

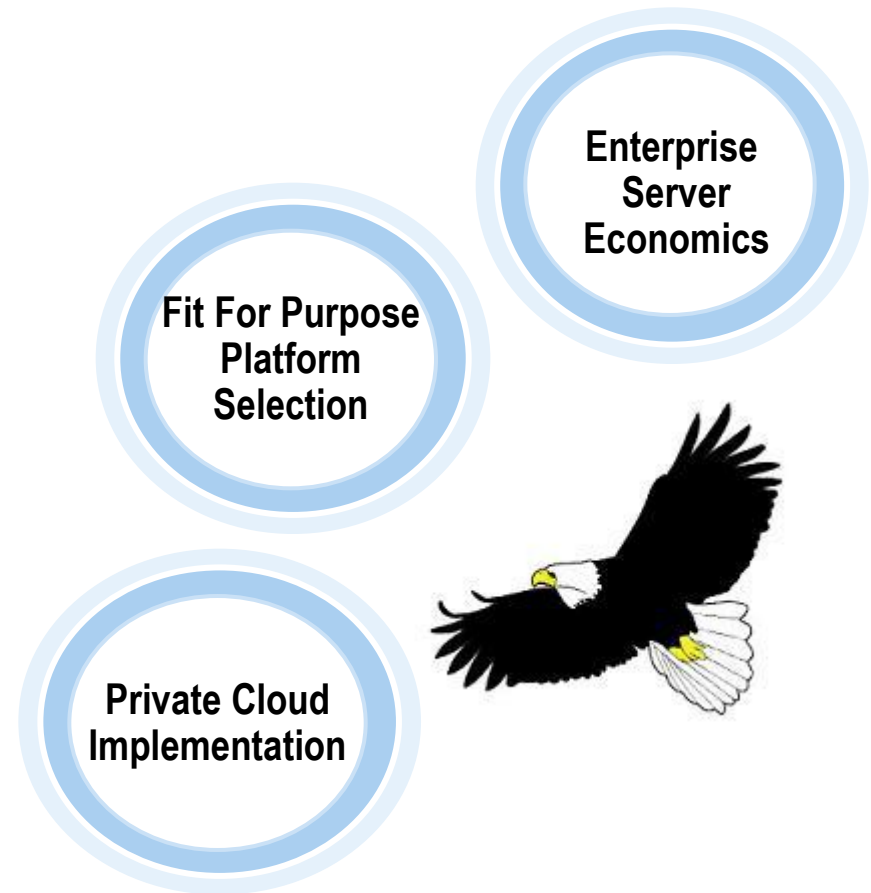
The New zEnterprise – A Cost-Busting Platform

TCO Lessons Learned, Discovering Total Costs

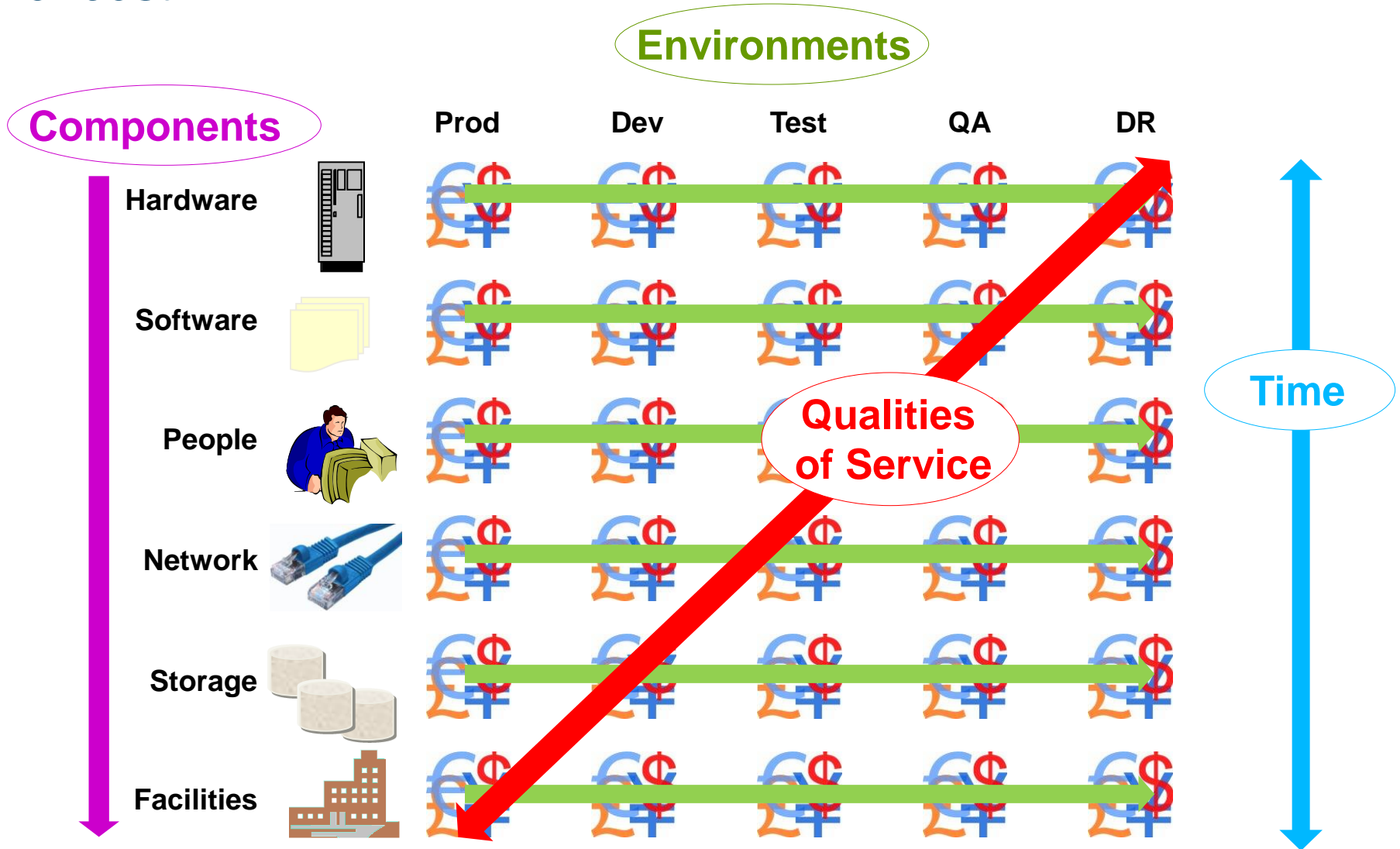


The IBM Eagle team helps customers understand mainframe costs and value

- **Worldwide** team of senior technical IT staff
- **Free of Charge** Total Cost of Ownership (TCO) studies
 - Help customers evaluate the lowest cost option among alternative approaches
 - Includes a one day on-site visit and is **specifically tailored to a customer's enterprise**
- Studies cover POWER, PureSystems and Storage accounts in addition to System z
 - For both IBM customer and Business Partner customer accounts
- Over 300 customer studies since formation in 2007
- Contact: eagletco@us.ibm.com



Understanding TCO means understanding multiple dimensions of cost



Some mainframe clients are tempted to move workloads off the mainframe, allegedly to save money



z900
and
z/OS v1

... our hardware and software are old...

“...we’re only running 87 MIPS...”

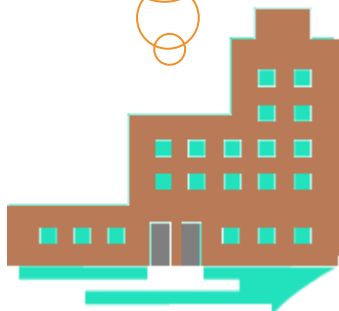


... our mainframe is pretty small...

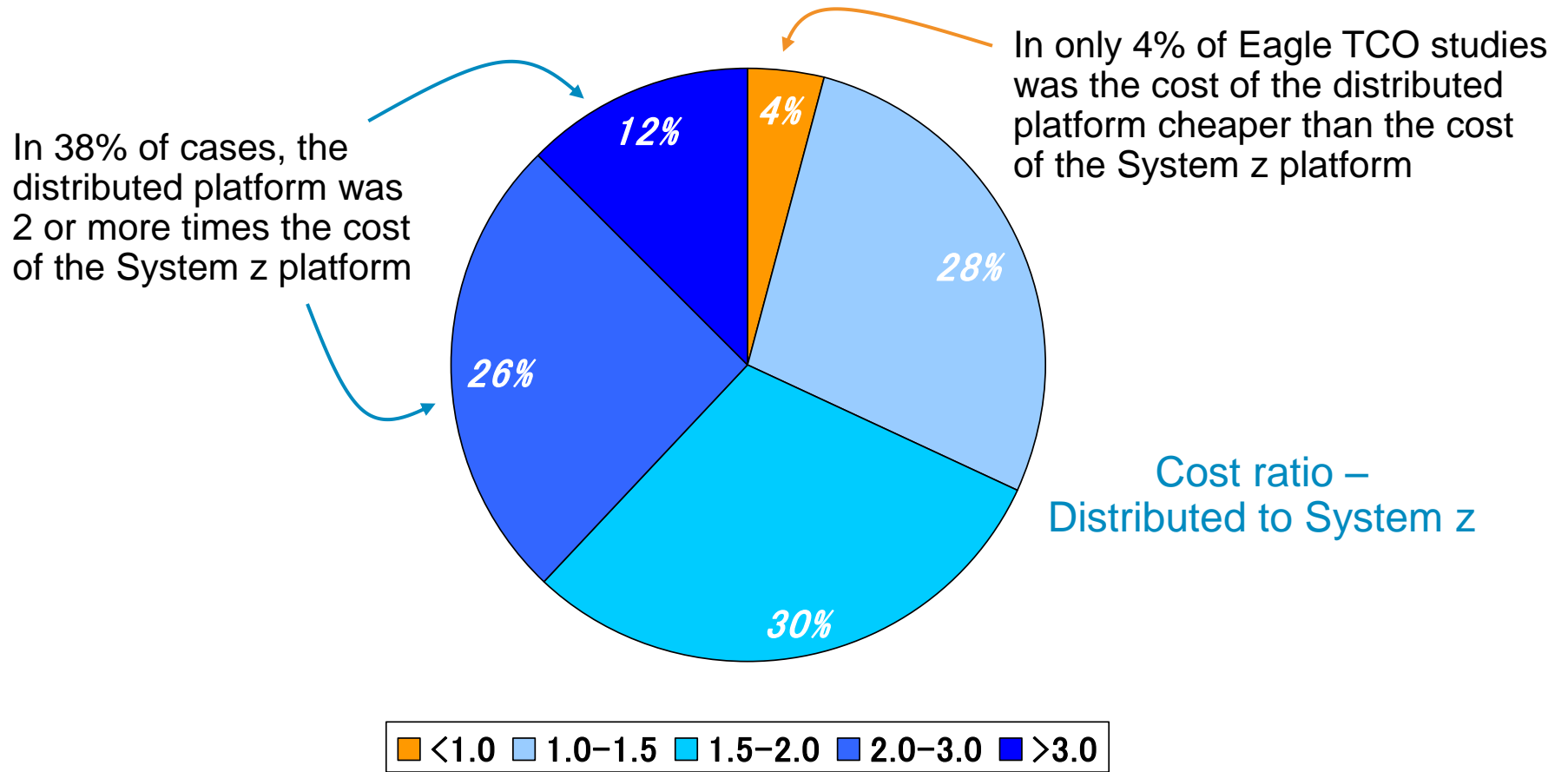


\$\$\$\$

... accounting is telling me the mainframe is expensive...



