Extending Your Mainframe for More Business Value

Consolidate Workloads
to Reduce Costs

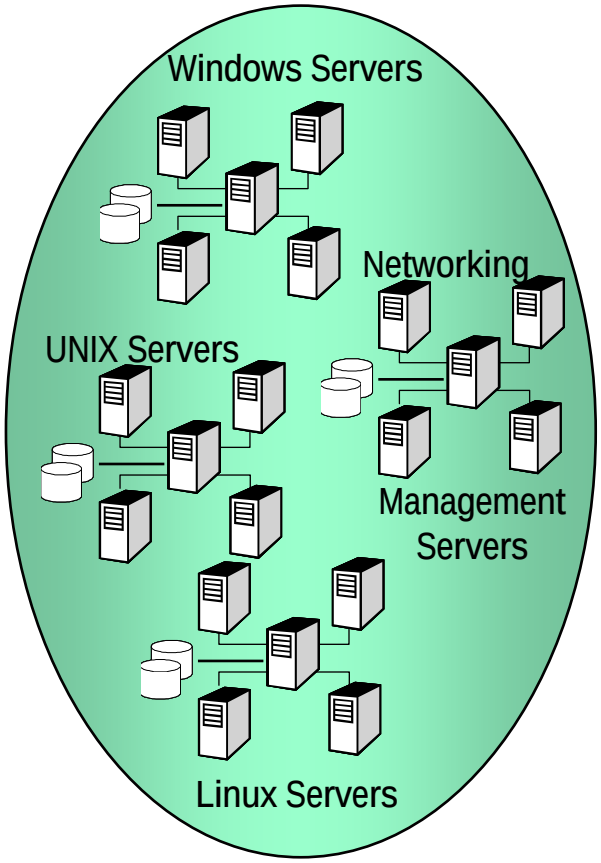
Distributed Server Sprawl

Service Oriented Finance CIO

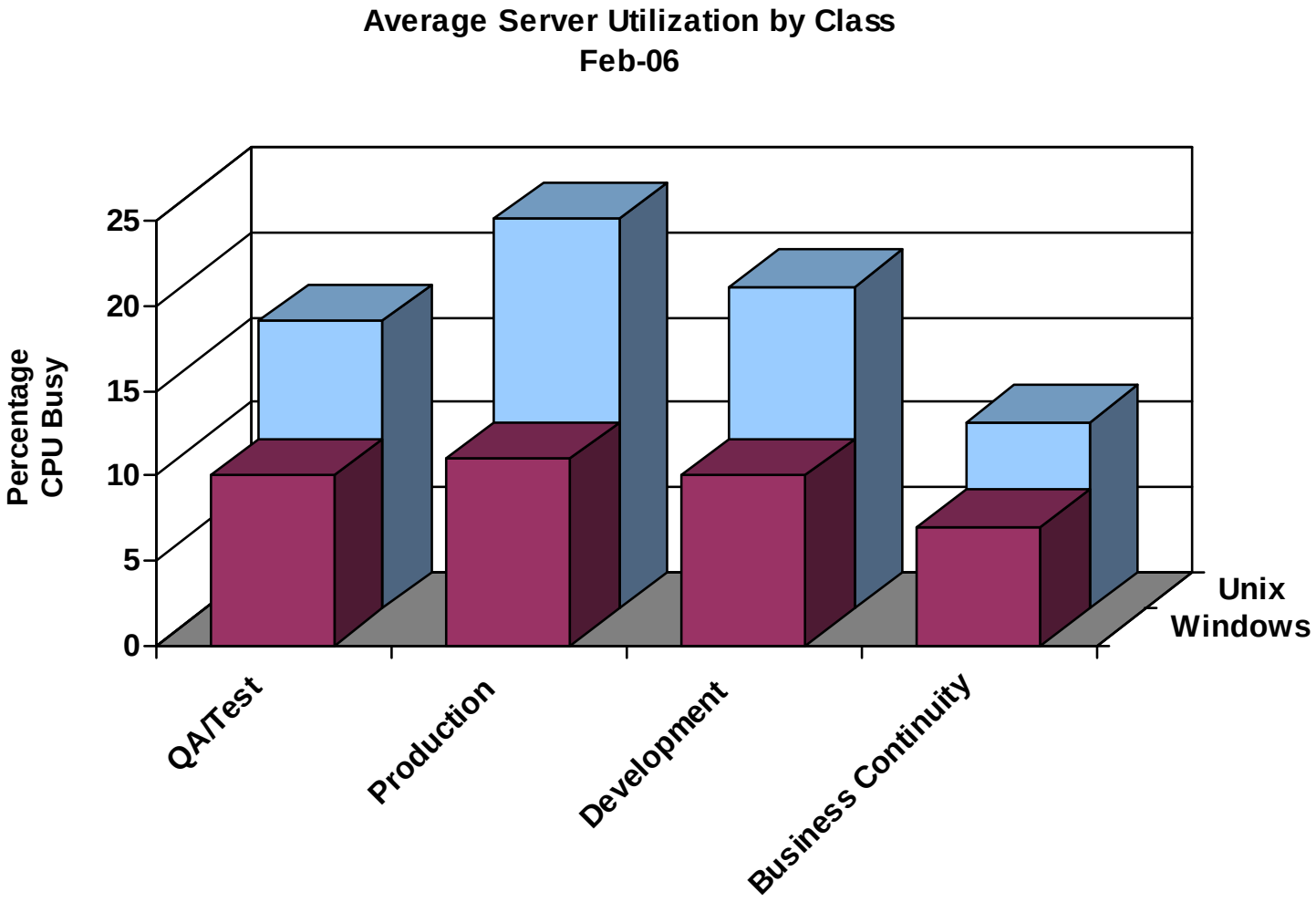
IBM

Distributed Server Sprawl Uses...

