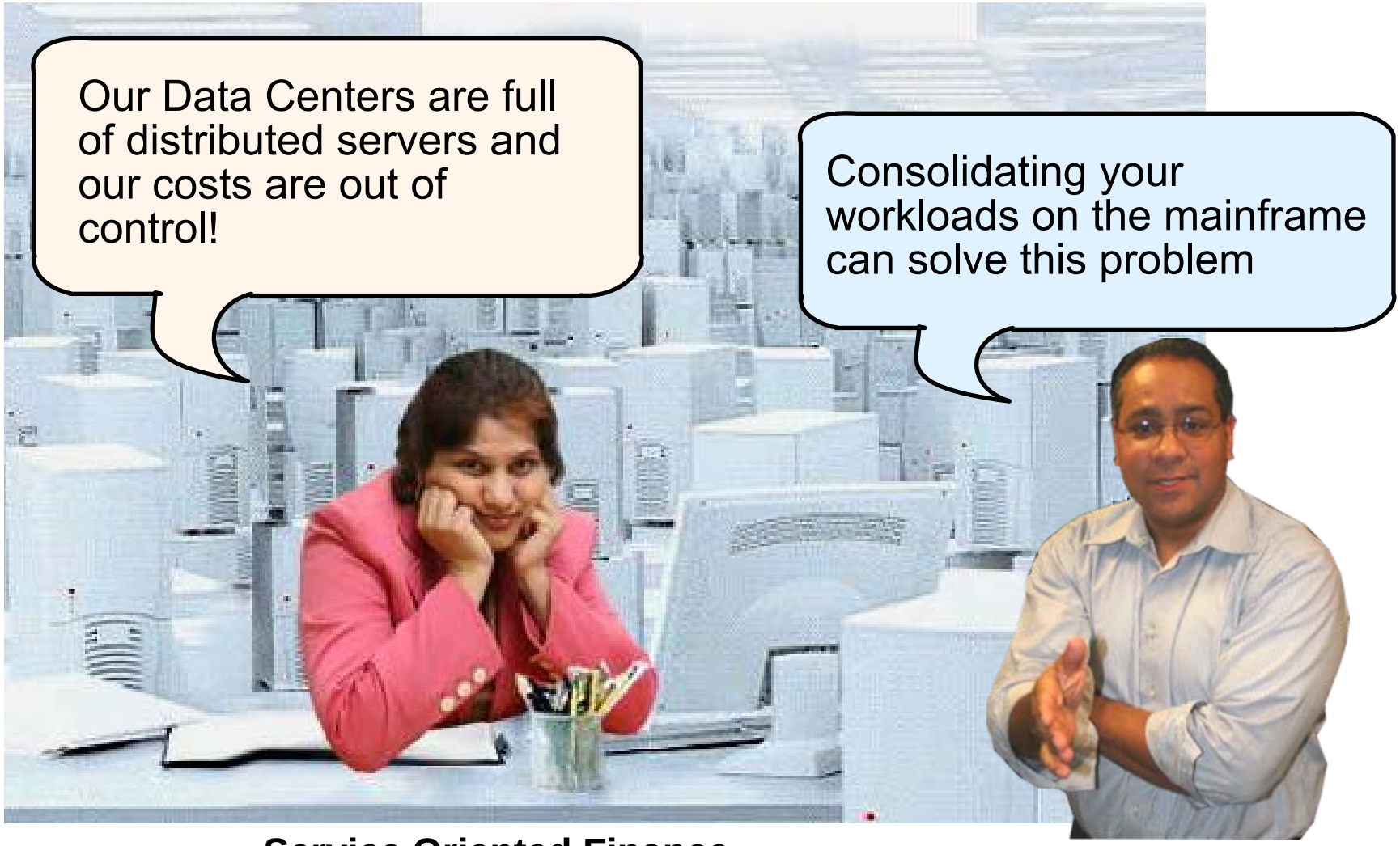
Extending Your Mainframe For More Business Value

Server Consolidation To Linux On IFLs

Typical Scenarios

- Most data centers are not green field projects
- Cost concerns drive typical 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