But Eagle team data shows that in 96% of mainframe rehosting cases, clients ultimately end up spending *more* for an offload



Sampling of 97 Eagle team TCO studies from 2007 - 2011

Status of an on-going offload project

We did a big offload*!
Big savings!
ROI in 2 years!



European financial company

*actually a *projection* for a project
not yet started (financial customer)

The reality...

...a couple of years later

- No decrease in mainframe MIPS...
...but addition of 10s of Intel multi-core servers...
- Project only 2/3 done, but \$34M spent already...
- Operational FTEs increased by 4 so far...
- Project 18 months behind schedule...
- DB2 migration proving difficult...
- Executive sponsor no longer employed...

In general, rehosting projects tend to be longer than anticipated and more expensive

1 year

Project length

Typically turns into...

2-3 years*

Project length

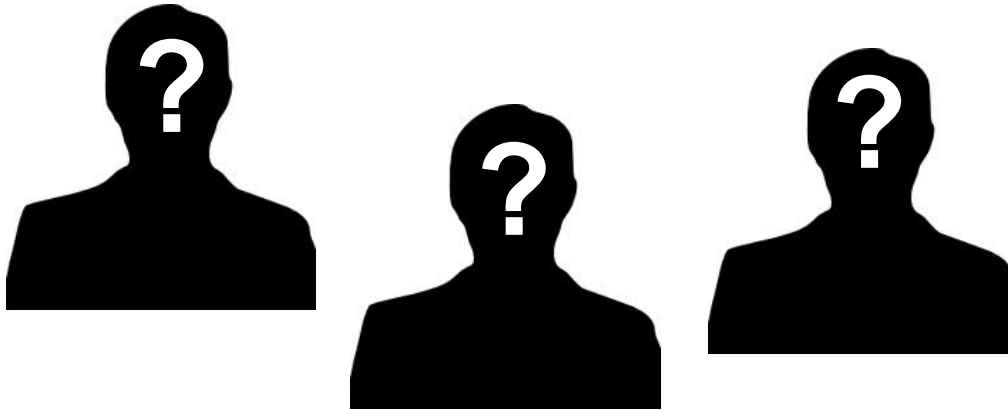
Even if results includes annual savings, TCO is typically quite poor

Examples:

	<i>European government entity</i>	<i>US county government entity</i>
<i>Project time frame overrun</i>	1 year	1 year and 8 months
<i>Final total migration costs</i>	\$19.6M	\$6M
<i>Payback period</i>	>29 years	>20 years

* On average, real customer migrations that completed took 2x the original projected period

We often get asked about “failed” rehosting attempts...



*But nobody
likes to admit
“failure”!*

- Infer failures
 - Search for announcements of mainframe rehosting claims...
 - Follow up to determine what was achieved...
 - Is IBM still receiving mainframe revenue from the customers?
- Based on Eagle Team experience, we know a couple of representative real examples...
- The cost of a failed rehosting project can be quite expensive...

In 2005, Canadian insurance company partnered with Micro Focus on a rehosting project...

Lombard Canada Ltd. wanted to replace their old mainframe

- 200 MIPS
- CICS, COBOL, VSAM, DB2

**VP of IT
Lombard Canada Ltd.**



*"We estimate this project will save us in excess of \$1 million a year..." **

BUT one year after starting, the project was abandoned

- System integrator and Micro Focus did not have the skills
- Millions of dollars spent with no results
- VP lost his position

Today, Lombard continues as a System z customer, moving to z114...

*Source: <http://www.finextra.com/news/Announcement.aspx?pressreleaseid=4858>

Asian bank project demonstrates another more recent example of failed rehosting

- 60 MIPS CICS/COBOL application plus additional 30 MIPS of Batch processing
 - 2.8M lines of COBOL code
 - 123K LOC in Assembler
 - 44K LOC of JCL
- IMS DB remained on System z
- **Two years later:**
 - Project abandoned after failing to complete development
 - \$5.7M spent but unable to estimate eventual deployment costs
 - Team of 10 was disbanded and left the business – no one could describe the problems encountered
 - Management responsible was fired



Ongoing rehosting project at US Retail company provides another example of the risks involved

Customer's stated objective:

- Offload 3,500 MIPS with Micro Focus...
- \$10M budget...
- 1 year schedule...

■ 18 months later:

- \$60M spent, but only 350 MIPS offloaded
- Increased staff to cover over-run
- Required additional hardware over initial prediction
- Implemented manual steps to replace mainframe automation
- Extended the dual-running period of the rehost...
- Executive sponsor no longer employed...



Eagle team had advised
against this offload...

Recent US government agency rehosting project also had to be abandoned

- 360 MIPS of CICS/COBOL for payroll and HR
 - 4M lines of COBOL code
 - Estimated 270K LOC needed to be changed
- Additional 30 MIPS of batch
- IMS DB to stay on System z
- Agency estimated a 5 year contract worth \$80M to perform this offload

- **Project abandoned** and manager responsible for the decision left



Why are rehosting costs underestimated?

From HP's "Mainframe Alternative Sizing" guide, published in 2012...

MIPS Level	z196 Models	Actual MIPS	z10 EC Models	z10 Actual MIPS	z10 BC Models	z10 BC Actual MIPS	z114 Models	z114 Actual MIPS	HP Cores Estimate	Total HP equivalent MIPS
1,000	2817-701	1,202	2097-701	889	2098-Z02	1250	2818-Z01	782	2	866
2,000	2817-702	2,272	2097-702	1,667	2098-Z03	1784	2818-Z03	2026	5	1,860
3,000	2817-703	3,311	2097-704	3,114	2098-Z05	2760	2818-Z05	3139	8	3,021

Can a 2-chip, quad-core x86-based Blade server really replace 3,000+ MIPS?

- Simple core comparisons are inherently inaccurate...
- Real world use cases suggest this number is off by a factor of **10-20 times**

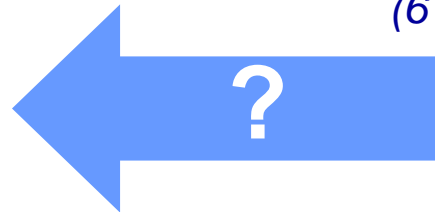
Eagle TCO study shows this mid-sized workload was *not* cheaper on the distributed platform

6x 8-way (x86) Production / Dev
2x 64-way (Unix) Production / Dev
Application/MQ/DB2/Dev partitions

2x z900 3-way Production / Dev / QA / Test



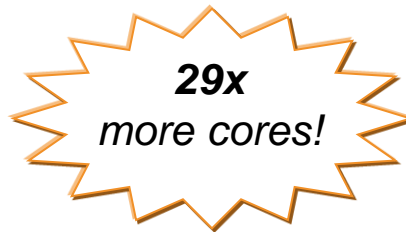
1,660 MIPS
(6 processors)



176 processors

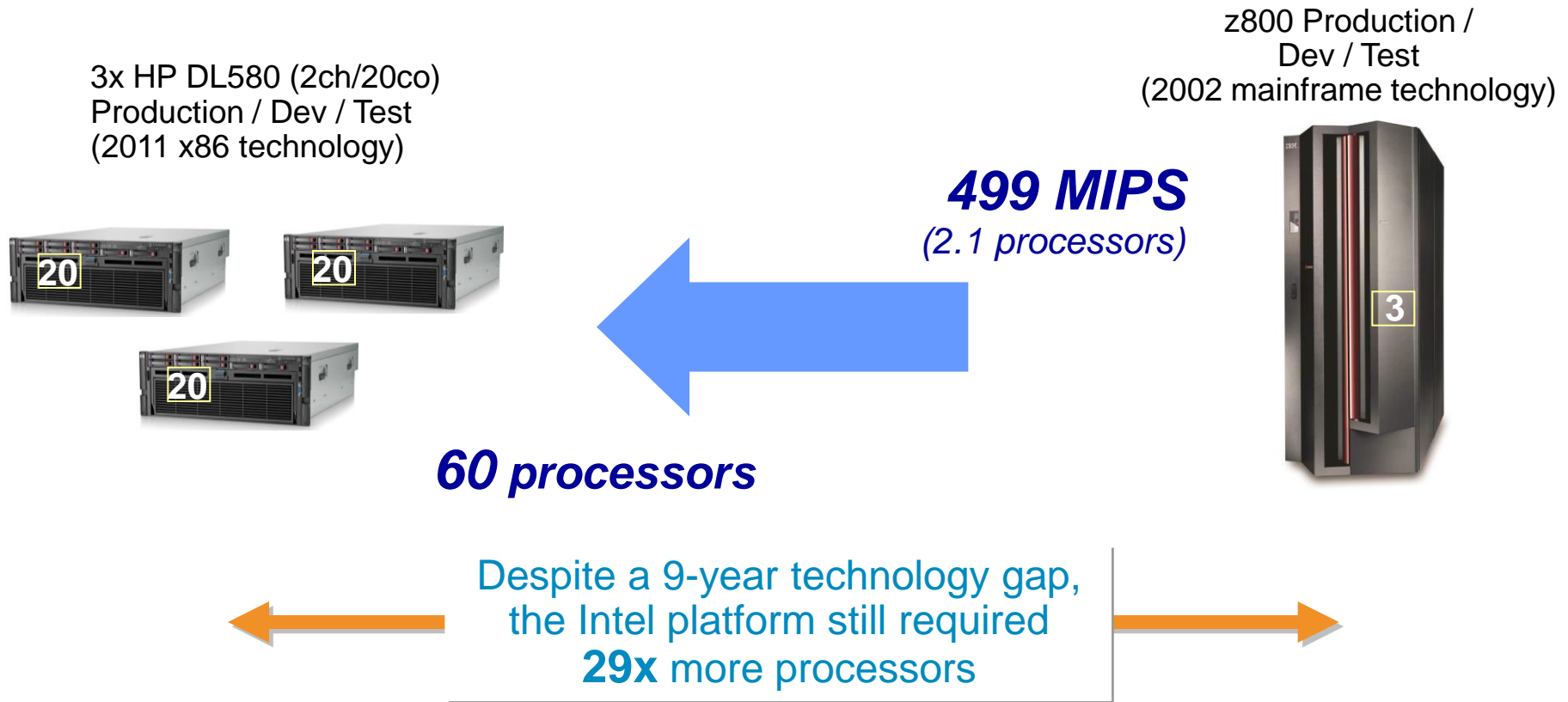
\$25.4M (5 yr. TCO)

\$17.9M (5 yr. TCO)



482 Performance Units per MIPS

Eagle TCO Study shows a pure Intel offload was not cost-effective...