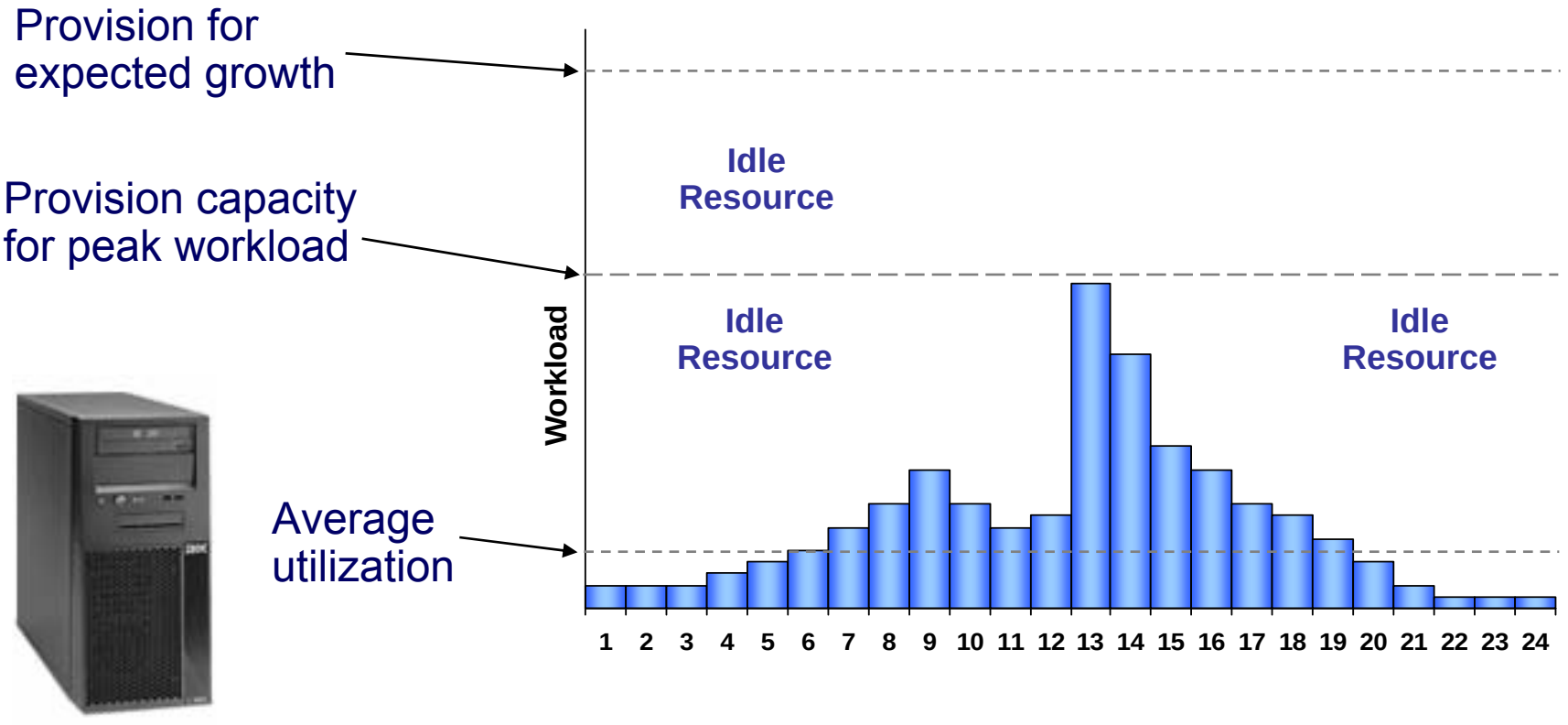
- Lots of hardware
  - Lots of floorspace
  - Lots of power
  - Lots of networking
- Lots of software licenses
- Lots of people to manage the systems
- **Consequences**
  - Low Utilization of Hardware Resources
  - Complexity
  - Increased time to respond to business requirements
  - Difficulty integrating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



