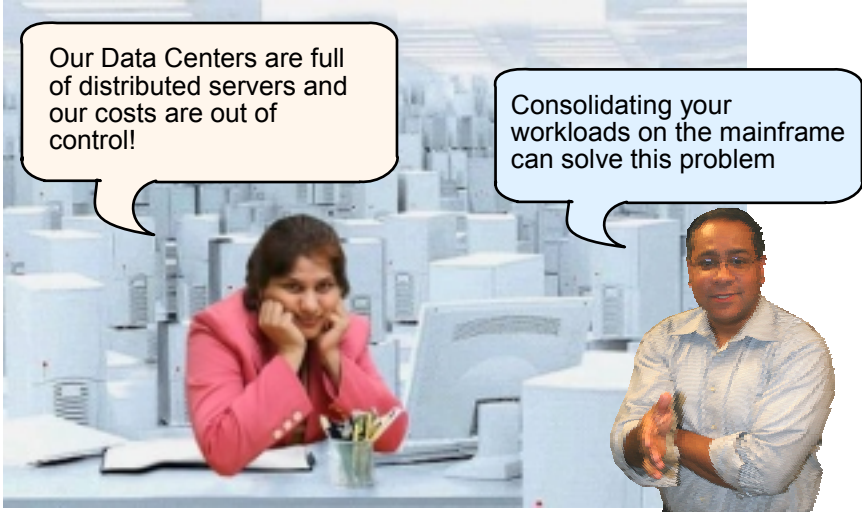


Extending Your Mainframe for More Business Value

Consolidate Workloads
to Reduce Costs

Distributed Server Sprawl



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

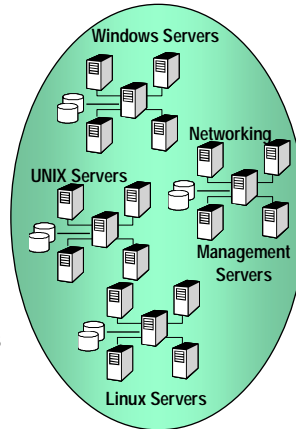
Consolidating your workloads on the mainframe can solve this problem

Service Oriented Finance
CIO

IBM

Distributed Server Sprawl Uses...

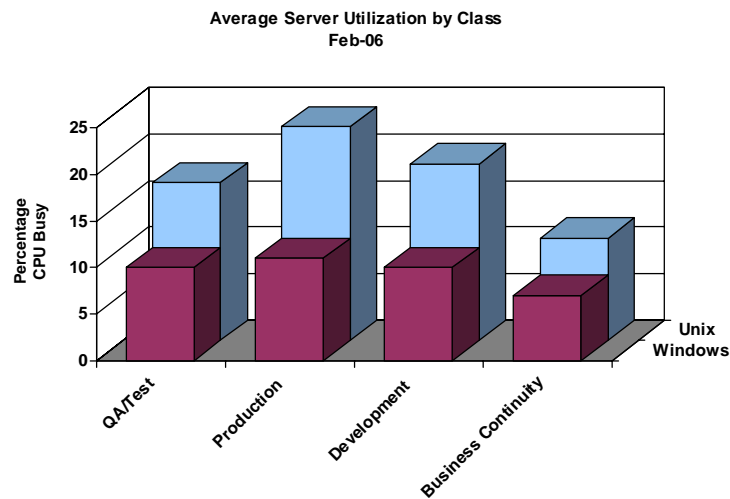
- Lots of hardware
 - ▶ Lots of floorspace
 - ▶ Lots of power
 - ▶ Lots of networking
- Lots of software licenses
- Lots of people to manage the systems
- **Consequences**
 - ▶ Low Utilization of Hardware Resources
 - ▶ Complexity
 - ▶ Increased time to respond to business requirements
 - ▶ Difficulty integrating information from various systems