Distributed Server Sprawl

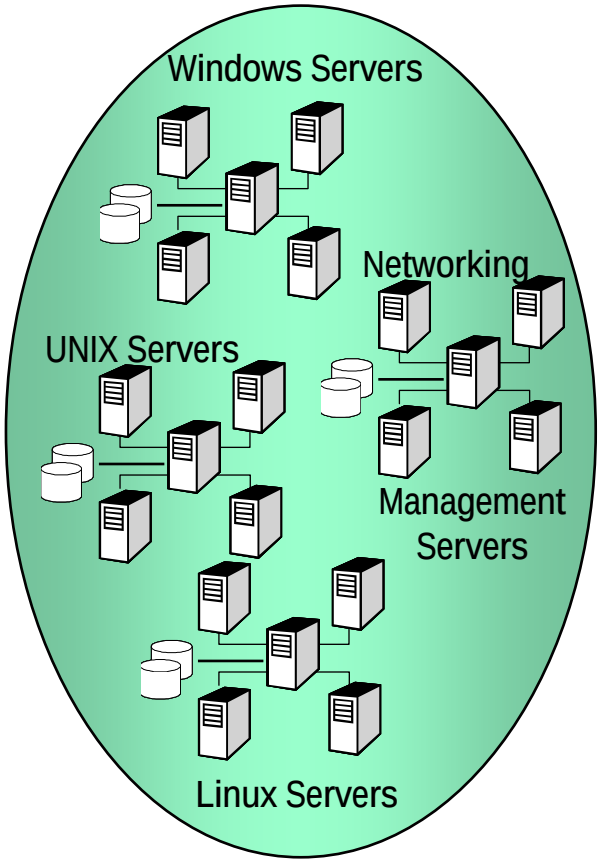


Service Oriented Finance CIO

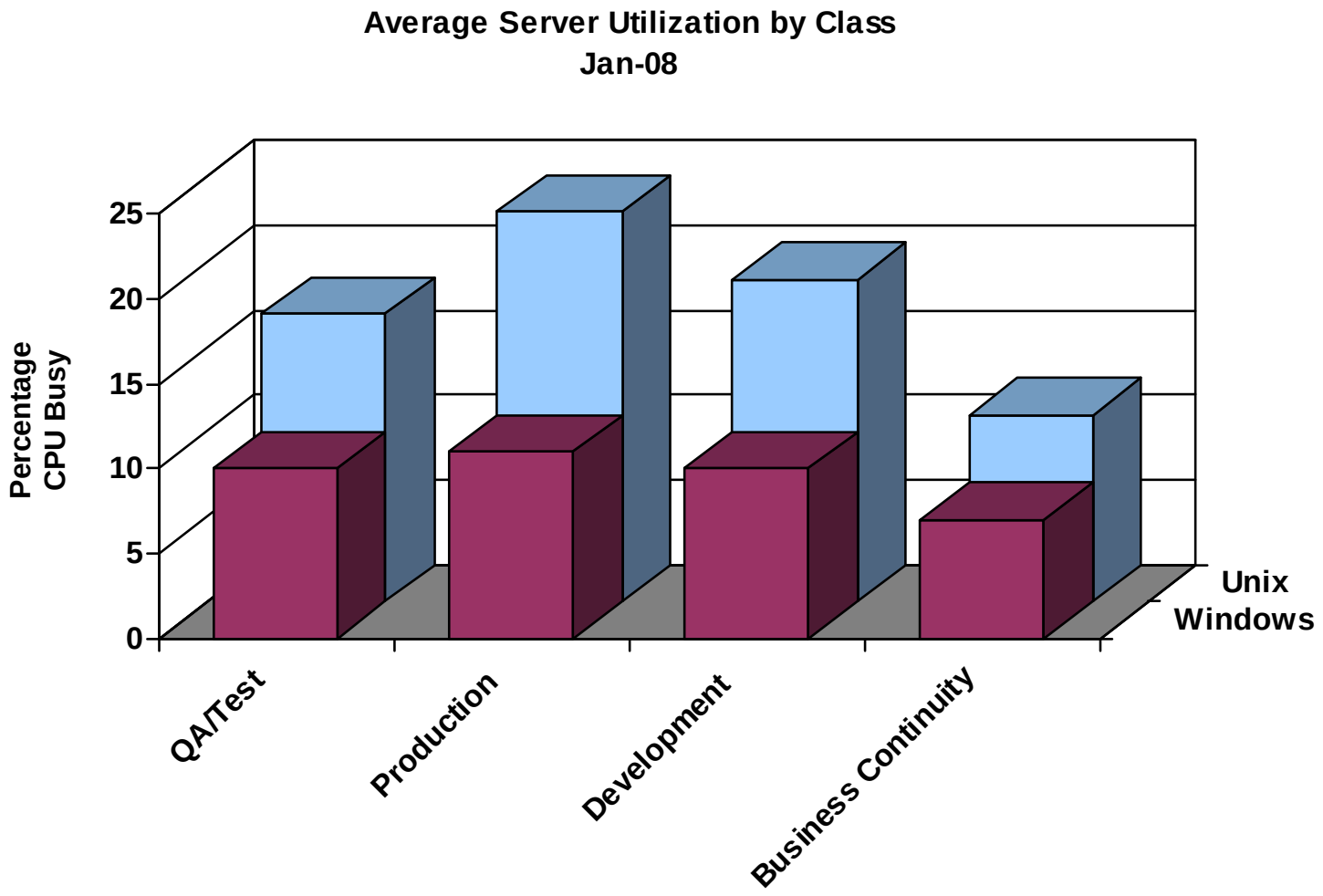
IBM

Distributed Server Sprawl Uses...

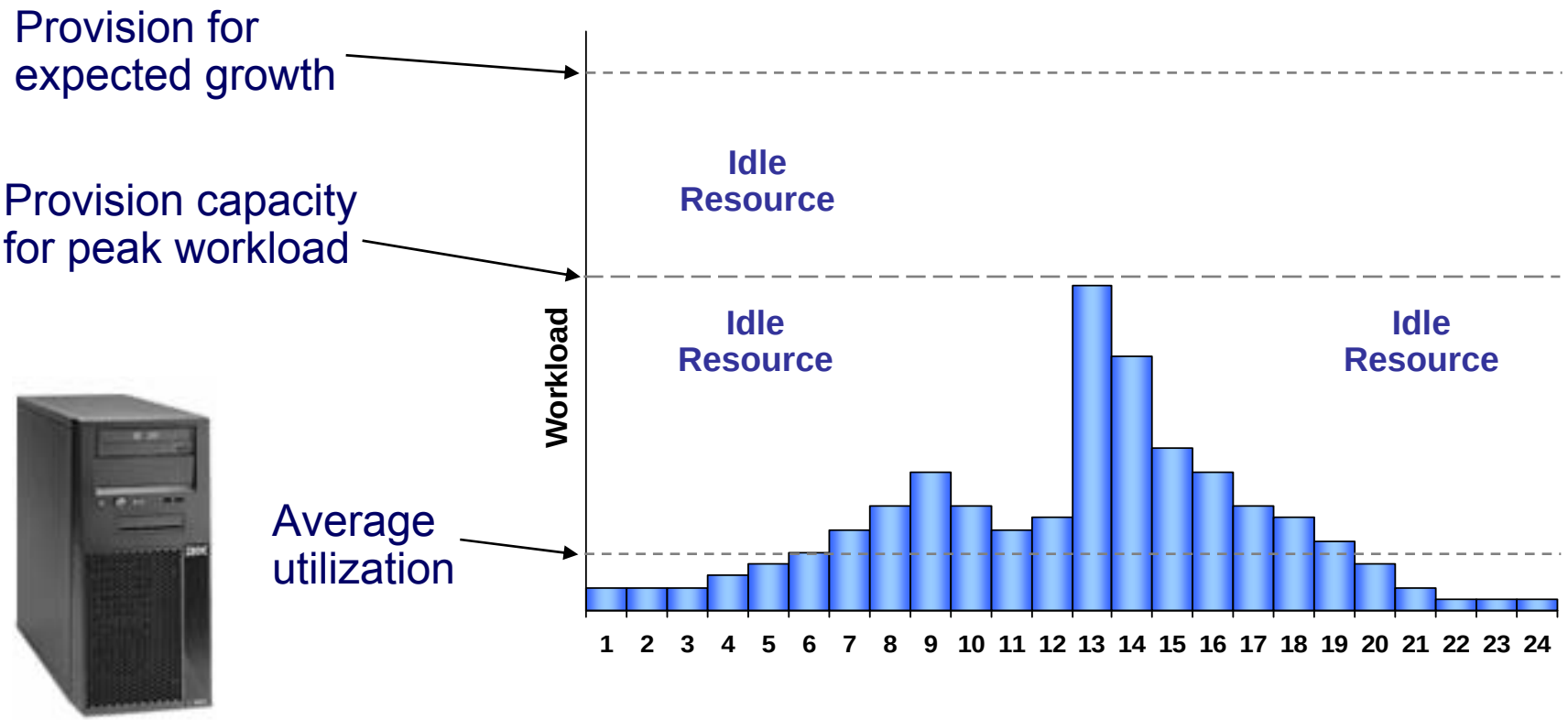
- Lots of hardware
  - Lots of floorspace
  - Lots of power
  - Lots of networking
- Lots of software licenses
- Lots of people to manage the systems
- **Consequences**
  - Low Utilization of Hardware Resources
  - Complexity
  - Increased time to respond to business requirements
  - Difficulty integrating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