Server Utilization at a Large Financial Institution



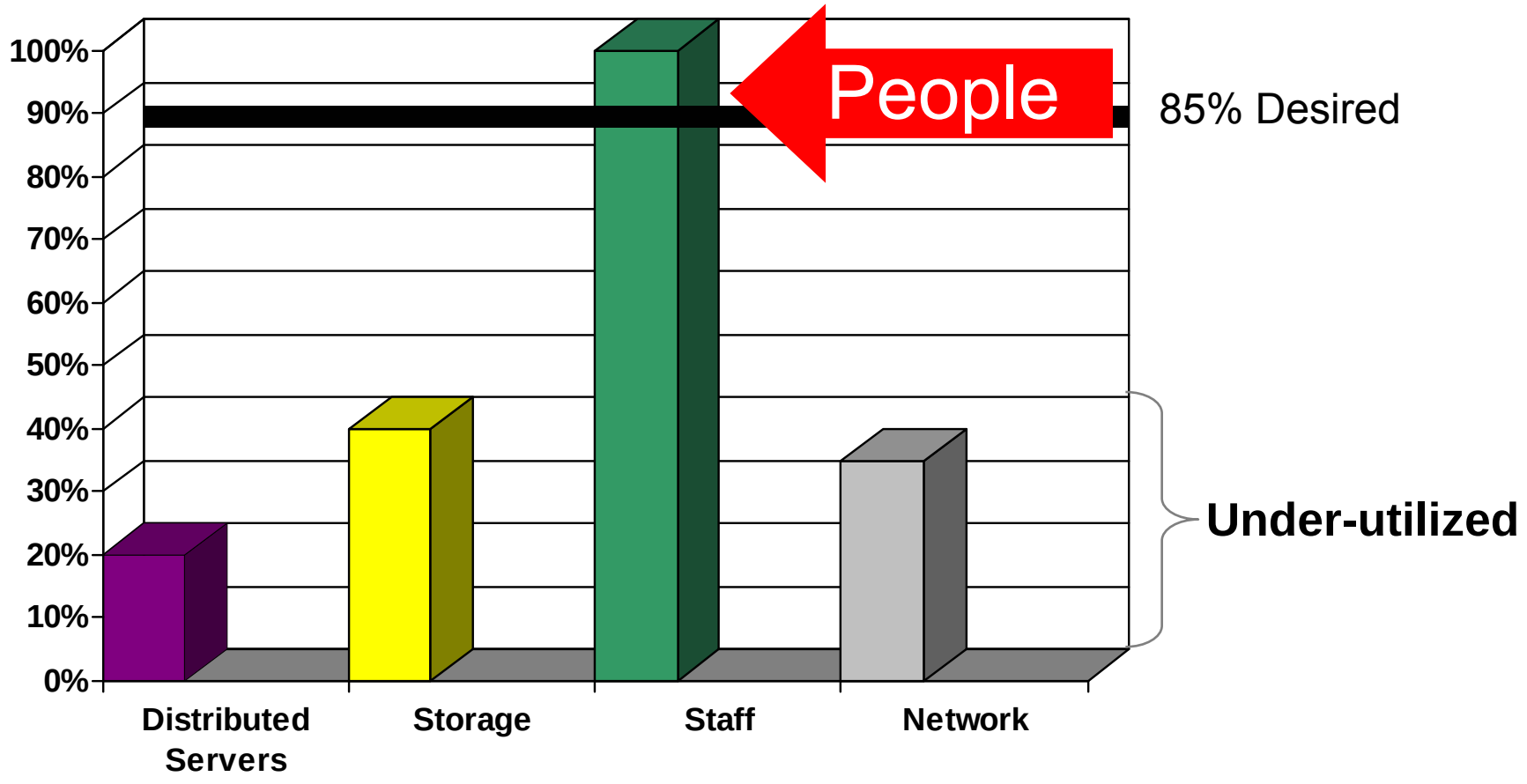
Utilization of Distributed Servers



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%

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

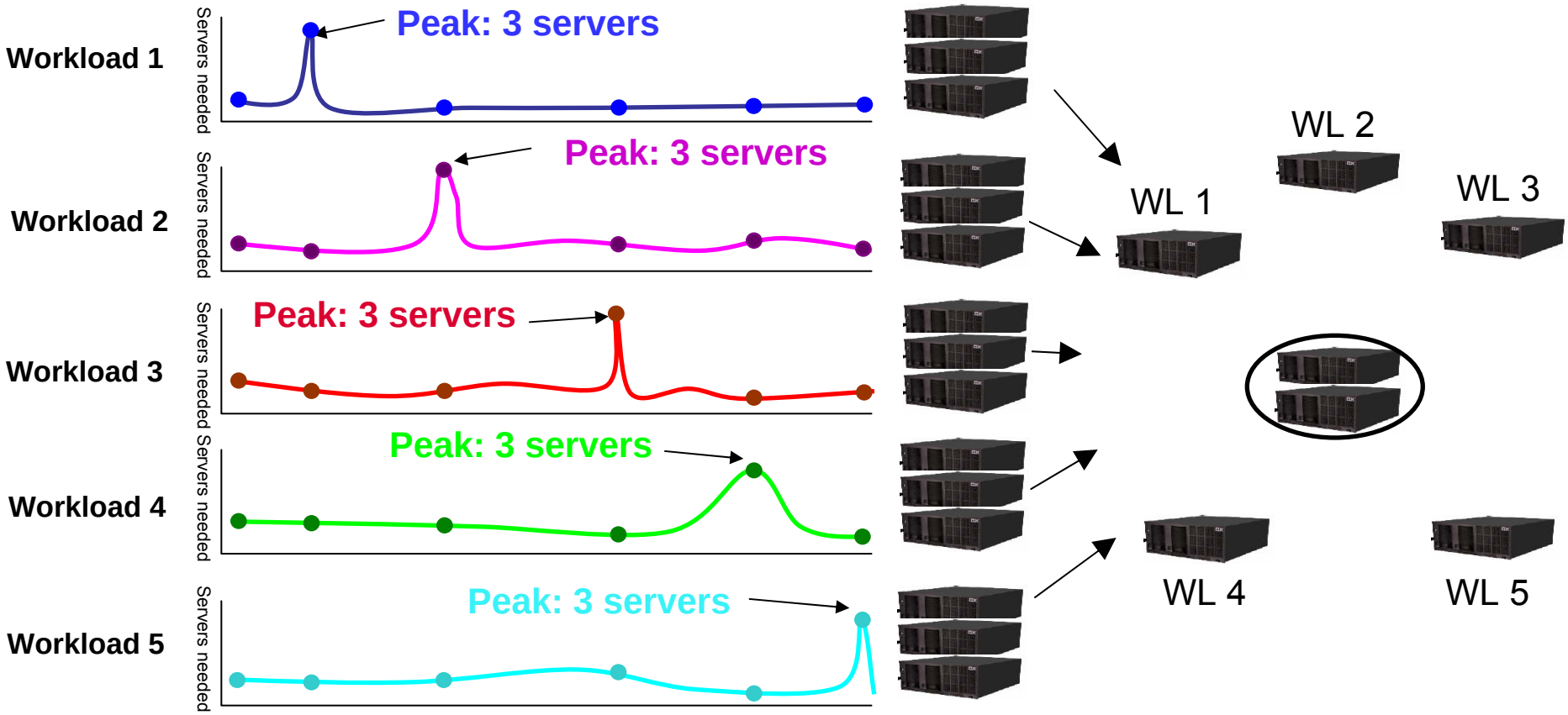
Service Oriented Finance CIO

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

Economics of Consolidation

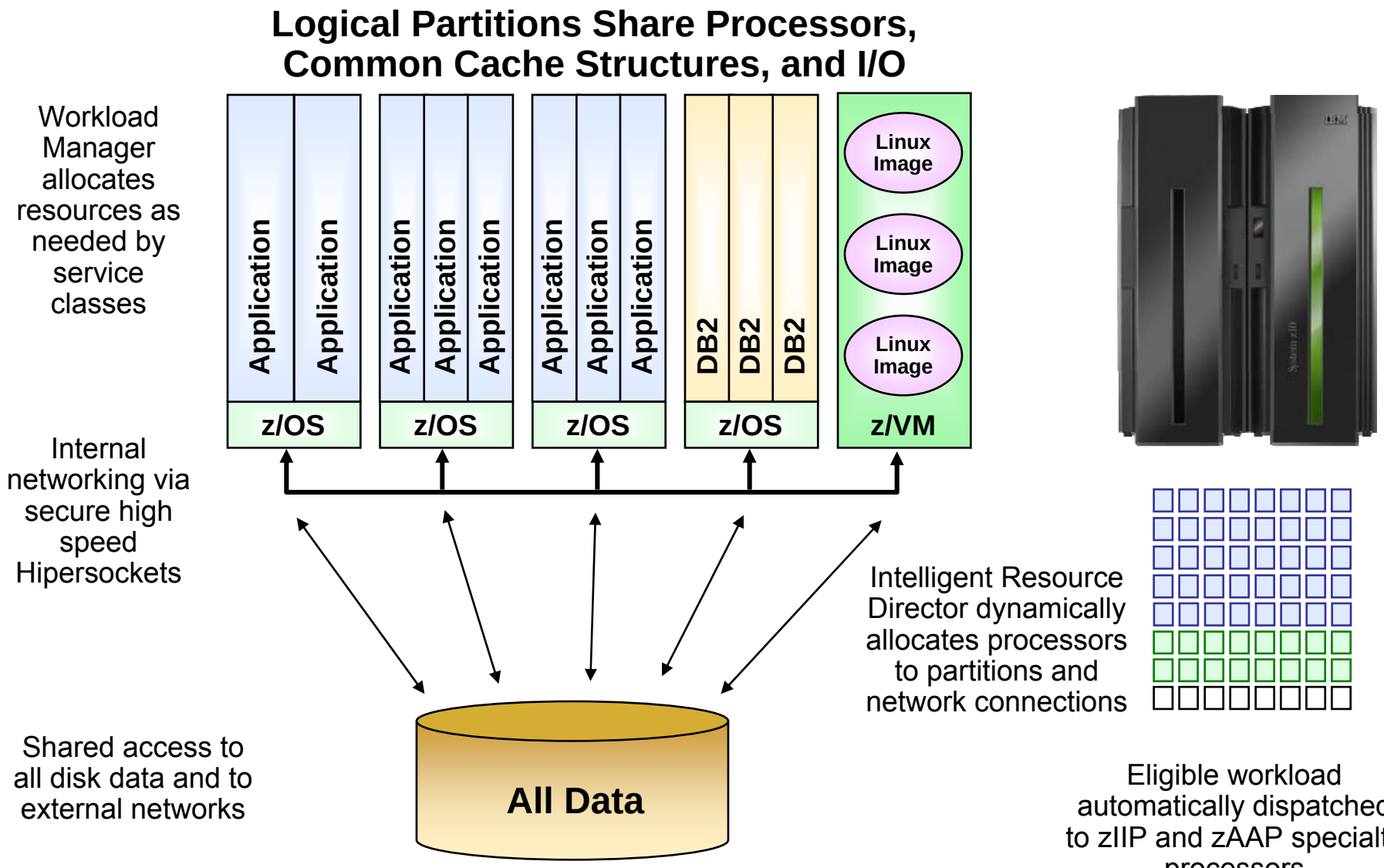
- Consolidating workload means running multiple workloads on the mainframe at the same time
- Consolidation achieves greater utilization of assets which minimizes cost per unit of work
- Same principal was applied by Henry Ford at the dawn of the industry era
  - It still applies today
- Workload consolidation on a mainframe squeezes out cost to achieve maximum efficiency
  - And return on investment