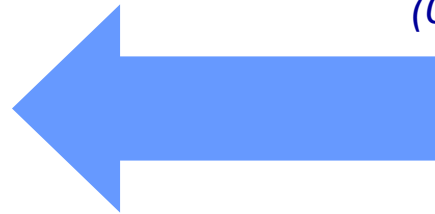
Eagle TCO study shows this small workload was *not* cheaper on the distributed platform

2x 16-way (Unix) Production / Dev / Test / Education
App, DB, Security, Print and Monitoring
4x 1-way (Unix) Admin / Provisioning / Batch Scheduling

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



36 processors

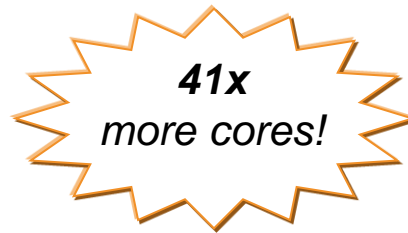


332 MIPS
(0.88 processors)



\$17.9M (4 yr. TCO)

\$4.9M (4 yr. TCO)



670 Performance Units per MIPS

Eagle TCO study shows even this VERY small workload was not cheaper on the distributed platform

z890 Production / Test

4x p550 (1ch/2co)
Application and DB



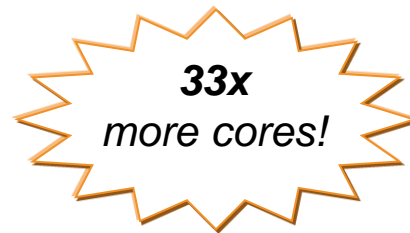
8 processors

88 MIPS
(0.24 processors)



\$8.1M (5 yr. TCO)

\$4.7M (5 yr. TCO)



499 Performance Units per MIPS

Slipped Schedules and Major Reduction in Scope – Customer Example

Schedule Objectives			
Met / Not Met	Scheduled Completion Date	Actual Completion Date	Variance
Not Met	Original 6/15/07 moved to 5/31/08 moved to 6/30/08 moved to 6/30/09	11/30/08	165% based on August 9, 2008 transfer of final application

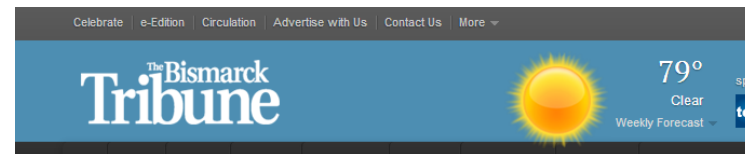
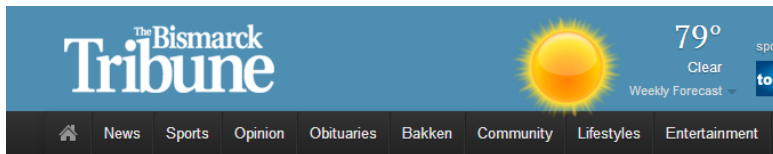
Major Scope Changes
<ul style="list-style-type: none"> • Extension of project timeline – September 2006 • Substitution of Micro Focus JCL Engine for original product ESPBatch – January 2007 • Removal of NDPERS from the migration – July 2007 • Removal of DHS TECS/Vision Application – September 2007 • Removal of DOT Drivers License Application – December 2007 • Removal of all of Phase IV (DHS and ITD Billing Applications) May 2008 • Removal of all DOT applications from the migration – July 2008

- **Original Completion Date 6/2007 – Actual “completion” 11/2009**
- **Major Scope reductions throughout the project**

Slipped Schedules and Major Reduction in Scope

Schedule Objectives				
Met / Not Met	Baseline Budget	Actual Expenditures	Variance	
Not Met	\$8,271,274	\$5,762,037	<u>Planned</u>	<u>Actual</u>
			Applications Migrated	84 46
			Percentage Completed = 55%	
			CPU Reduction:	77% 10%
			Budget Variance Based on Applications Migrated = 127%	
			Budget Variance Based on CPU Reduction = 536%	

***35 MIPS
(of 350 MIPS)**



Glitches hamper computer system for Legislature

Recommend 0 Tweet 0 +1 0 Share Print Email

August 10, 2008 7:00 pm • Associated Press (0) Comments

Delays and production glitches have been common on major computer projects in North Dakota government. Now, the state Legislature, which is laboring to replace its own computer system, is getting its own lesson on how treacherous the job can be.

A \$5.7 million overhaul of the Legislature's system, which was scheduled for completion before the 2009 session begins in January, has been delayed, lawmakers and staffers say. The project's manager is being replaced this week.

Woes continue for computer revamp

Recommend 0 Tweet 0 +1 0 Share Print Email

November 23, 2008 6:00 pm • Associated Press (0) Comments

The North Dakota Legislature's proposed budget for the next two years includes \$3.91 million for a troubled computer replacement project that already has cost more than \$3 million without producing any usable software.

Earlier this month, the Legislative Council declined to pay a \$303,516 bill from the initiative's software developer, PTC Corp., of Needham, Mass. The bill was submitted for wrap-up work after the company notified the council it was dropping the project.

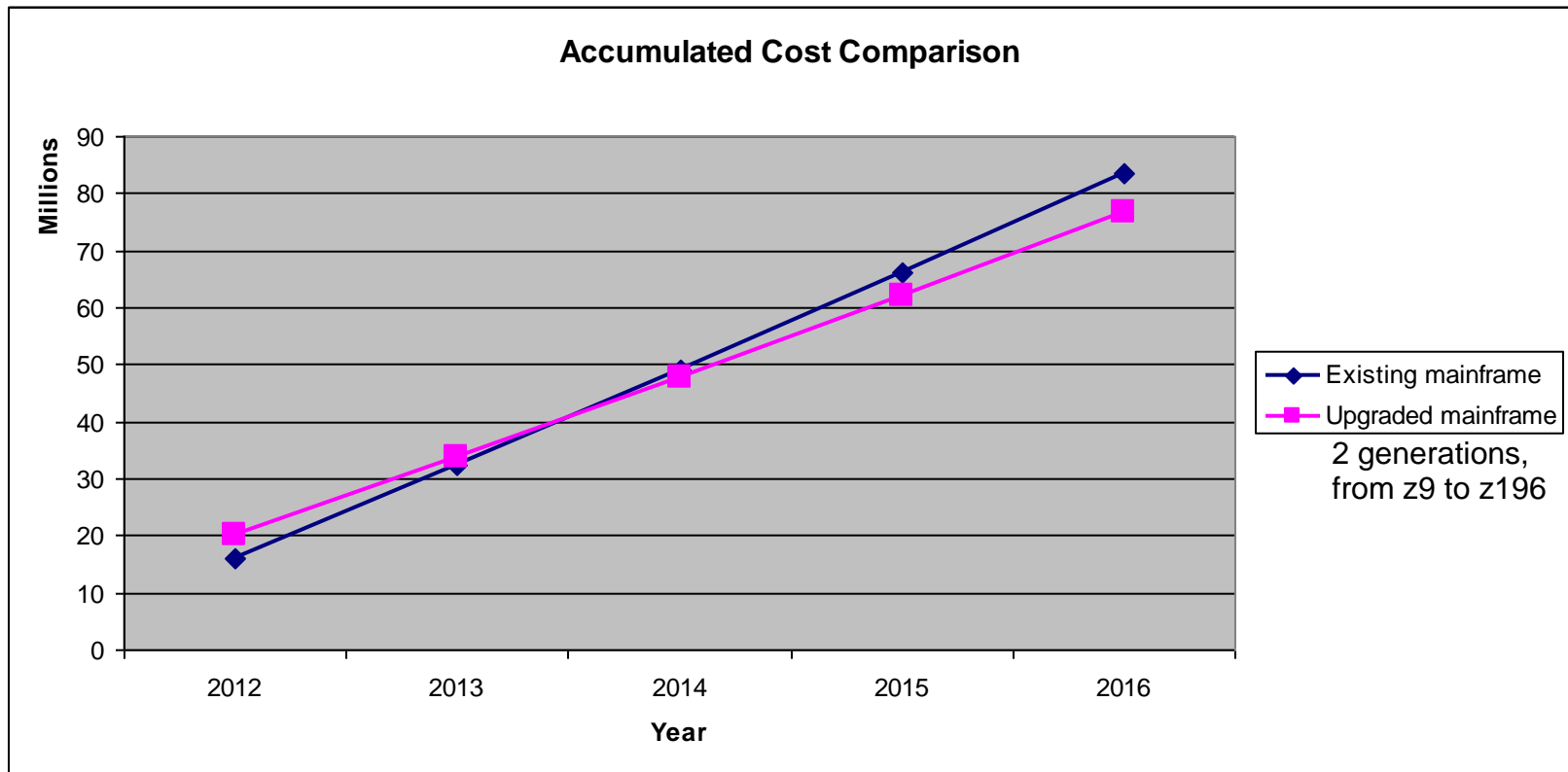
Lessons learned can be grouped into three broad categories

