

A decorative graphic in the top left corner consists of several overlapping circles of various sizes. Each circle is divided into multiple segments of different colors, including shades of orange, yellow, purple, blue, and brown, creating a vibrant, abstract pattern.

The Reality of Rehosting: Understanding the Value of the Mainframe

A refresh of “The Reality of Rehosting” message... *Please distribute!*

<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

By **Emily Farmer**
IBM Senior Analyst

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 Typically, these clients have outdated hardware and software, smaller mainframe footprints, or perhaps a poor understanding of the true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 contradicted by industry trends, such as server space constraints, and server space

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



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Businesses trust their most mission-critical applications and data to the mainframe

70%

of top 500 System z customers run CICS

21 of top 25

insurance organizations use System z

67%

of top 500 System z customers run CICS and DB2

23 of top 25

retailers use System z



Today

IBM zEC12

25 of top 25

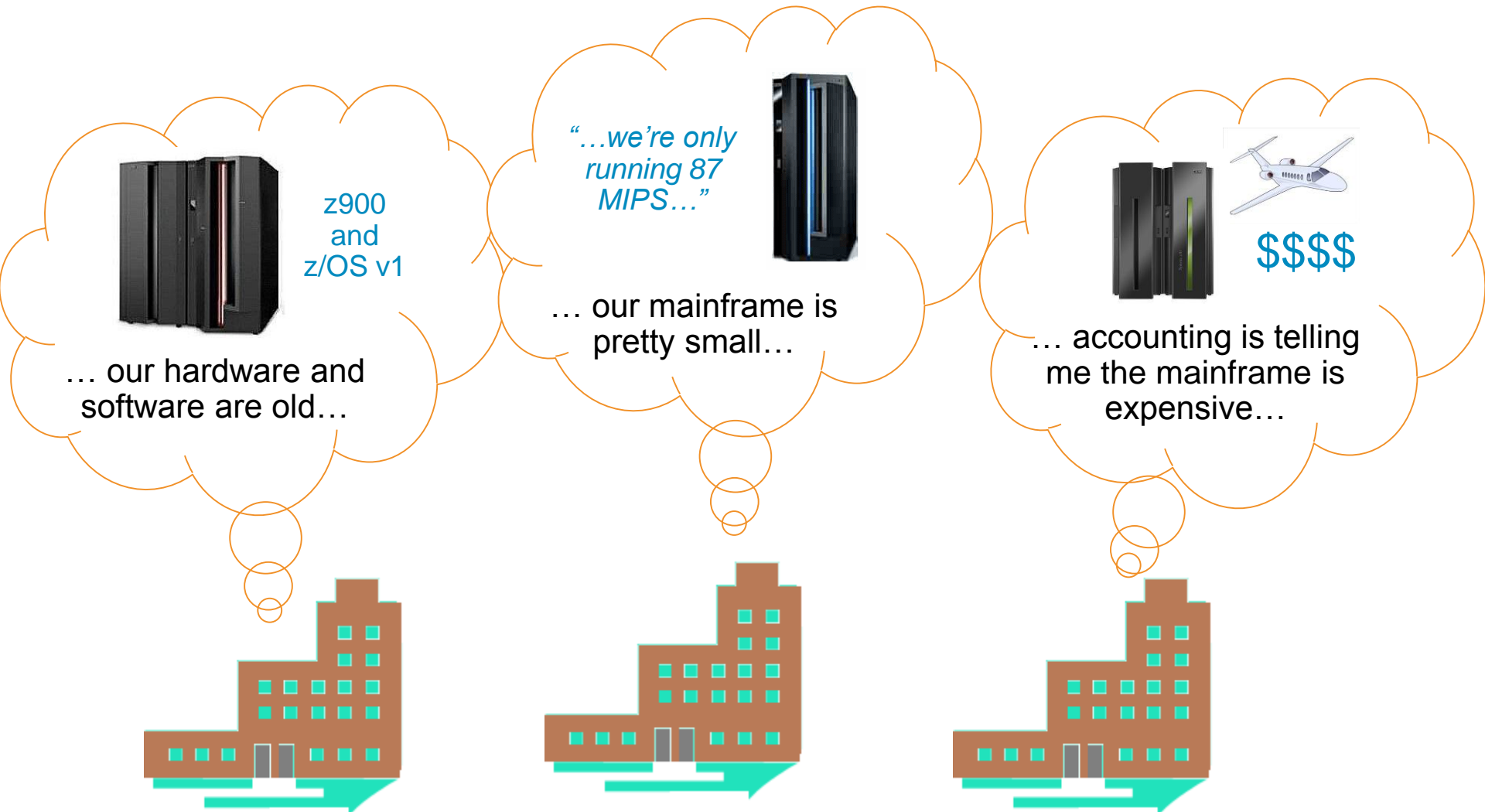
world's banks use System z

1964



IBM S/360

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



The IBM Eagle team can help 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**
- Over 300 customer studies since formation in 2007
- Contact: eagletco@us.ibm.com