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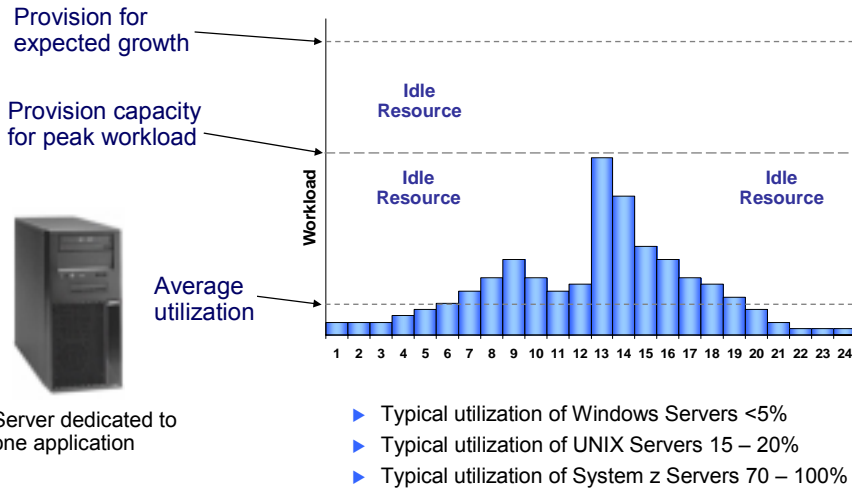
Server Utilization at a Large Financial Institution



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4

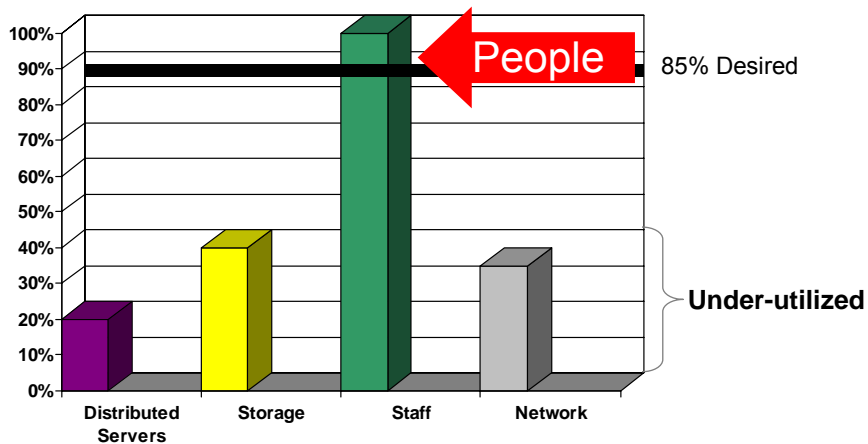
Utilization of Distributed Servers



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5

Distributed Result: Only One Resource is Highly Utilized!



Sources: IBM & Industry Studies

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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

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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