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

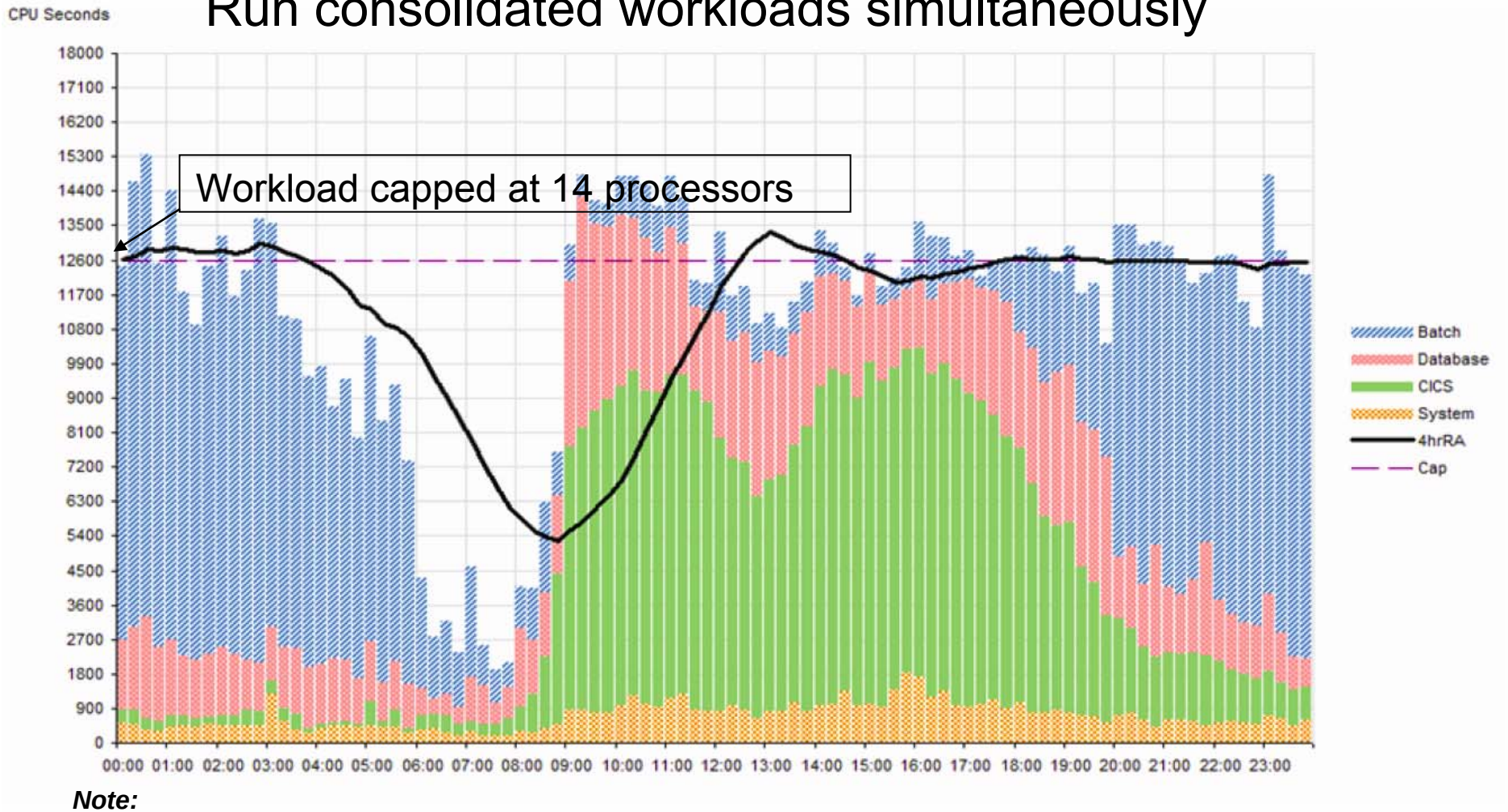


Multiple Workloads on a Single Server Requires Business Oriented Workload Management

- 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 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"*

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

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

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
  - Forecast $16M savings in 3 years, achieved in 2 years

Vastly improved TCO, Speed & Simplification

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)

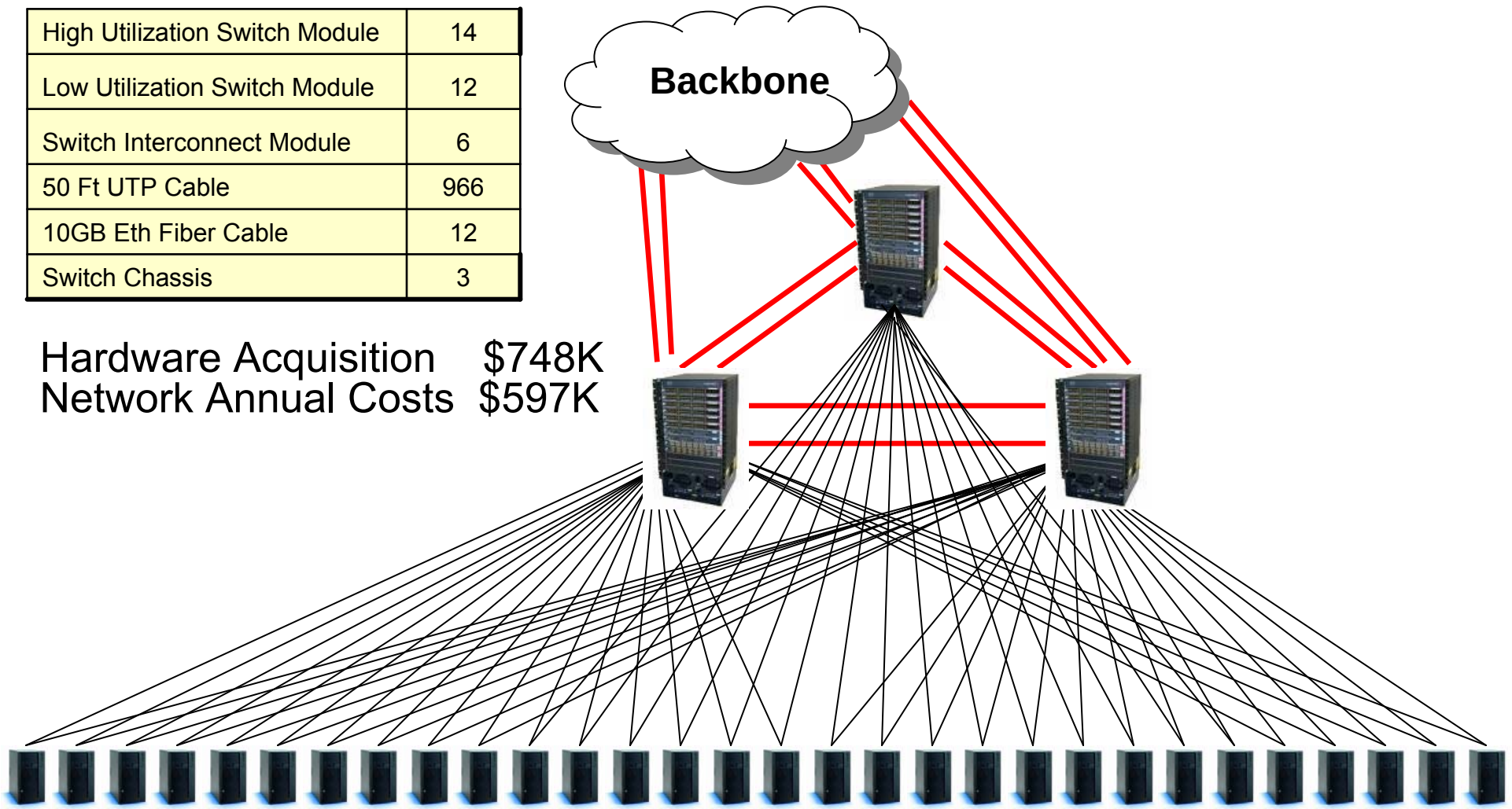
- **Note the servers:IFL ratio has decreased since initial deployment (23:1 decreased to 14:1)**
  - Nationwide used to put a single JVM per physical server
  - Now they have multiple JVMs per virtual server
  - They estimate 483 virtual servers are running equivalent workload to well over 1000 physical 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