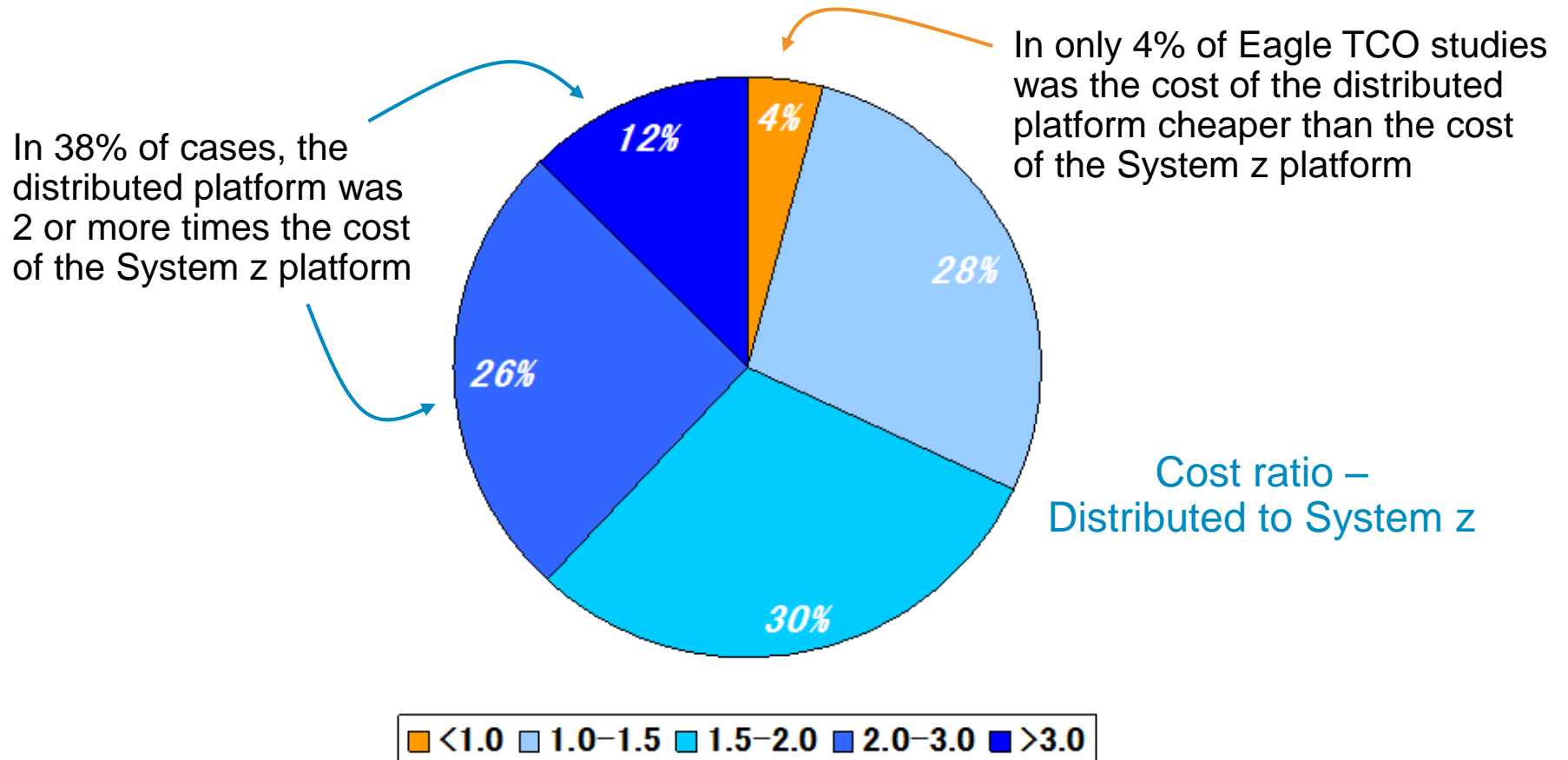
Fit For Purpose
Platform
Selection

Enterprise
Server
Economics

Private Cloud
Implementation



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

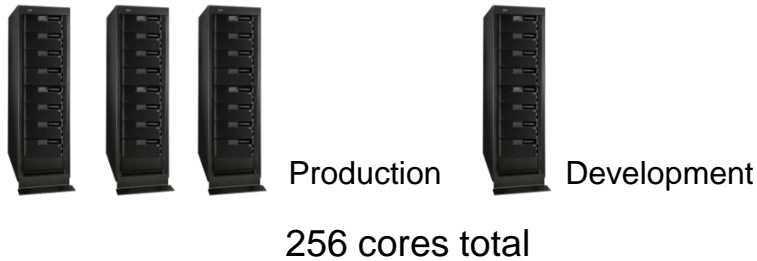


Sampling of 97 Eagle team TCO studies from 2007 - 2011

Example: Moving transaction processing off System z rarely reduces cost

Eagle TCO study for a financial services customer:

4 HP Proliant DL 980 G7 servers



Hardware	\$1.6M
Software	\$80.6M
Labor (additional)	\$8.3M
Power and cooling	\$0.04M
Space	\$0.08M
Disaster Recovery	\$4.2M
Migration Labor	\$24M
Parallel Mainframe costs	\$31.5M
Total (5yr TCO)	\$150M

System z z/OS Sysplex



Hardware	\$1.4M
Software	\$49.7M
Labor	Baseline
Power and cooling	\$0.03M
Space	\$0.08M
Disaster recovery	\$1.3M
Total (5yr TCO)	\$52M

**65%
less cost!**

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...
- Benchmarks can be deceiving...
- Real world use cases suggest this number is off by a factor of **10-20 times**

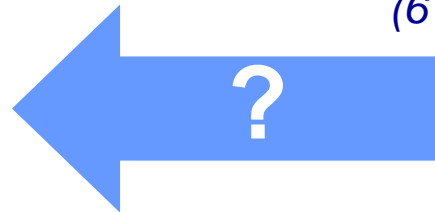
Eagle TCO study of a mid-sized workload demonstrates how HP's sizing guides are far from accurate

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)

29x
more cores!

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

3x HP DL580 (2ch/20co)
Production / Dev / Test
(2011 x86 technology)