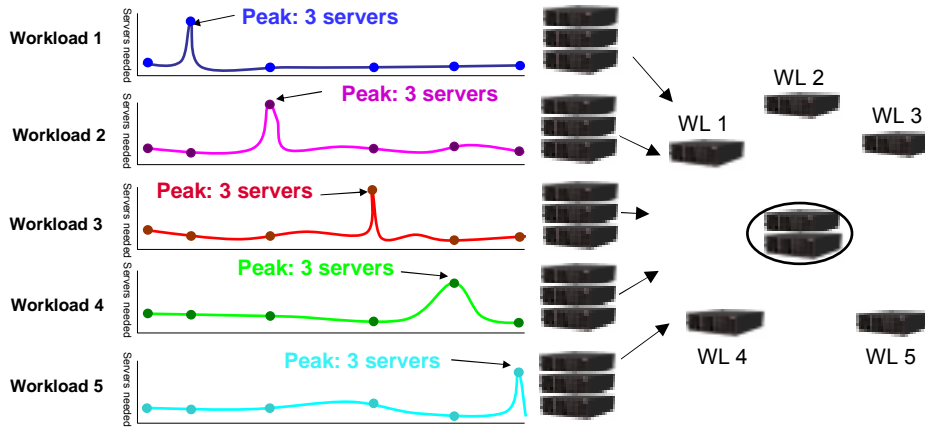


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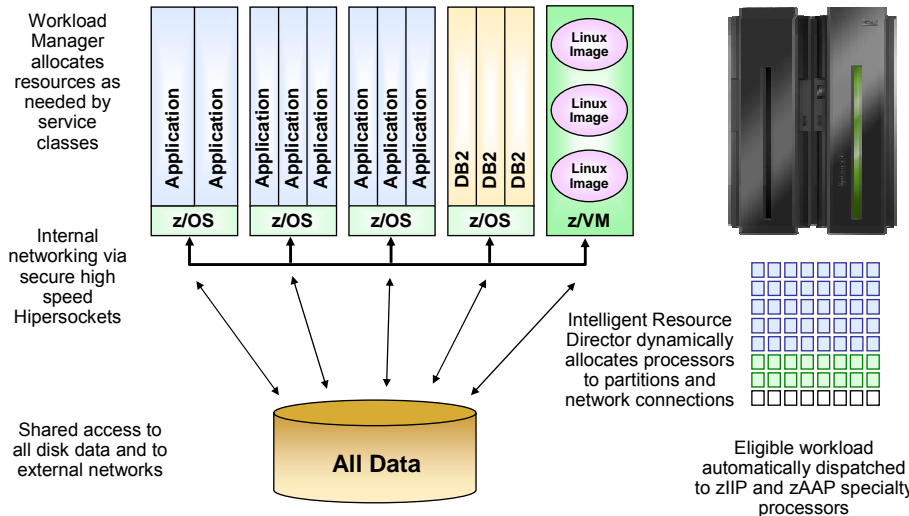
Theoretically Run the Same Workloads with Less Resources



What's Required: Virtualization and Intelligent Workload Management to Accommodate Shifting Workloads – automatic on the mainframe!

Dramatic Virtualization – How it Looks in z/Architecture

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



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)

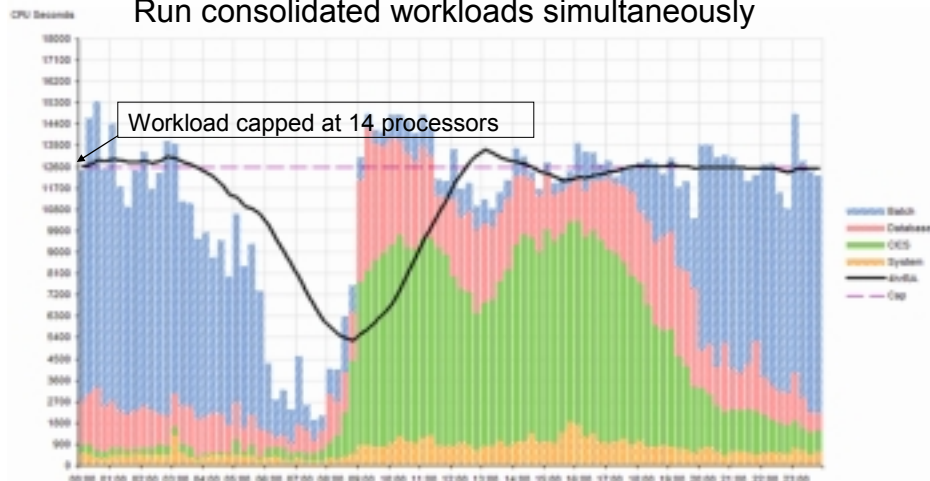
- All of these facilities provide
 - ▶ Business workload oriented goal or velocity definitions
 - ▶ Autonomic and continuous management to those definitions

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The Result – High Utilization on a Mainframe

Run consolidated workloads simultaneously



Note:

- Each bar represents the amount of CPU seconds used in 15 minutes (= 900 seconds) with 2 10-way machines
- The way Workload Management controls the workload 4-hour rolling average to the Cap "high-water mark"

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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
Domino	z/OS	--	Deploy

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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

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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

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Nationwide® Saves \$16+ Million with Linux on System z

On Your Side™

■ **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
- ▶ Forecast \$16M savings in 3 years, achieved in 2 years

Vastly improved TCO, Speed & Simplification

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Nationwide®
On Your Side™

Saves \$16+ Million with Linux on System z

■ Update (February 2008):

- ▶ Now **483** servers running on **34** z9 IFLs
 - Up to 18 mission critical applications
 - Added more WebSphere, Portal, and DB2
- ▶ \$16M savings realized a year earlier than planned (2 years not 3)

■ Note the servers:IFL ratio has decreased since initial deployment (23:1 decreased to 14:1)

- ▶ Nationwide used to put a single JVM per physical server
- ▶ Now they have multiple JVMs per virtual server
- ▶ They estimate 483 virtual servers are running equivalent workload to well over 1000 physical servers (29:1)
- ▶ More applications per server increases overall efficiency
 - Less server instances to look after
 - Less copies of Linux and software stack in real memory