Server Utilization At A Large Financial Institution



Utilization Of Distributed Servers



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%

Economics Of Consolidation

- Consolidating workload means running multiple workloads on the mainframe at the same time
- Consolidation achieves greater utilization of computing assets
- The more workloads you can consolidate on a mainframe, the lower the cost per unit of work
- Same principal was applied by Henry Ford at the dawn of the industrial era
  - It still applies today

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Example Workloads That Can Be Consolidated On A Mainframe

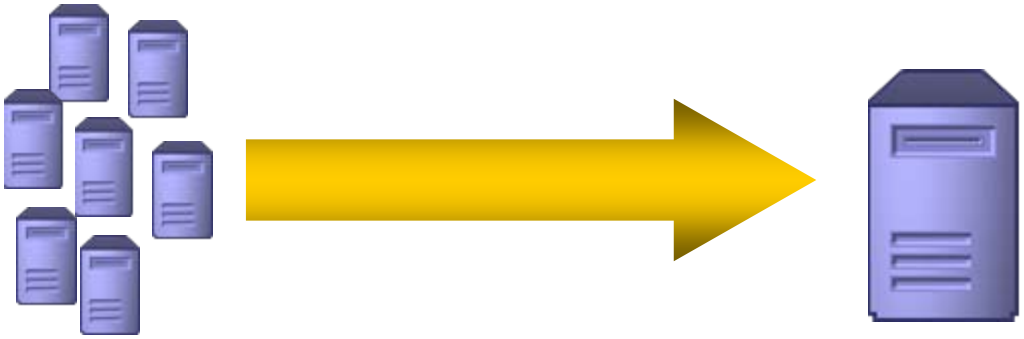
What	Where	Specialty Processor	How
Growth of Existing Mainframe Workload	z/OS	--	Capacity on demand
New CICS or IMS Applications	z/OS	--	Develop
Data Warehouse	z/OS	zIIP	Deploy
SAP Database Server	z/OS	zIIP	Deploy
WebSphere Application Server	z/OS	zAAP	Deploy
WebSphere Portal Server	z/OS	zAAP	Deploy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