60 processors

z800 Production /
Dev / Test
(2002 mainframe technology)



499 MIPS
(2.1 processors)

Despite a 9-year technology gap,
the Intel platform still required
29x more processors

Is there a cross over point? 1,000 MIPS? 500 MIPS?

A sampling of Eagle TCO data suggests there is no minimum MIPS value that automatically makes an offload financially beneficial...

Customer			5-Year TCO		
	z (MIPS)	distributed (PUs)	z	distributed	z/dist %
Average	1,166	218,472	9,050,451	16,325,492	
SA Government Agency	475	241,291	19,773,442	25,261,624	78.27%
German Financial	1,200	263,177	3,939,889	4,701,033	83.81%
NA Financial Services	2,526	308,144	3,456,611	5,939,476	58.20%
US utility company	456	163,744	6,157,295	13,380,866	46.02%
European Insurance	904	171,062	13,019,980	15,877,484	82.00%
US Manufacturer	900	453,168	11,277,266	16,019,269	70.40%
Asian Bank	1,416	136,013	2,342,300	7,237,681	32.36%
US Retailer	1,700	215,124	3,543,154	8,951,851	39.58%
US County Government	88	43,884	4,717,394	8,108,668	58.18%
US Retailer	1,500	184,732	9,254,186	20,861,515	44.36%
AP bank	1,336	168,113	17,300,000	27,200,000	63.60%
AP bank	300	24,162	5,200,000	11,500,000	45.22%
US Manufacturer	1,917	261,040	4,758,313	7,350,216	64.74%
US Food Services	1,600	424,952	21,966,475	56,167,206	39.11%

The determining factor is really the *nature* of the workload...