- Always compare to an optimum System z environment
- Look for not-so-obvious distributed platform costs to avoid
- Consider additional platform differences that affect cost

**All examples discussed
are from actual
Eagle Team customer studies**

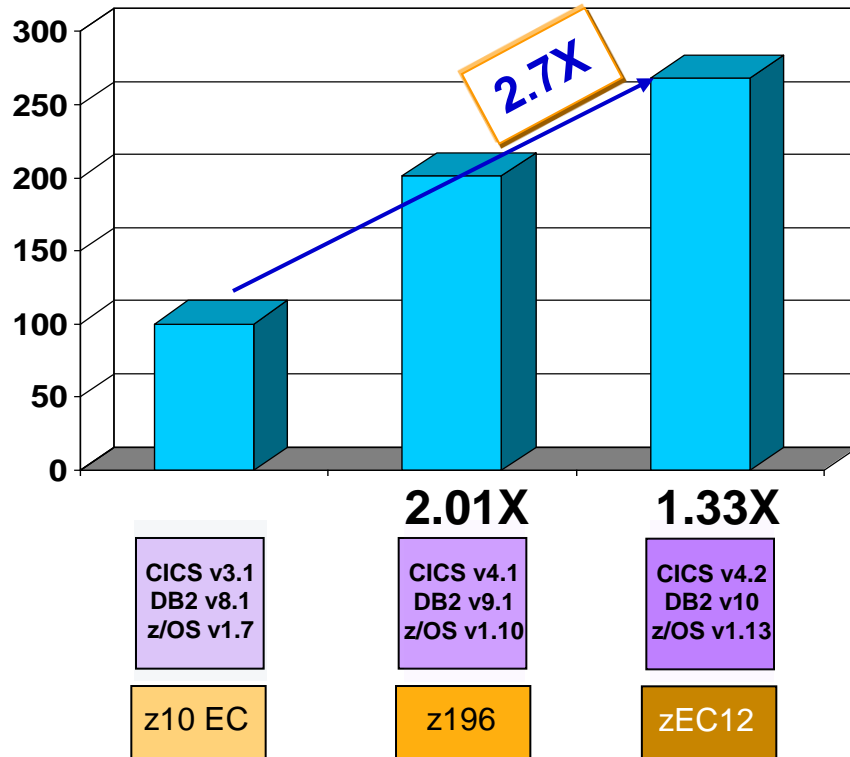


Keeping current with respect to hardware saves money



- Typical customer (European bank) hardware refresh scenario
 - 2M investment pays back >1M savings every year – most cases positive in a 3 year period
 - Savings from technology dividends and specialty processor offload
- Comparing latest technology servers to old mainframes is unfair but often done

Continuous hardware and software performance improvements means MLC costs reduced and hardware capacity freed



Customer examples:

(1) Large MEA bank

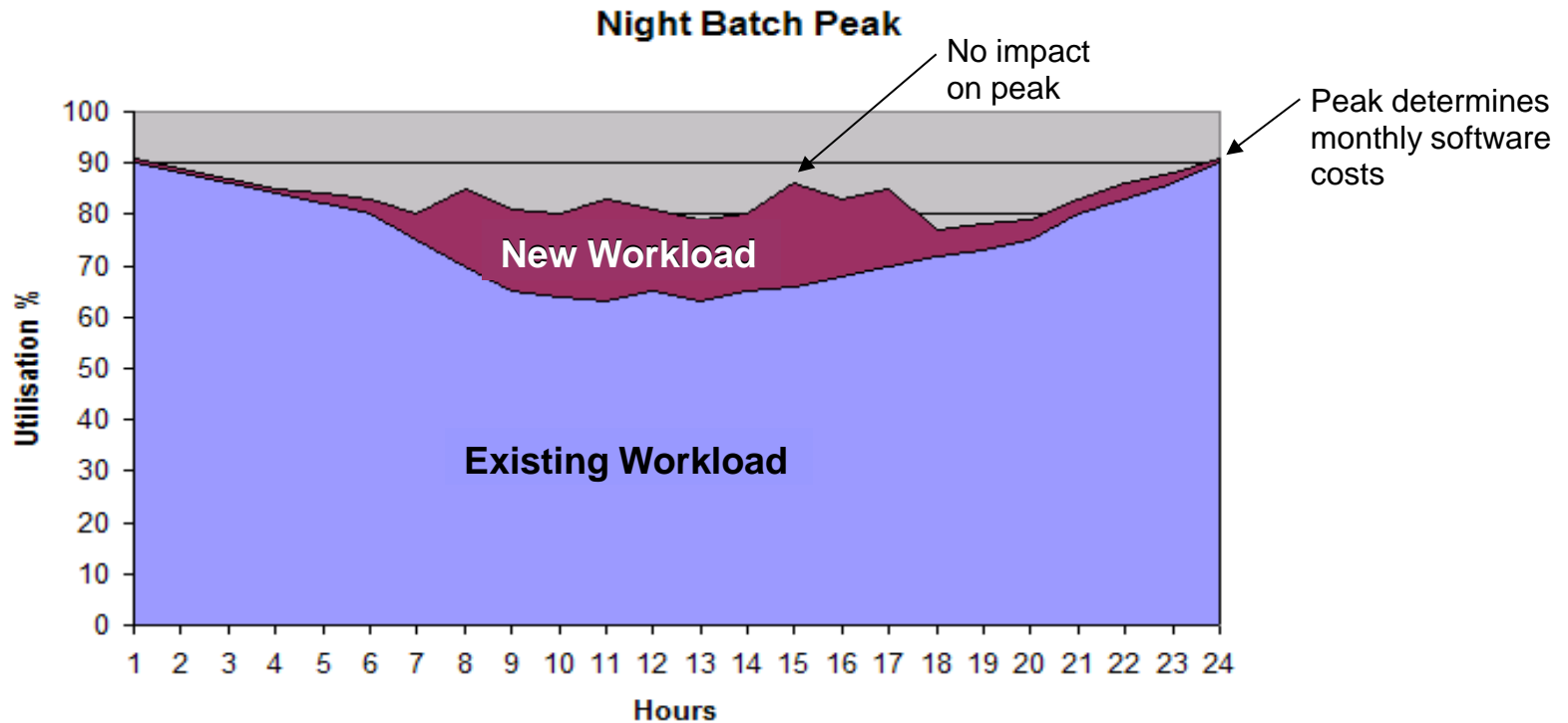
- Delayed upgrade from z/OS 1.6 because of cost concerns
- When finally did upgrade to z/OS 1.8
 - ▶ Reduced each LPAR's MIPS by 5%
 - ▶ Monthly software cost savings paid for the upgrade almost immediately

(2) BMW Autos

- Upgraded to DB2 10
- Realized 38% pathlength reduction for their heavy insert workload
 - ▶ Other DB2 10 users saw 5-10% CPU reduction for traditional workloads

IBM internal core banking workload. Results may vary.

Take advantage of sub-capacity pricing to create free workloads



- Standard “overnight batch peak” profile – drives monthly software costs
- Hardware and software are free for new workloads using the same middleware (e.g. DB2, CICS, IMS, WAS, etc.)
- Ensure you exploit any free workload opportunities, and conversely, avoid offloading free applications!

Save money by replacing ISV software with IBM software

A medium-sized European financial company...

Average Profile (BEFORE)	
Weighted MIPS	8,800
Cost Per MIPS per Year	Profile
IBM Software	1,000.00 24.72%
	0.00%
ISV Software	1,540.00 38.07%
TOTAL SW	2,540.00

IBM software costs increased slightly...

... but ISV software costs decreased dramatically!

Actuals (AFTER)	
Weighted MIPS	8,900
Cost Per MIPS per Year	Profile
IBM OTC	376.09 13.66%
IBM MLC	1,023.77 37.20%
ISV Software	136.09 4.94%
TOTAL SW	1,535.95

Result:
\$1,000 per MIPS
 per year savings!

Replacing ISV software with IBM software is also more cost-effective than offloading

A major global bank considered two options...

	<i>Mainframe Offload</i>	<i>Move to IBM Tooling</i>
<i>Investment cost -> time period</i>	\$54M -> 2 years	\$3M -> 1 year
<i>Predicted annual cost savings</i>	\$13M (from year 3)	\$6M (from year 2)
<i>5 Year TCO, breakeven time</i>	\$140M, year 7	\$101M, year 2
<i>Assessed level of risk</i>	Very high	Very low

The choice was obvious!

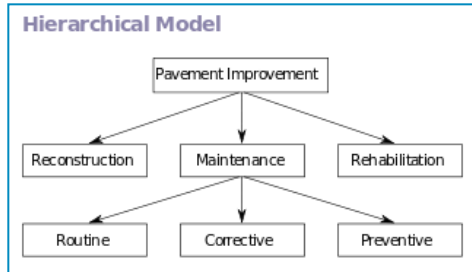


Large project,
expensive,
high risk,
distant payback



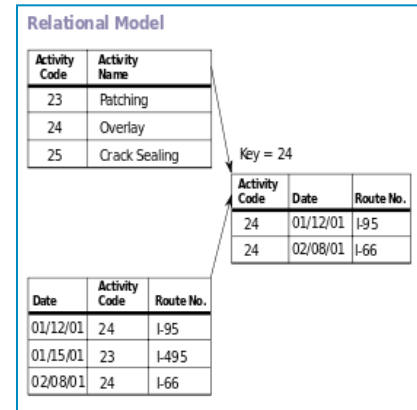
Small project,
cheaper,
lower risk,
instant payback

Changing databases can have dramatic capacity impacts



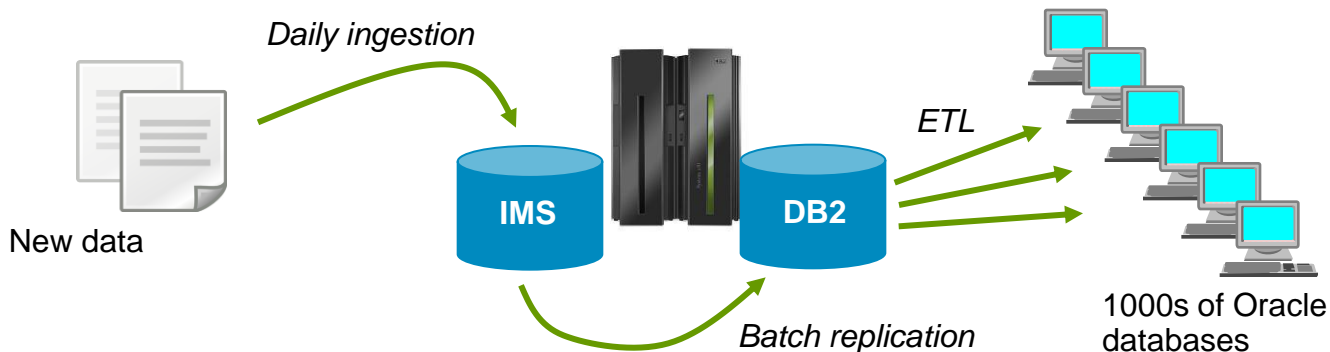
IMS is the most widely used hierarchical data store

Converting from IMS to DB2 can result in 2-3x more MIPS used and degraded response time



SQL databases, including DB2

A European financial company is attempting a conversion while continuing to run the business...