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

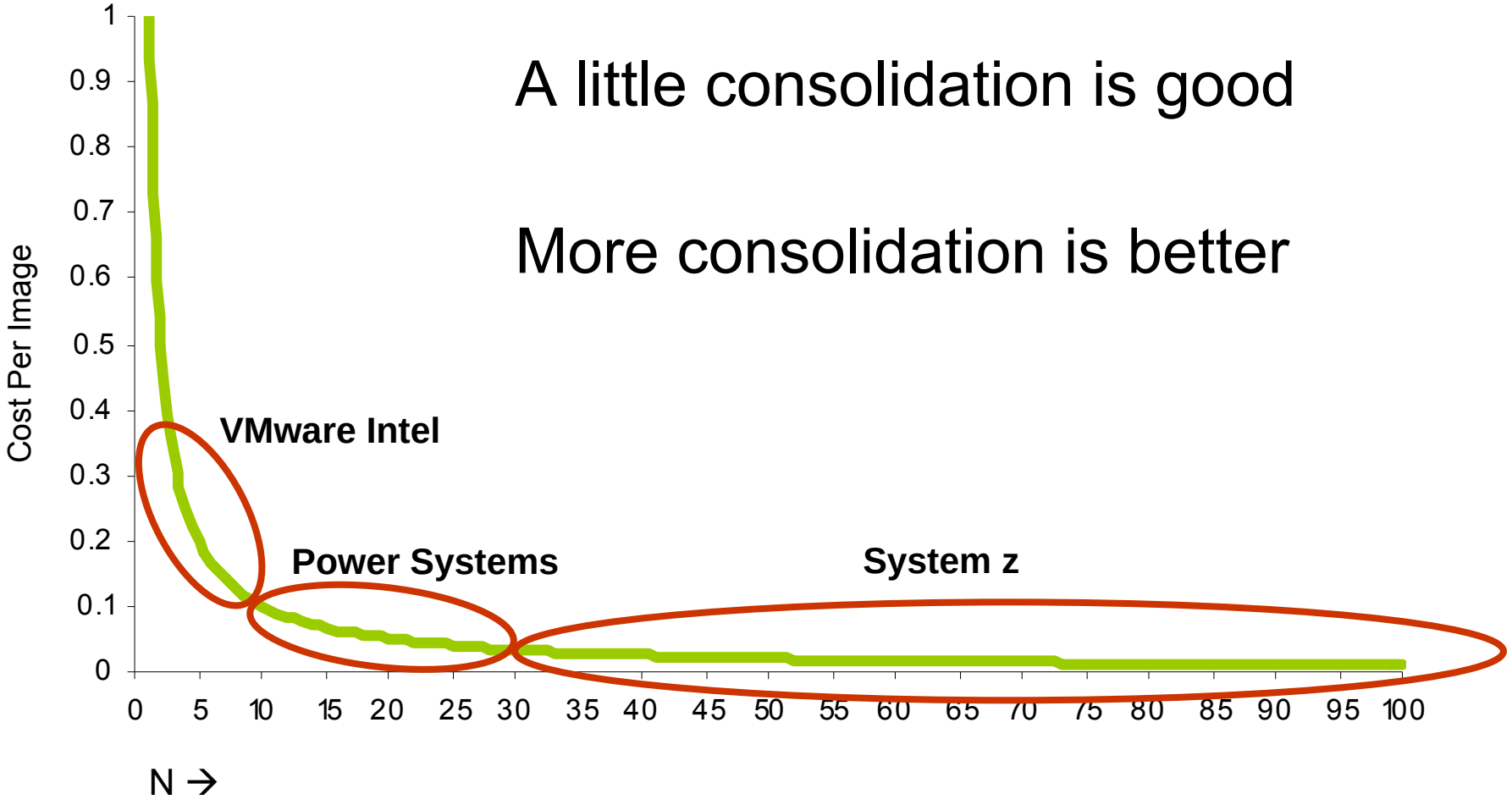
The more servers you can consolidate, the more money you will save (Maximize N)

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

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

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

Observed Consolidation Ratios



The Mainframe Can Consolidate Thousands Of Workloads

- 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

Other Workload Management Solutions Lack Business Goals and Dynamic Flexibility

- For example, HP-UX workload manager
  - Uses static relationships based on the IT environment, not related to business goals
  - Can adjust share/number of CPUs available to a workload but only via static relationships:
    - "3 cpu-shares per connected user with a minimum of x, maximum of y"
  - Can only hard code memory and disk bandwidth shares
    - Dynamic changes not possible so only useful for hard-caps

- No sign of z/OS WLM business goals like:
  - Application X will achieve <2s response time for 95% of users during US Eastern business hours, <5s at other times

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

Nationwide® On Your Side™ Saves $16+ Million With Linux On 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 (August 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
- **517** virtual servers with 1,630 JVM's running on **35** z9 IFL's
  - So, workloads that would have required **1,630** physical servers are running on **35** z9 IFL's – **47 to 1 consolidation**

Improved TCO, Speed and Simplification

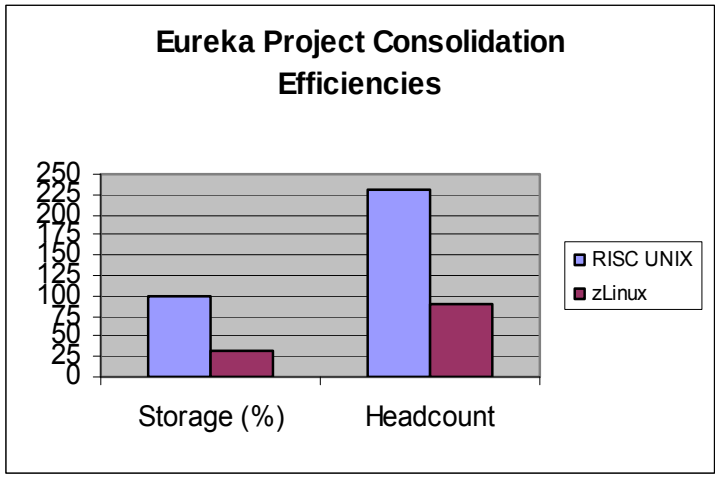
Telemar Roll-up Consolidation Project

Largest provider of fixed-line telecommunications services in South America.