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

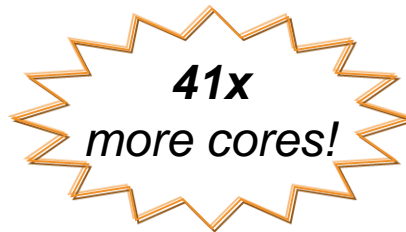
2x 16-way (Unix) Production / Dev / Test / Education
App, DB, Security, Print and Monitoring
4x 1-way (Unix) Admin / Provisioning / Batch Scheduling

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

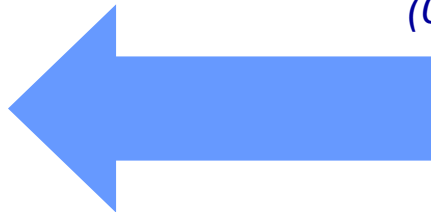


36 processors

\$17.9M (4 yr. TCO)



332 MIPS
(0.88 processors)



\$4.9M (4 yr. TCO)

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)

33x
more cores!

Better understanding of mainframe workloads and the platform can prevent embarking on a bad rehosting experience

The value and advantages of the System z platform

- Perfect workload management
- Multiple environments on one platform
- Disaster Recovery
- ...

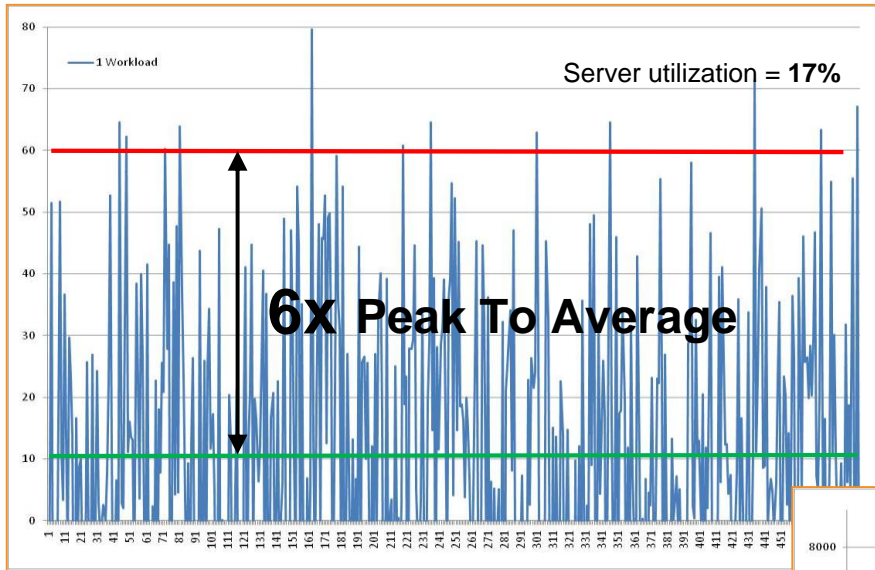


Why some workloads are best fit on System z

- I/O-intensive workloads
- CICS/COBOL workloads
- “Chatty” workloads
- ...

Note that this is not intended to list *all* the advantages of the System z platform, nor is it intended to list *all* workloads that are best fit on System z.

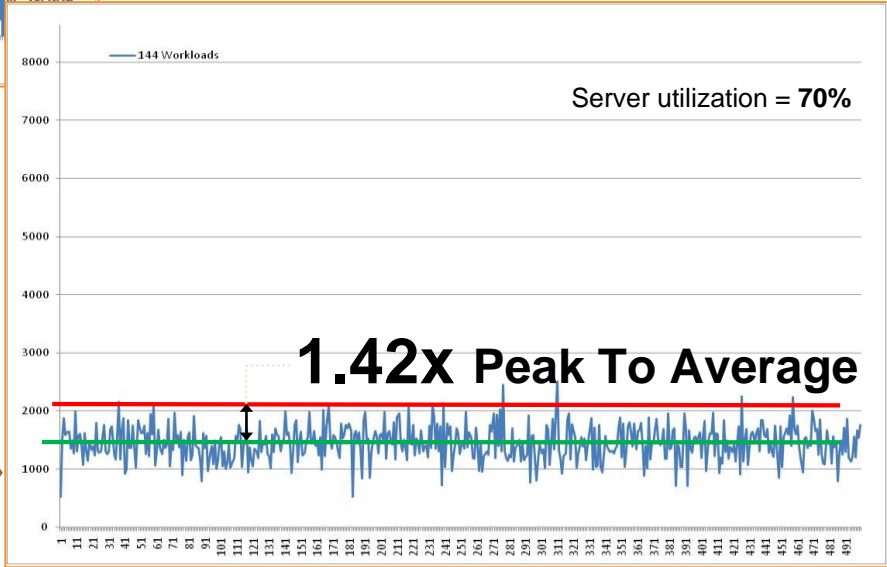
System z is a highly efficient virtualized platform designed to benefit from statistical multiplexing of many workloads