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



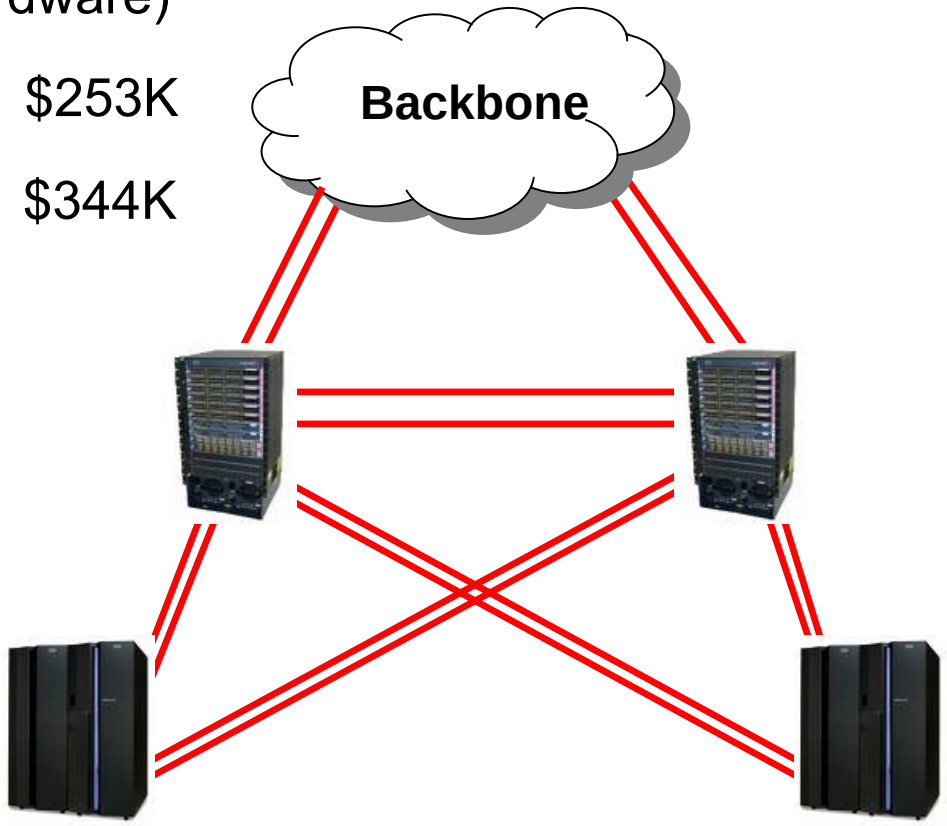
The diagram only shows **30** of the **483** Servers at Nationwide

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



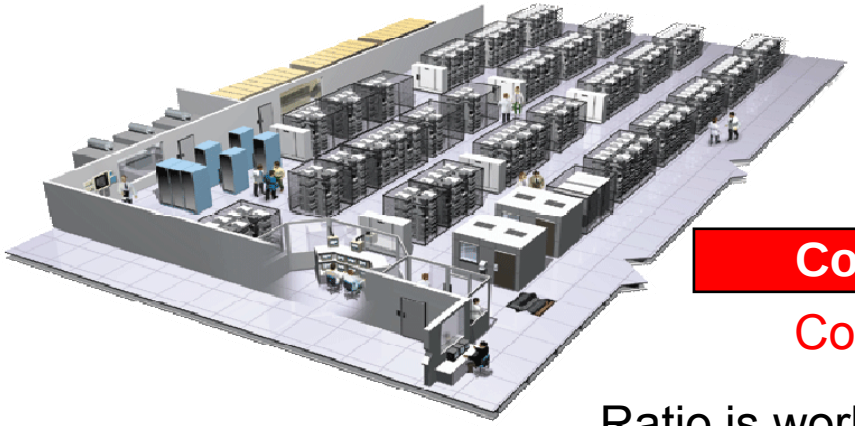
Case Study: Québec Government Runs Oracle at IFL Prices

- 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?