In 4 years, only 30% converted and €500M spent so far

Source: Wikipedia

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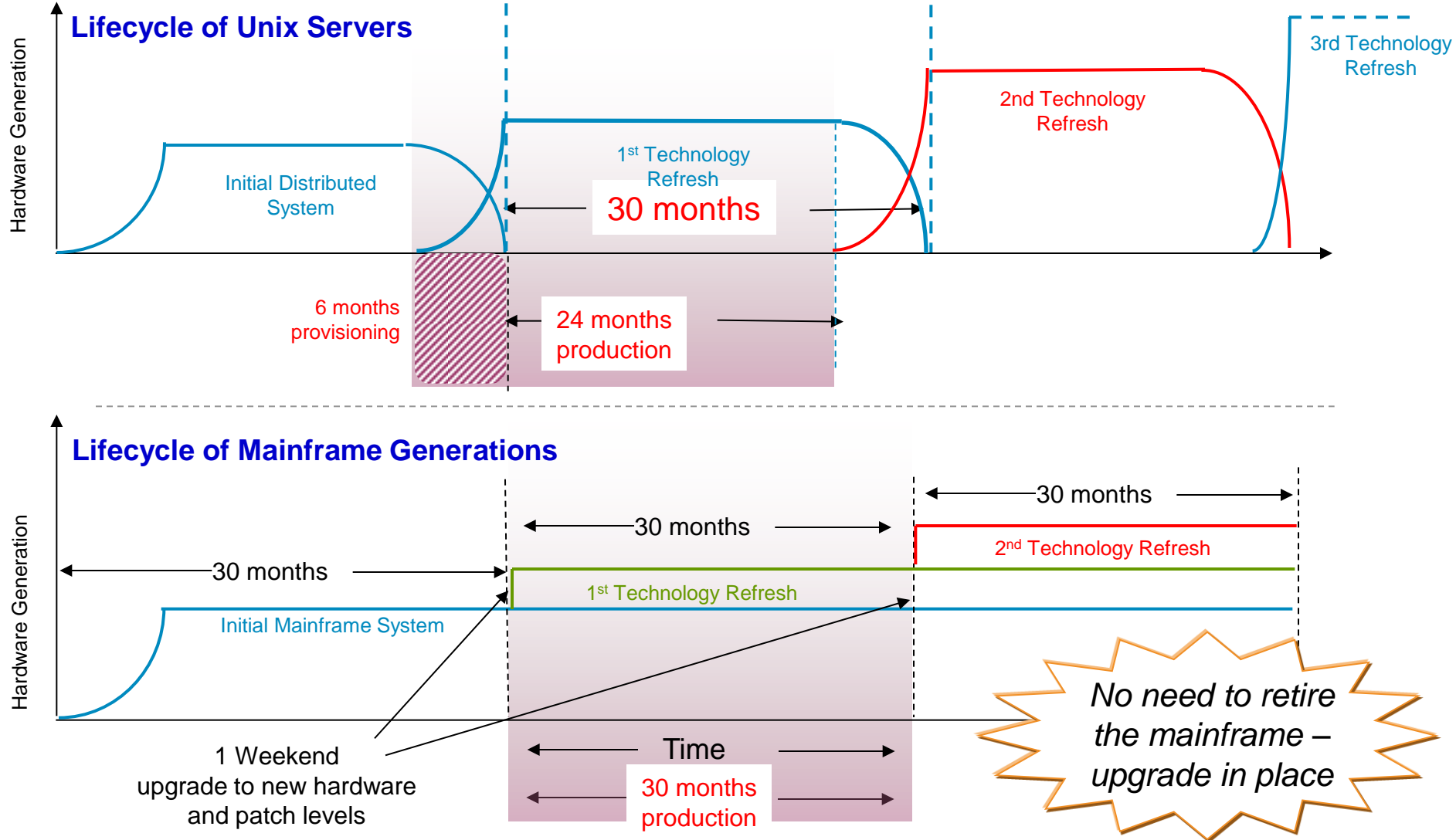
Distributed servers are typically replaced every 3-5 years



- Hardware refreshed in 2-7 year intervals, with average 3-5 years
- New, complete servers purchased each time
 - Typically additional growth capacity added (e.g., CPU, memory, I/O, etc.)
- Upgrade normally consists of purchase of additional (new) MIPS capacity
- Existing MIPS, memory, I/O facilities, specialty processors, etc. often carried over to new hardware

5 year TCO studies make sure to include 1 hardware refresh

Distributed server refresh leads to periods of reduced productivity along with extra costs



Disaster Recovery on System z costs much less than on distributed servers

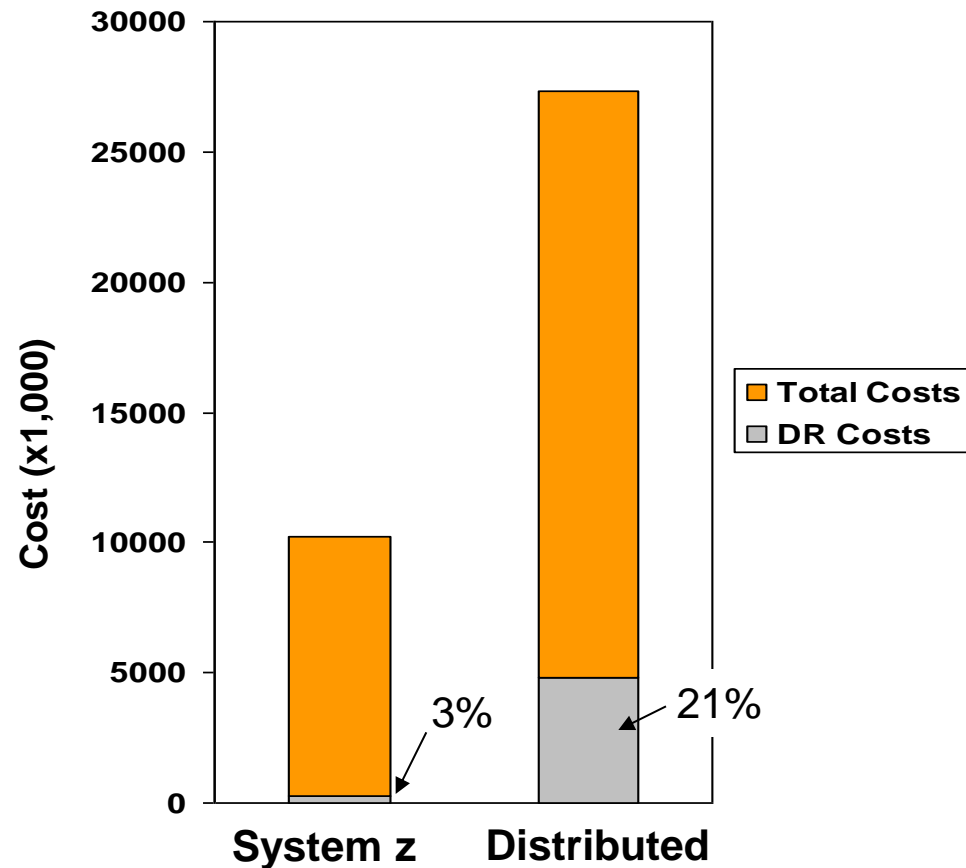
A large European insurance company with mixed distributed and System z environment:

Disaster Recovery Cost as a percentage of Total Direct Costs:

System z – **3%**

Distributed – **21%**

Two mission-critical workloads on distributed servers had DR cost > 40% of total costs



Disaster Recovery *testing* is also more expensive on distributed platforms

A major US hotel chain calculated how much it was spending for DR testing of its 200 distributed servers...

	<i>Person-hours</i>	<i>Elapsed days</i>	<i>Labor Cost</i>
<i>Infrastructure Test (3 times)</i>	1,144	7	\$89,539
<i>Full Test (4 times, inc. Infra Test)</i>	2,880	13	\$225,416
Annual Total – Distributed	14,952*	73	\$1,170,281
Estimated Total – Mainframe	2,051*	10	\$160,000

Customer estimates for Recovery Time Objective (RTO):