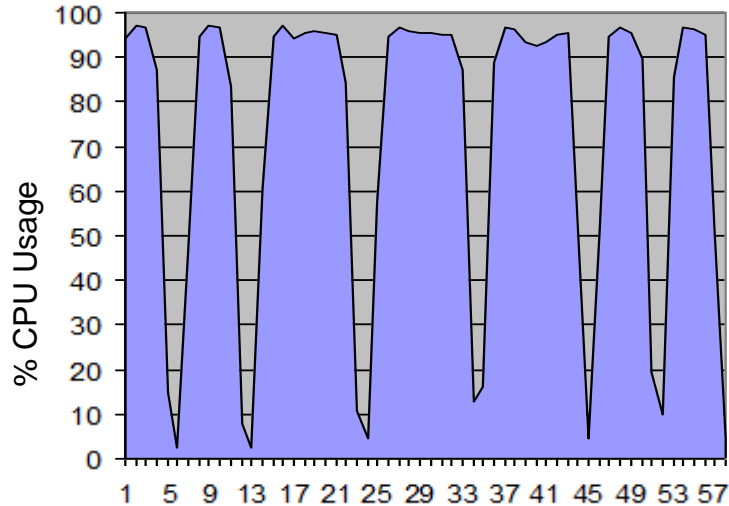
- Consolidating workloads with variance on a virtualized server reduces the overall variance (statistical multiplexing)
- Consequently, larger servers with capacity to run more workloads can be driven to higher average utilization levels without violating service level agreements

1 variable workload:
Machine capacity (red) =
6x average demand (green)

144 variable workloads:
Machine capacity (red) =
1.42x average demand (green)

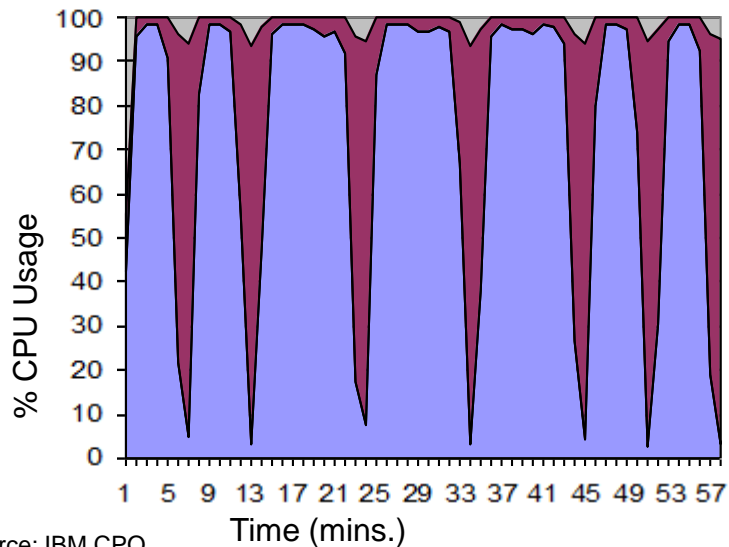


System z demonstrates perfect workload management...



Demand curve for 10 high priority workloads running in 1 z/VM LPAR (PR/SM weight = 99)

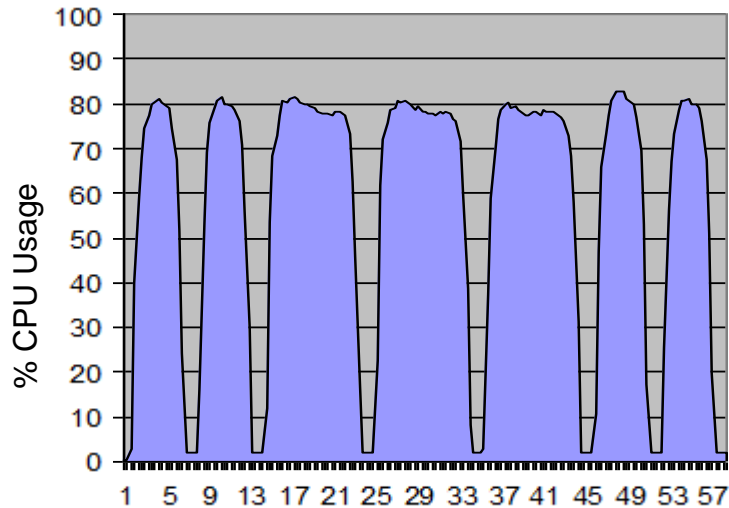
- **Workloads consume 72% of available CPU resources**