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	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

3 year TCO $4.80 M

Annual operating cost $0.31 M

Breakeven 2 yrs

Or maintain existing 200 server farm for Oracle data servers

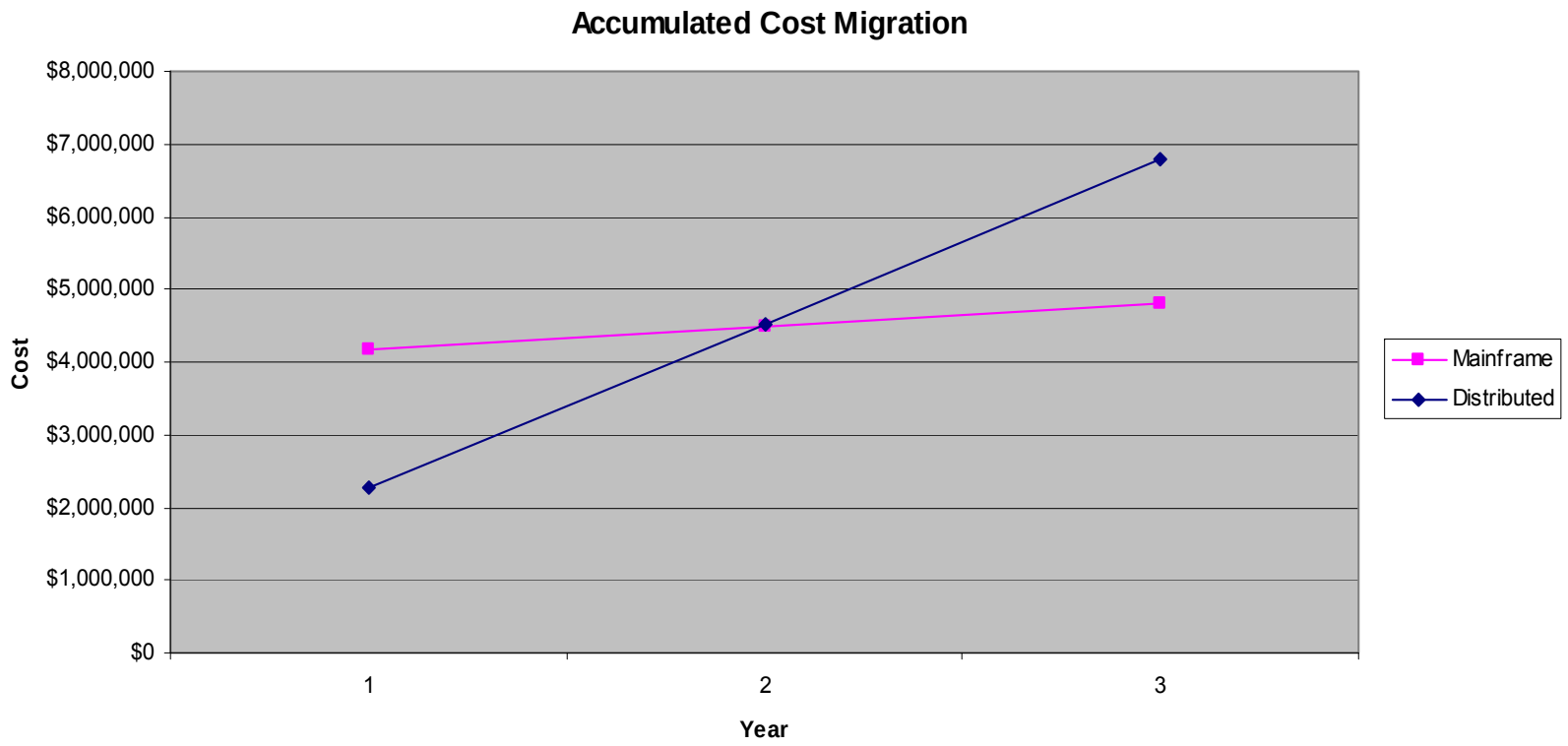
50 → 1

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

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

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 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

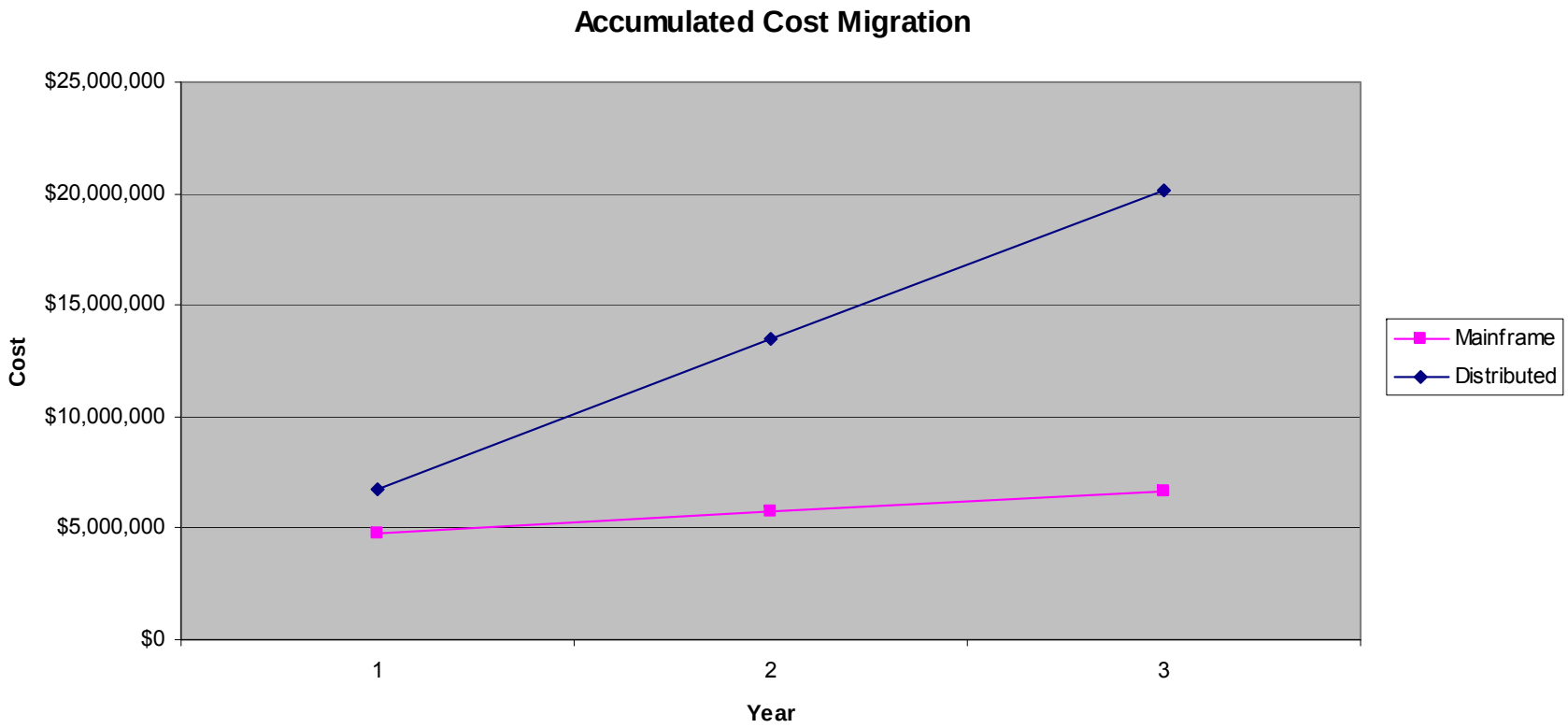
Or maintain existing 200 server farm for Oracle data servers