48-60 hrs
Distributed

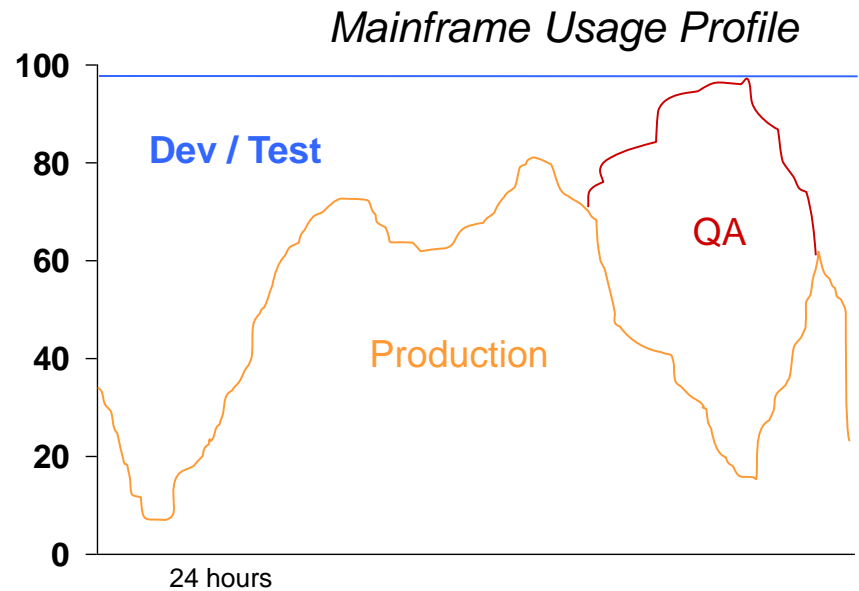
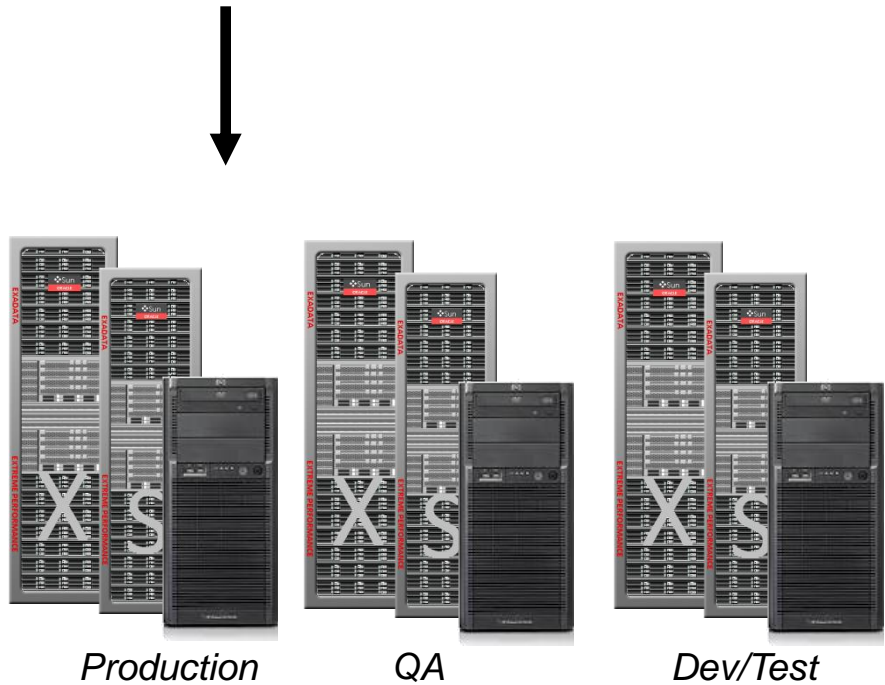
20 mins.
Mainframe

*Mainframe both
simplifies and
improves DR testing!*

* Does not include DR planning and post-test debriefing

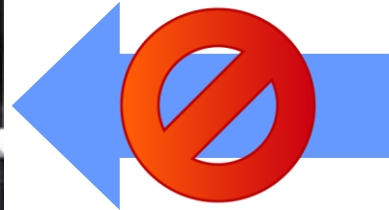
Non-production environments require fewer resources on the mainframe

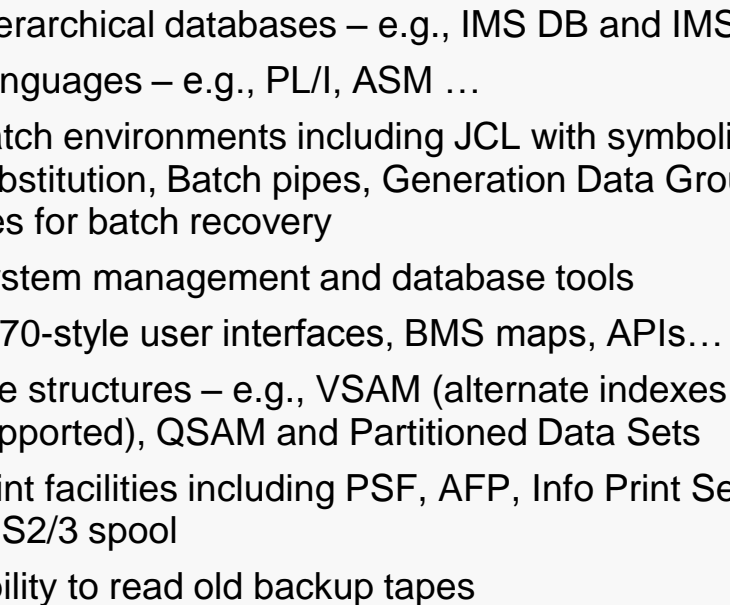
- Development and Test Capacity
 - Mainframe – Prod +20%
 - Distributed – a range, often Prod +200%



Replacement technologies are not always available for many mainframe functions

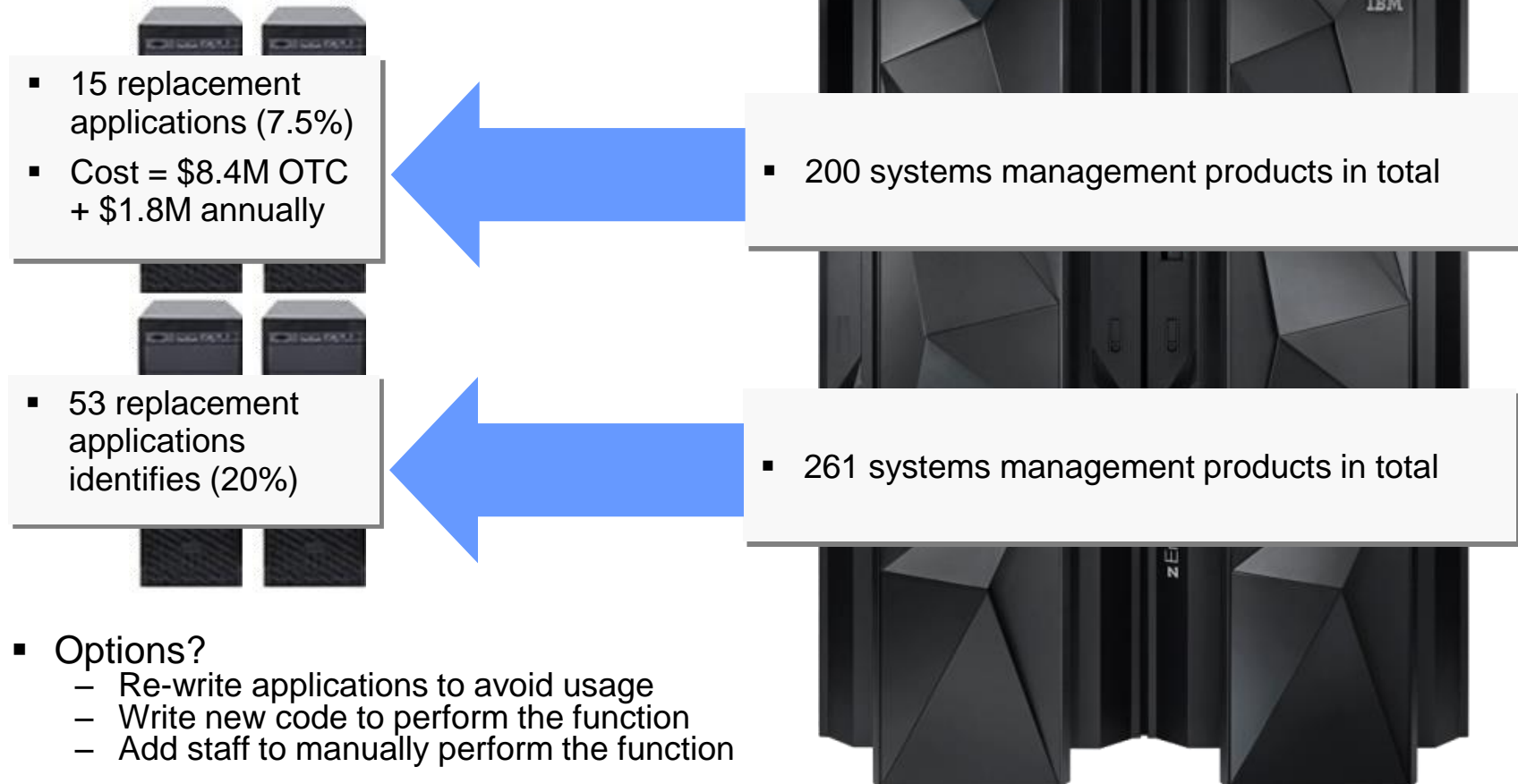
Rehosted platform



- 
- Hierarchical databases – e.g., IMS DB and IMS DC
 - Languages – e.g., PL/I, ASM ...
 - Batch environments including JCL with symbolic substitution, Batch pipes, Generation Data Group files for batch recovery
 - System management and database tools
 - 3270-style user interfaces, BMS maps, APIs...
 - File structures – e.g., VSAM (alternate indexes not supported), QSAM and Partitioned Data Sets
 - Print facilities including PSF, AFP, Info Print Server, JES2/3 spool
 - Ability to read old backup tapes

Eagle studies for two US retailers highlight missing systems management functionality

Rehosted platform



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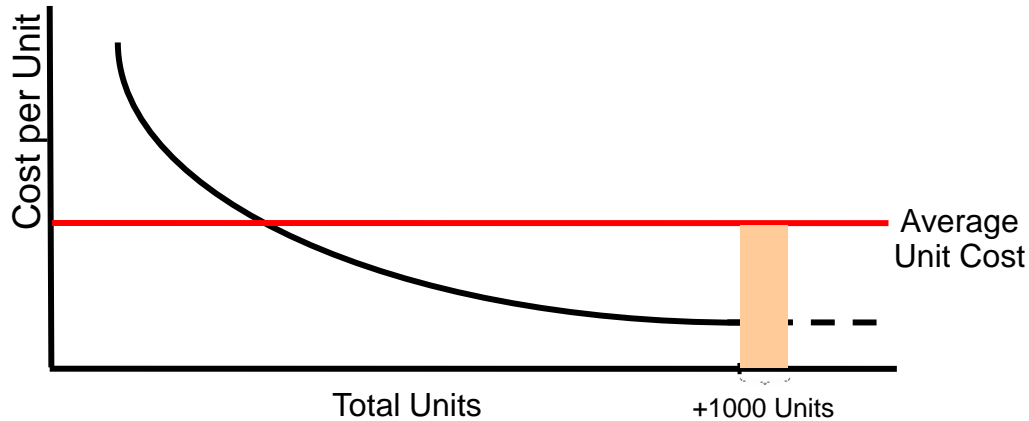
Mainframes with Capacity on Demand can respond to unforeseen business events