Demand curve when 14 low priority (PR/SM weight = 1) workloads are added in a second z/VM LPAR

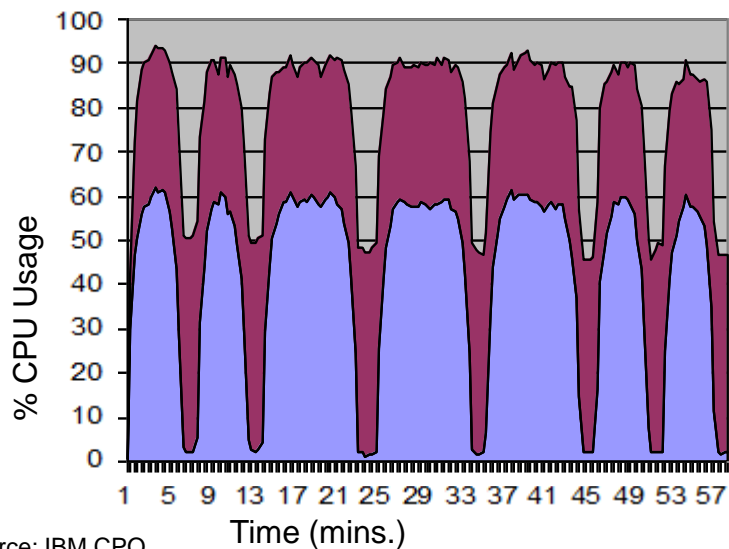
- **High priority workload throughput is maintained**
- **No response time degradation**
- **All but 2% of available CPU resources is used**

...Unlike this common Intel hypervisor which demonstrates imperfect workload management



Demand curve for 10 high priority workloads running on a common Intel hypervisor (high share)

- **Workloads consume 58% of available CPU resources**

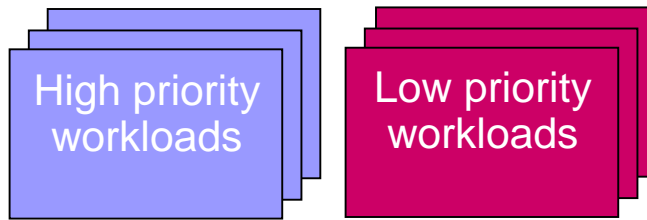


Demand curve when 14 low priority (low share) workloads are added

- **High priority workload throughput drops 31%**
- **Response time degrades 45%**
- **22% of available CPU resources is unused**

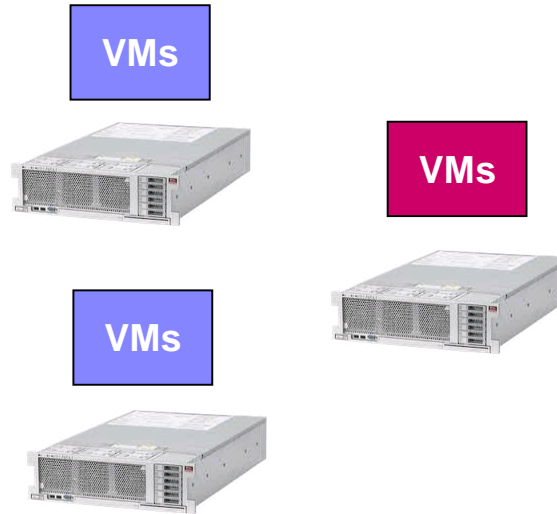
Imperfect workload management leads to core proliferation and higher costs

Which platform provides the lowest TCA over 3 years?