3 year TCO $20.17M

Annual operating cost $6.72 M

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



200 Oracle DBs to 4 IFLs on Existing Mainframe

DEMO: Fast Linux Provisioning

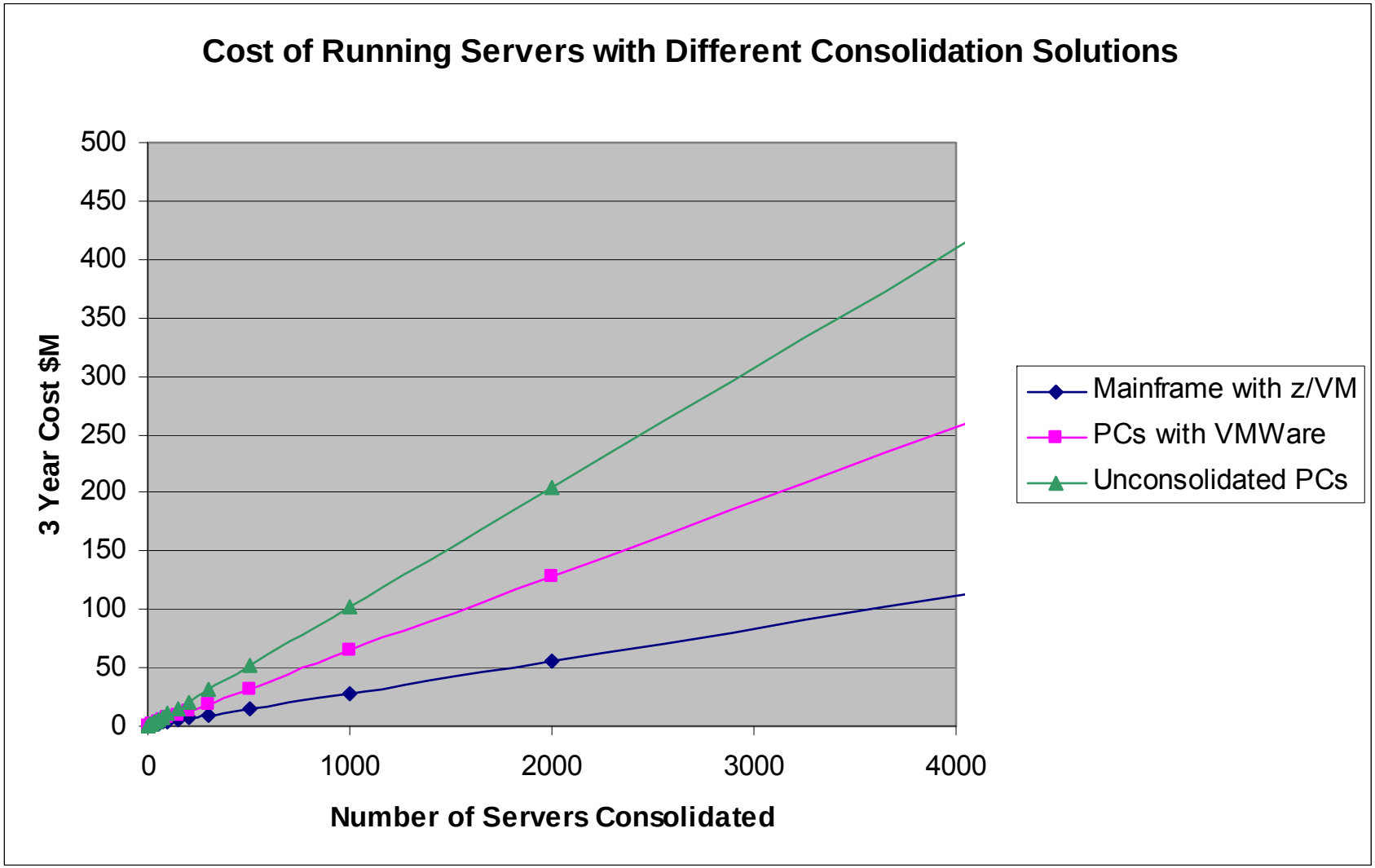
- Another benefit of virtualization is speed of provisioning
  - No additional resources required, no purchase necessary!
- Coupled with standardization, reduces complexity
- Need a new machine? Let's see how fast we can get one...

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 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

Result: Consolidation on z/VM Saves the Most Money



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

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

Service Oriented Finance CIO