- Transportation company experienced a natural disaster
 - Required them to re-run a whole weeks worth of business while continuing to operate normally
 - Able to turn on double capacity immediately to achieve this



- Customer decided to run a Super Bowl advertisement with very short notice
 - Informed IT department to expect a massive capacity spike
 - Temporarily turned on additional capacity
 - Stress tested their systems prior to the event despite short notice

The cost of adding incremental workloads to System z is less than linear



- Mainframes are priced to deliver substantial economies of scale as they grow
- Doubling of capacity results in as little as a 30% cost growth for software on z/OS
- Average cost is significantly more than incremental cost

Example: European bank compared costs of growing WAS applications on distributed and on mainframe

Incremental cost of adding one large WAS application to platform (5 yr. TCO):

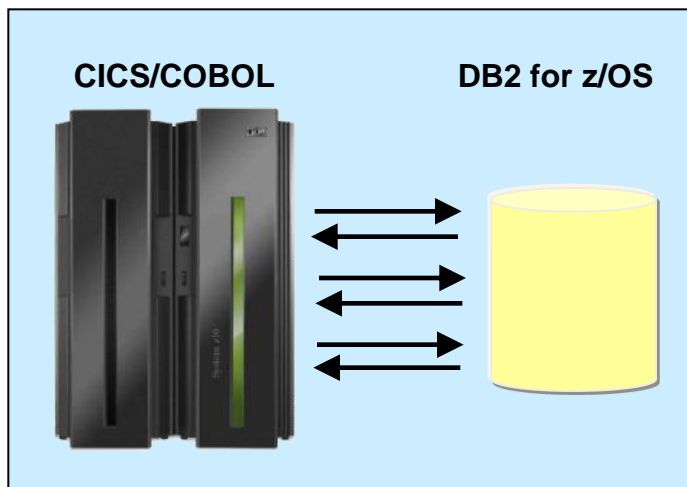
<p>€1.56M</p> <p>(378K OTC, 192K Y1, 249K Y2-5)</p> <p>Distributed</p>	<p>€1.29M</p> <p>(657K OTC, 42K Y1, 147K Y2-5)</p> <p>Mainframe</p>
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Future deployments will be targeted to the mainframe!

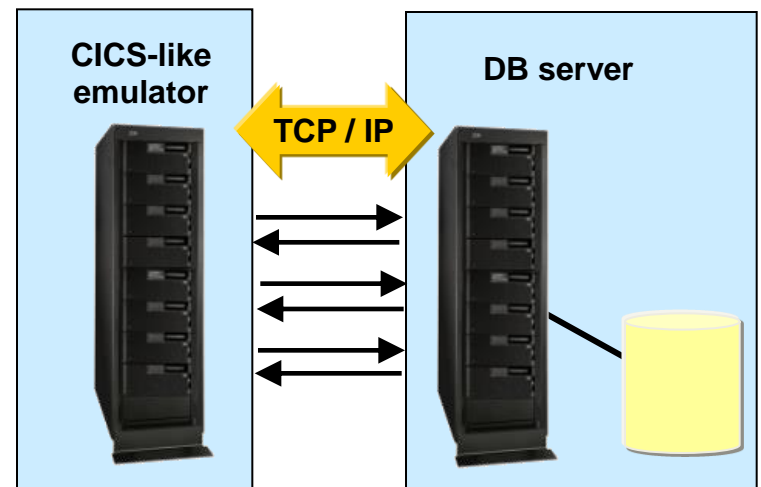
Some applications originally designed with co-located data are not good offload candidates

- Large insurance company rehosted portion of application as POC
 - Found TCP/IP stack consumed considerable CPU resource, and introduced security compromises and network latency
- European bank tried rehosting CICS workload to Linux while maintaining VSAM and DB2 data on System z
 - Induced latency resulted in CICS applications no longer meeting its SLA

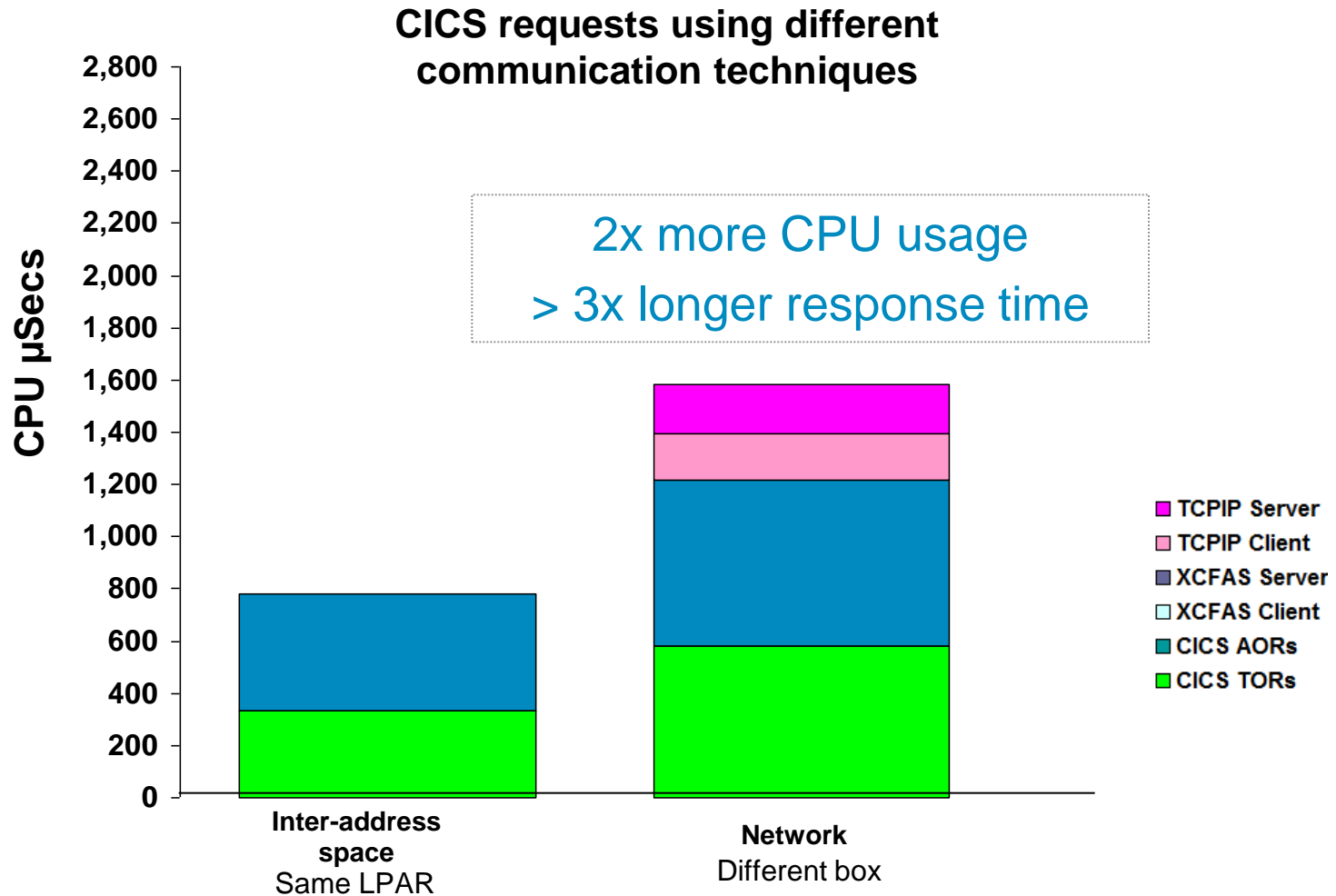
Single z/OS LPAR



Distributed architecture



Co-locating in the same address space is more efficient



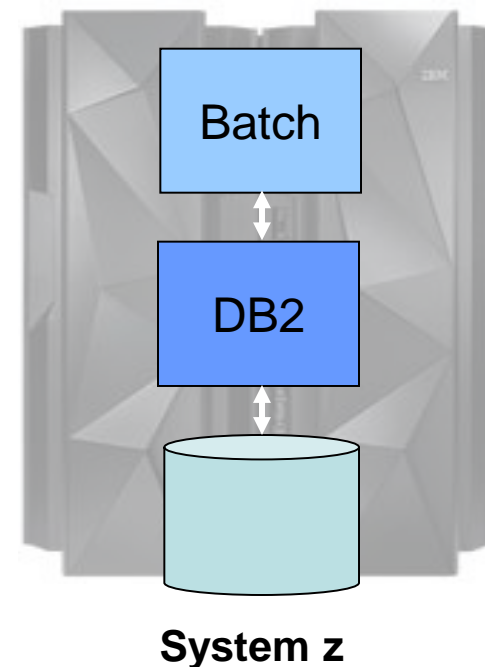
Source: http://hurgsa.ibm.com/projects/tp_performance/public_html/OS390CICS/reports/CICS%20TS%20V4.2%20Performance.ppt
and email with z/OS Communications Server development team

Moving Batch applications off the mainframe can have serious consequences

- Customer was facing large one-time charges for mainframe growth
- Rehosting vendor committed to a quick partial migration to avoid mainframe growth

Before:

- 1 Mainframe CPU usage units
- 1 Units of elapsed job time



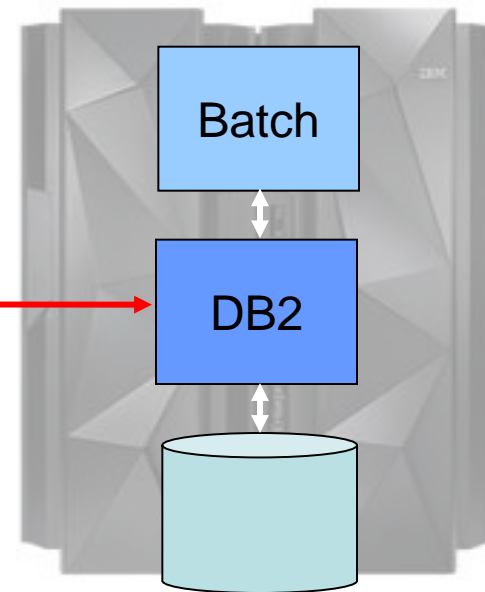
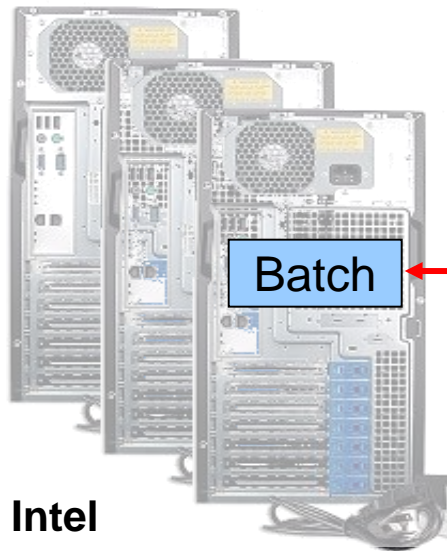
Moving Batch applications off the mainframe can have serious consequences