Improved TCO, Speed and Simplification

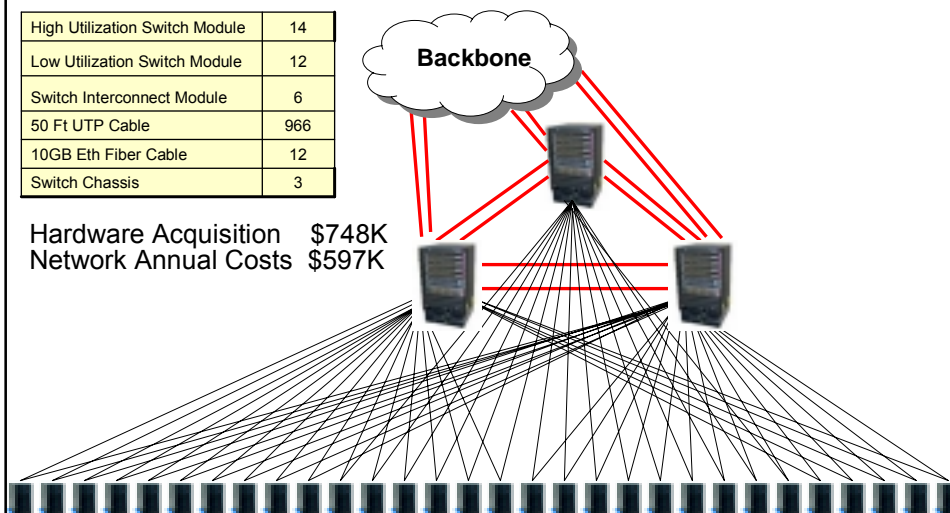
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Case Study: Network Costs –Before Consolidation (483 Servers to 2 System z’s)

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



The diagram only shows 30 of the 483 Servers at Nationwide

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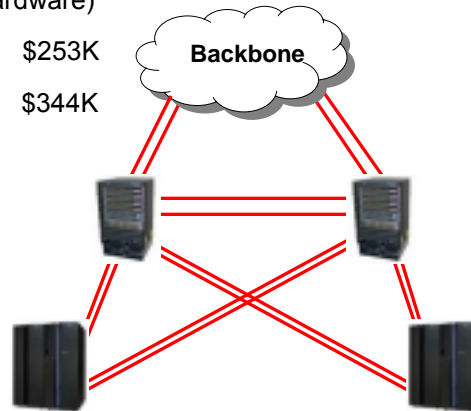
18

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

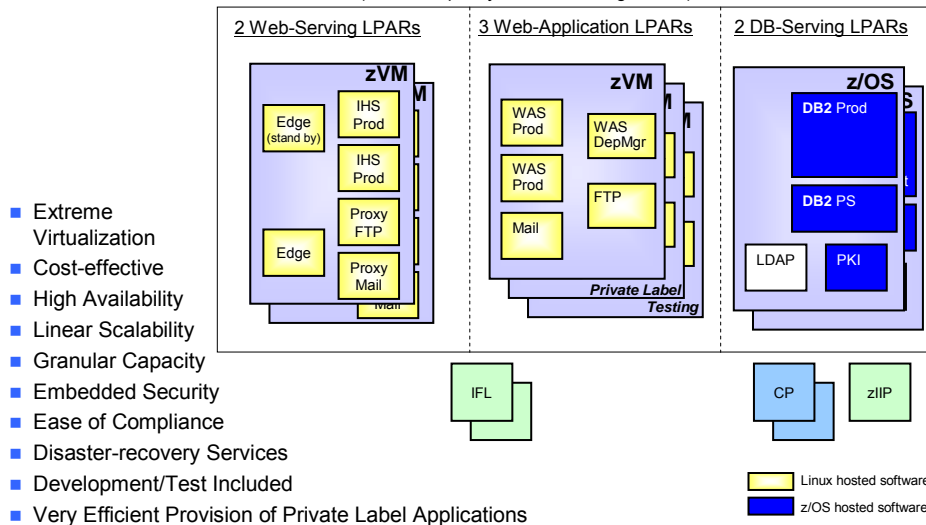


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Nexxar Provides Remittance and Transaction Processing Services to Unbanked Ethnic Markets

IBM z9 BC (at 47% capacity, and 6% of largest z10)



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Case Study: Québec Government Runs Oracle at IFL Prices