TELEMAR
100% brasileira

Consolidated 16 geographically dispersed UNIX servers on a centralized System z9 EC

16 to 1 consolidation



Source Robert Frances Group

Benefits:

- Open-standards-based solution
- Maximized manageability, scalability, security and availability of its key business systems.
- Reduced need for server capacity by one-third
- Lowered operating and administration for maintaining email server applications.

Case Study: Canadian Provincial Government Runs Oracle At IFL Prices

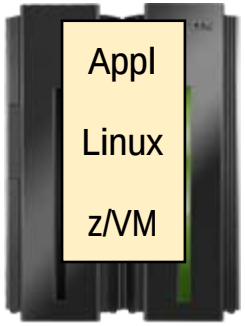
- Running **292** server instances on a z9-EC with **5** IFL's
  - 200 Oracle, 80 WebSphere, 12 WebSphere messaging
  - Reduced cost of hardware and software by 30%
    - Saved $800,000 in licensing cost in the first year
  - Used RACF for consistent security
  - Each administrator can manage 100 consolidated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

Case Study: Consolidate On Mainframe vs. Keeping Dedicated Servers

Existing Mainframe

Existing processors:
4 general purpose

Add 1 LPAR for Oracle Server Consolidation



Add three processors:
3 IFLs

3 year TCO $9.06M

Annual operating cost $0.67M

Breakeven in first year

Or maintain existing 292 server farm for Oracle data servers

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

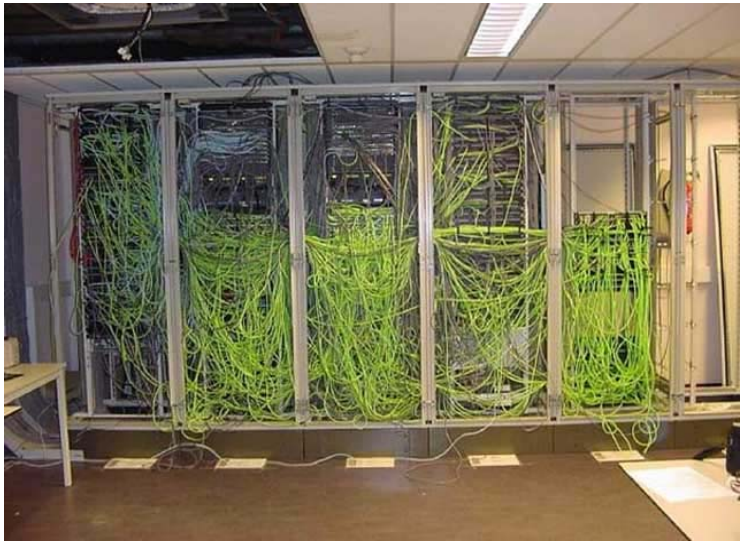
OTC		ANNUAL	
Sunk Cost	$0	Disk Maintenance [1]	$59,276
		Server maintenance [1]	$226,884
		Off-Premise Network [1]	$299,008
		Power/Floorspace [1]	$501,656
		System Admin [1]	$5,944,828
		On-Premise Network Maintenance [1]	$62,196
TOTAL	$0	TOTAL	$7,093,848

Dedicated Software

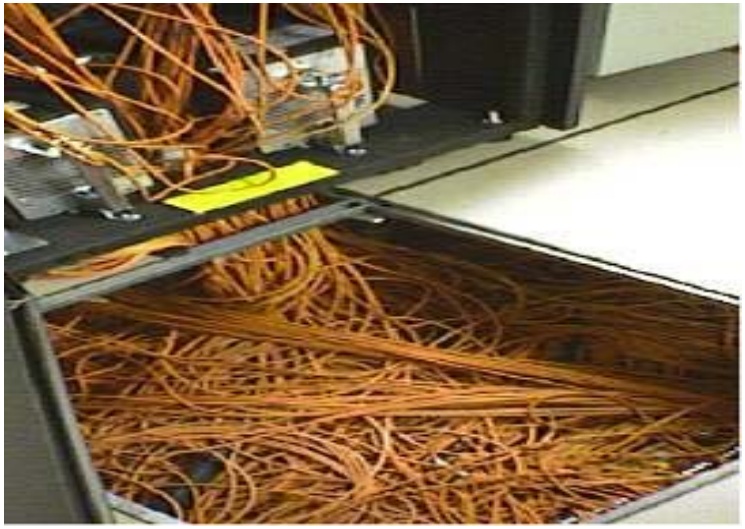
OTC		ANNUAL	
Sunk Costs	$0	Oracle S&S [1]	$2,569,600
		Linux S&S [1]	$379,308
TOTAL	$0	TOTAL	$2,948,908