- Additional DRDA processing doubled mainframe CPU usage even though the application was now running on Intel
- Additional network latency dramatically increased elapsed job time (10-25x)

After:

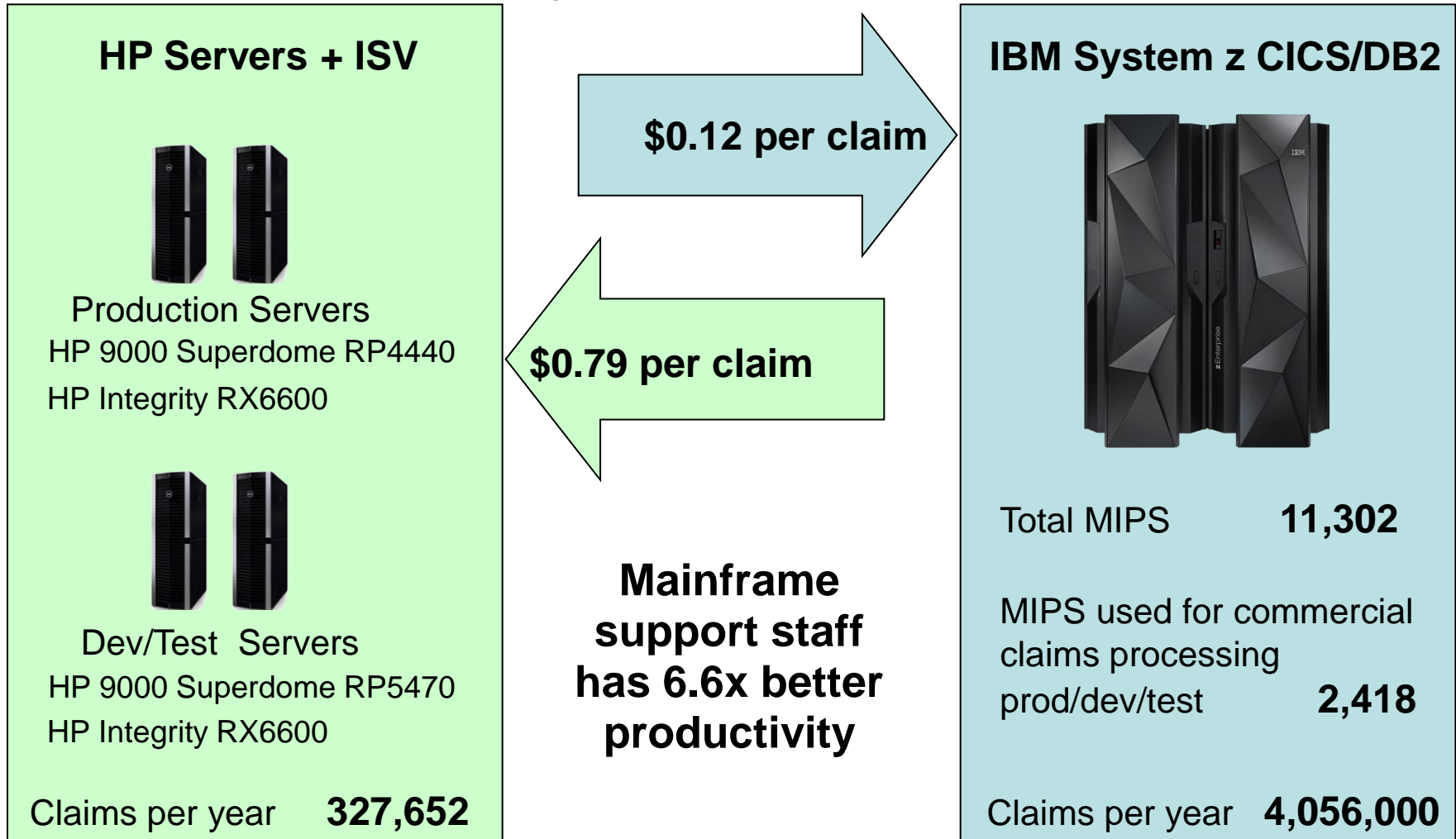
2 Mainframe CPU usage units

10-25 Units of elapsed job time

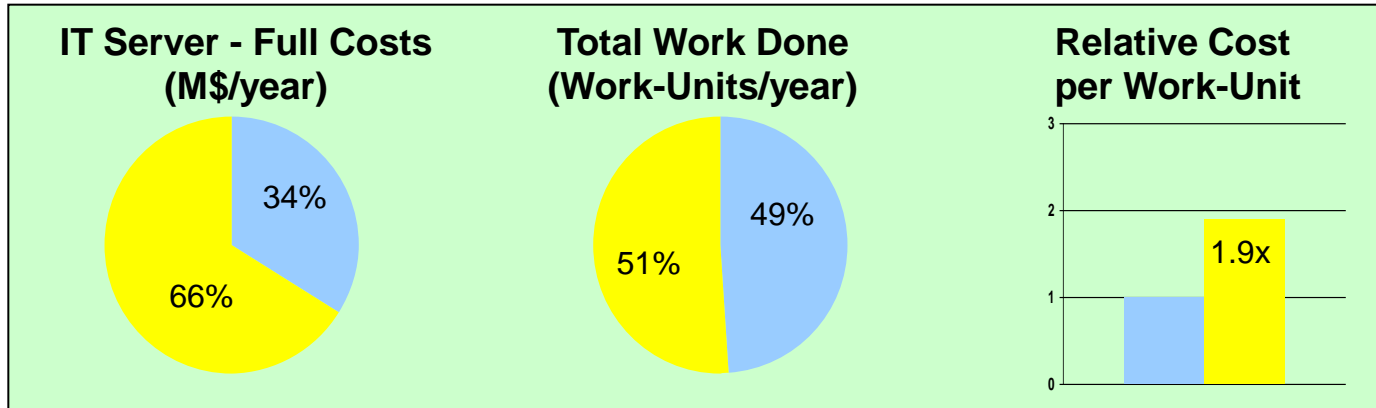


Large systems with centralized management deliver better labor productivity

Large US Insurance Company



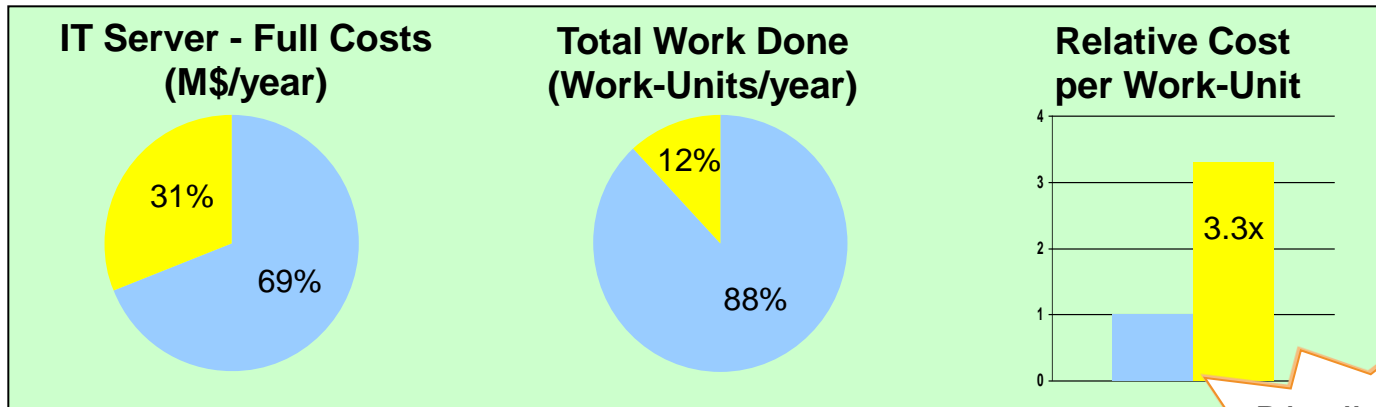
Cost per unit of work is much lower for the mainframe than for distributed platforms



Case 1:
Very large retail bank –
total of service delivery plus
application development

Mainly UNIX distributed
(>5000 servers)

■ Mainframe
■ Distributed



Case 2:
Medium retail bank service
delivery only. Mainly mainframe
2,500 MIPS, 13M txns/day.
Limited distributed servers
Windows + some UNIX
(~350 servers, 12% util'n)

**Distributed cost is
2-3x more than
mainframe!**

For more information on TCO and “The Reality of Rehosting”, see...

<http://www.redbooks.ibm.com/redpapers/pdfs/redp5032.pdf>

The Reality of Rehosting: Understanding the Value of Your Mainframe

An IBM® Redbooks® Point-of-View
publication

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Highlights

Moving applications from the mainframe to distributed environments often comes with the expectation of cost savings. However, studies reveal a conclusion that is counter to conventional wisdom:

- ▶ It could actually cost less to stay and grow on the mainframe than to move to

The first mainframe computers were introduced in the 1960s, and in the intervening years, the mainframe has become a mainstay for corporate businesses worldwide. Today, businesses trust their most mission-critical applications and data to the mainframe. Yet in recent years, some mainframe clients are attempting to move workloads off the mainframe (often referred to as *rehosting*) believing this will save them money. Typically, these clients have outdated hardware and software, smaller mainframe footprints, or perhaps a poor understanding of the true

Although some service providers claim cost savings, a careful analysis shows this claim in most cases is not supported by industry trends, such as server space constraints, and server space

An incorrect assessment of migration costs, replacement operations costs, and a rehosting effort can be a

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