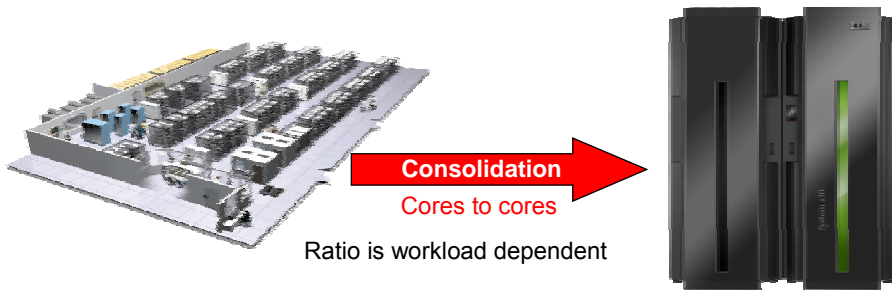
- Running **292** server instances on a z9-EC with **5** IFL's
 - ▶ 200 Oracle, 80 WebSphere, 12 WebSphere messaging
 - ▶ Reduced cost of hardware and software by 30%
 - Saved \$800,000 in licensing cost in the first year
 - ▶ Used RACF for consistent security
 - ▶ Each administrator can manage 100 consolidated 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

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!



How Many IFLs Will Be Required?



	Some recent examples:
Major Brokerage House	112 to 1 (z9)
A Major US Bank	37 to 1 (z9)
Hannaford	150 to 1 (z9)
Nationwide	23 to 1 (z990)
Nexxar	80 to 1 (z9-BC)
Major Brokerage House	90 to 1 (z9)

Case Study: Consolidate to Mainframe vs. Keeping Distributed Servers (HW and SW Cost Only)

Existing Mainframe



Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation



Add four processors:
4 IFLs

Or maintain existing 200 server farm for Oracle data servers



50 → 1

*3 year TCO
\$4.80 M*

*Annual operating
cost \$0.31 M*

Breakeven 2 yrs

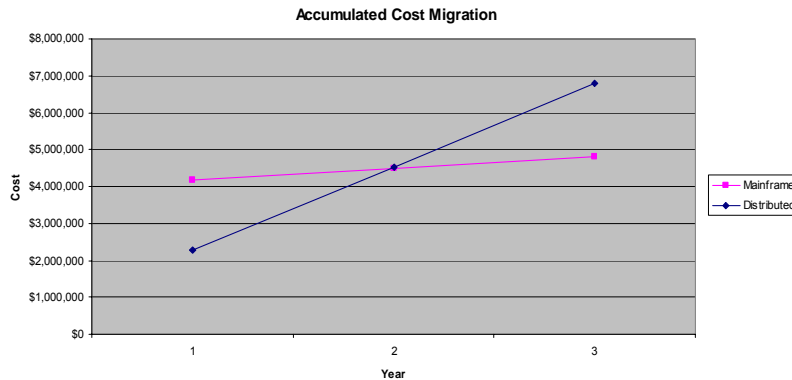
*3 year TCO
\$6.80 M*

*Annual operating
cost \$2.27 M*

Case Study: Consolidate to Mainframe vs. Keeping Distributed Servers (HW and SW Cost Only)

■ Rehosting Risks

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



200 Oracle DBs to 4 IFLs on Existing Mainframe

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IBM Internal Project to Consolidate Over 3000 Servers

- IBM expects substantial savings by consolidating 3,917 distributed servers to about 30 mainframes
 - ▶ 86% savings in system admin cost
 - ▶ 85% savings in floor space
 - ▶ 81% savings in power
 - ▶ 57% savings in network
 - ▶ 41% savings in software support
 - ▶ 19% savings in disk storage maintenance
- \$81M savings per year

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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