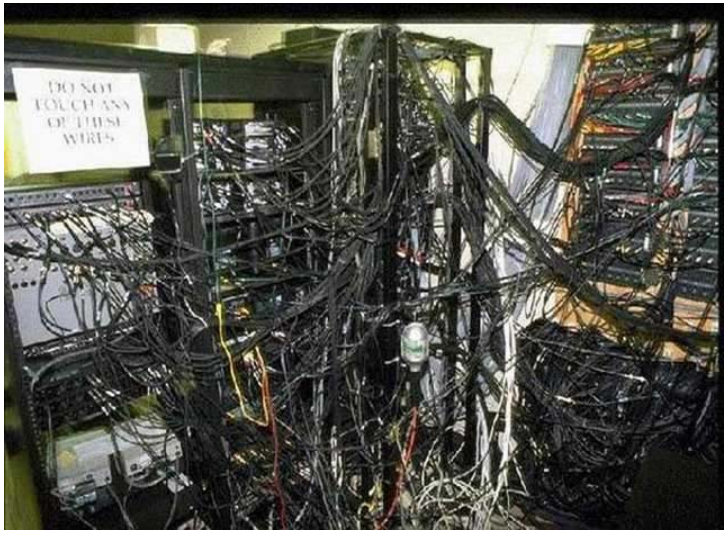
1 – Needs three years maintenance, 2 – Needs two years maintenance

Network Simplification



- Consolidation replaces cables and routers with internal connections
- Better performance and security

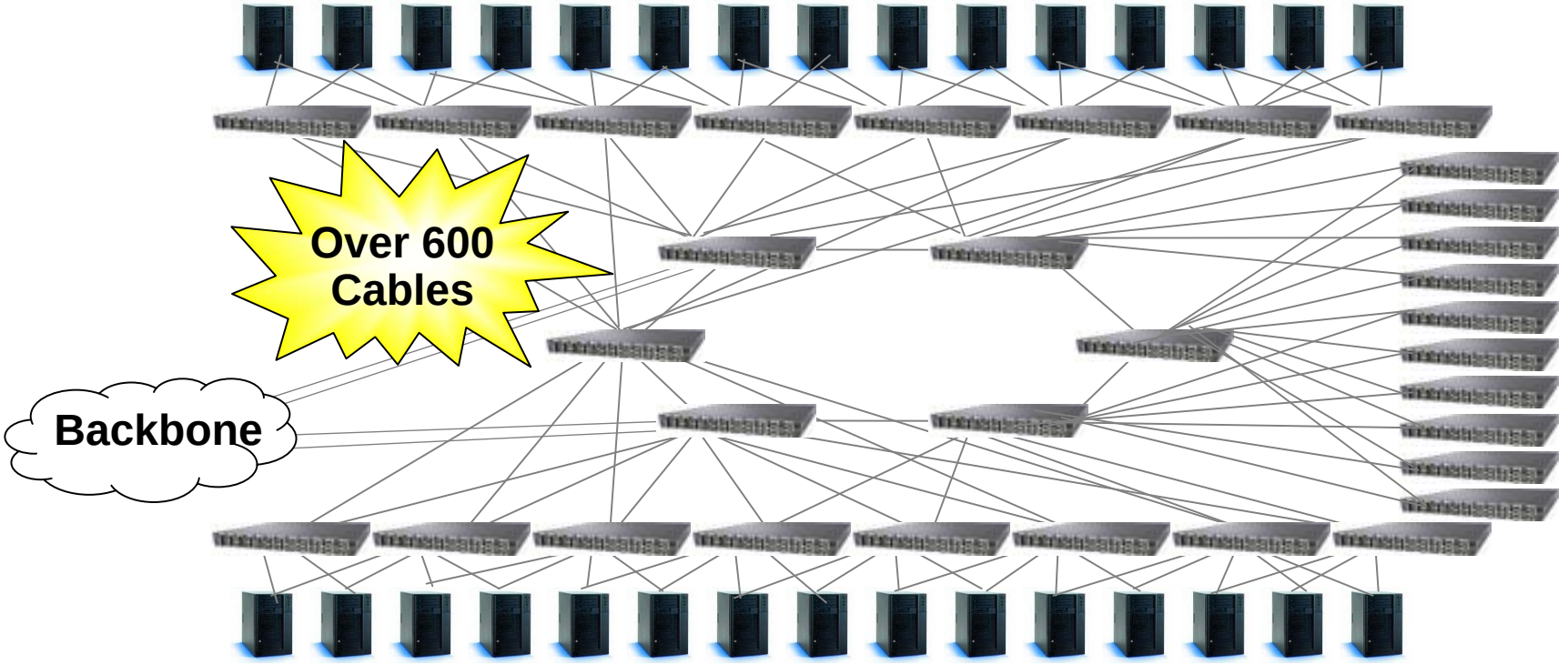




Case Study: Network Before Consolidation (292 Servers To 1 System z)

Catalyst 3560E-24TD – 24 ports 1gbps	25
Catalyst 3560E-12D – 12 ports 10gbps	6
50 Ft UTP Cable	584
10GB Eth Fiber Cable	60

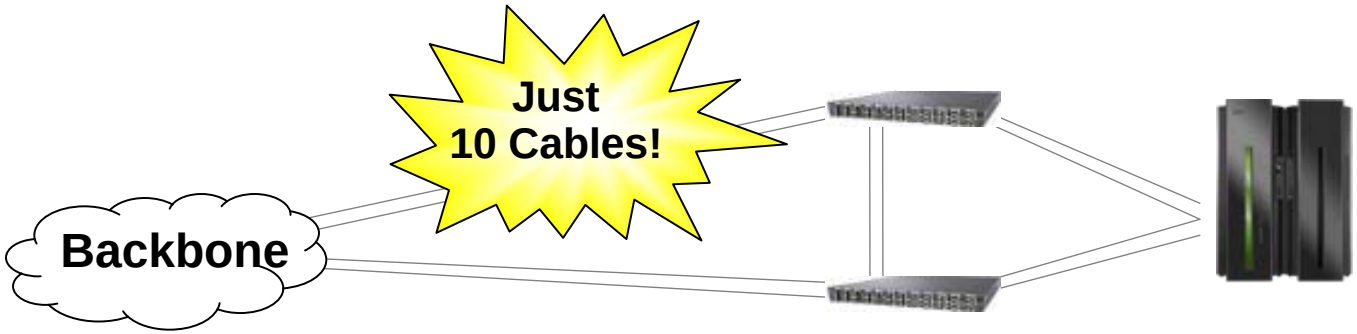
The diagram shows only **30** of the **292** Servers



Case Study: Network After Consolidation (292 Servers To 1 System z)

Network Simplification!

Better Performance and Security

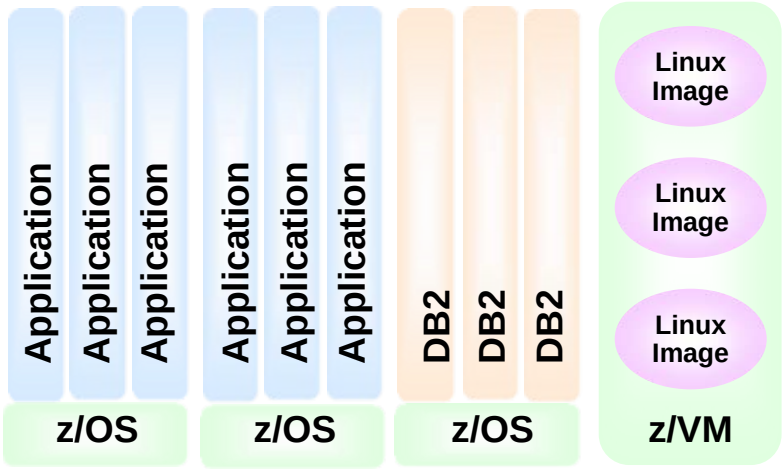


Other Benefits Of Virtualization

- Fast provisioning of pre-installed and configured images
  - Minutes instead of days or weeks
  - No additional space, electric connections or network cables
- Compatible with the data center practice of standardizing on strategic software stacks
  - Pre-tested stacks
  - Consistent levels and patch
  - A management approach to achieve better stability
  - Jukebox selection of standard enterprise images
- On ramp to cloud computing services

Demo: Provisioning Using z/VM Center

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



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!

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

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					1630	→	35	47 → 1
– Canadian Provincial 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				**82 : 1**

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

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