05 - Consolidate Workloads to Reduce Cost v5.1

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

Existing Mainframe



Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation



Add four processors:
4 IFLs

*3 year TCO
\$6.67M*

*Annual operating
cost \$0.94M*

*Breakeven in first
year*

*3 year TCO
\$20.17M*

Or maintain existing 200 server farm for Oracle data servers



*Annual operating
cost \$6.72 M*

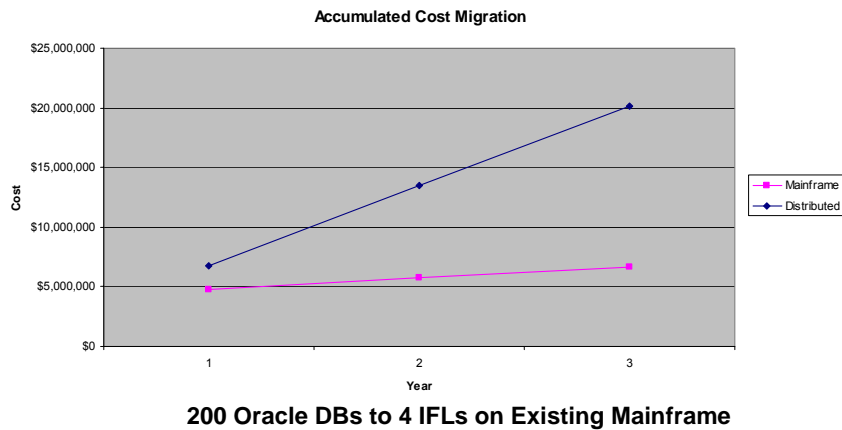
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Case Study: Consolidate Mainframe vs. Keeping Distributed Servers (All Operating Costs Considered)

■ Rehosting Risks

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



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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...

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What About Using VMWare on Intel?

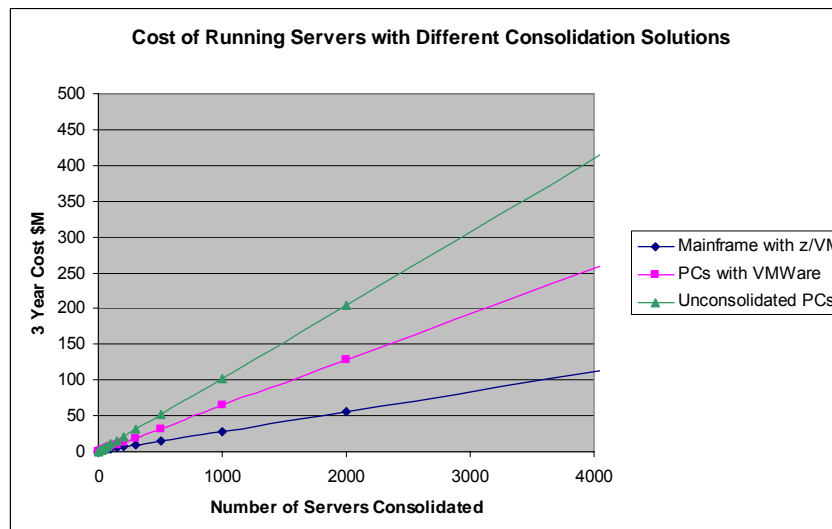
- VMWare lacks the consolidation efficiency of z/VM
- Less efficient use of memory and storage
- Less efficient use of processors

	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 real CPU's	Up to 32	Up to 32
Maximum virtual CPU's per core	Not Applicable	Up to 8
Maximum real memory	Up to 256GB	Up to 64GB
Maximum virtual servers per machine	>10,000s	128

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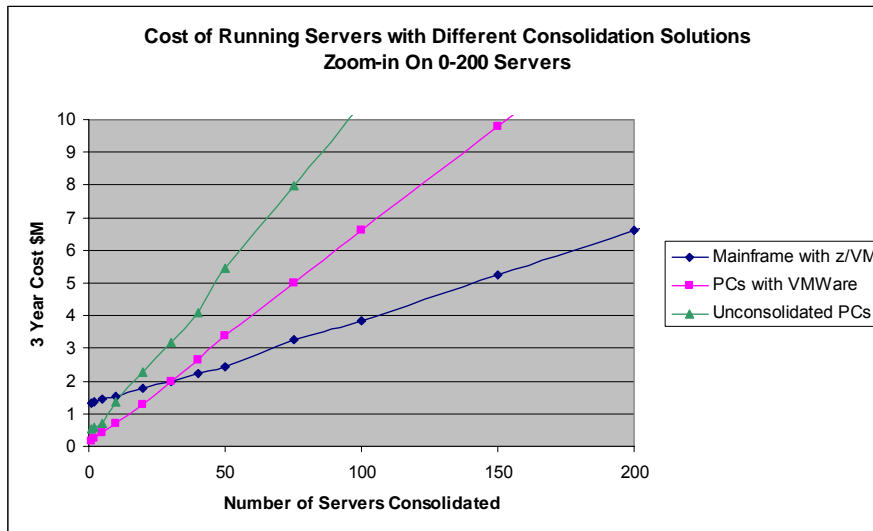
Result: Consolidation on z/VM Saves the Most Money



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Cost of Different Linux Consolidation Solutions (0-200 Servers)



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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)?



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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**

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