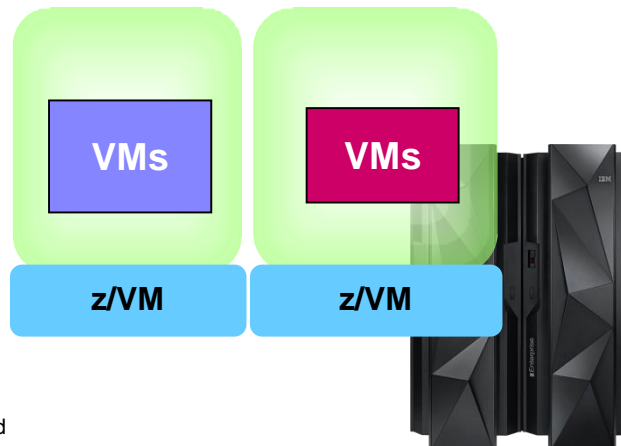


- IBM WebSphere 8.5 ND
- IBM DB2 10 AESE
- Monitoring software

High priority online banking workloads driving a total of **9.1M** transactions per hour and low priority discretionary workloads driving **2.8M** transactions per hour



Virtualized on 3 Intel 40 core servers
\$13.7M (3 yr. TCA)



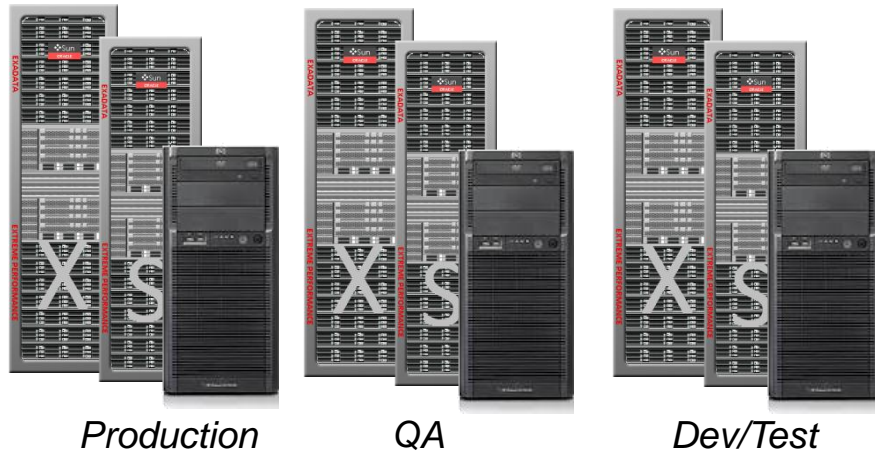
z/VM on zEC12
 32 IFLs
\$5.77M (3 yr. TCA)

58%
lower cost!

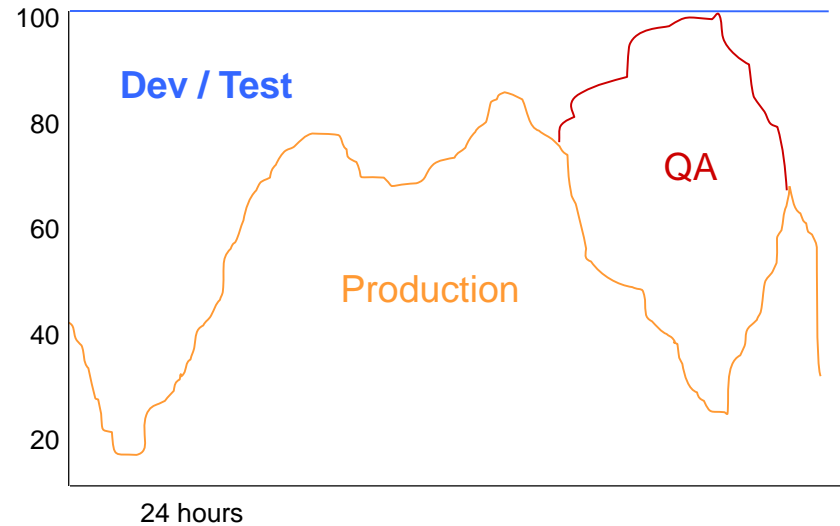
Consolidation ratios derived from IBM internal studies.. zEC12 numbers derived from measurements on z196. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

Non-production environments require fewer resources on the mainframe

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



Mainframe Usage Profile



Better understanding of mainframe workloads and the platform can prevent embarking on a bad rehosting experience

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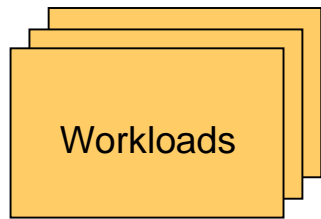
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- ...

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Comparison test demonstrates System z supports significantly more high I/O bandwidth workloads

Comparison of consolidation platforms



Online banking workloads, each driving **22** transactions per second, with **1 MB I/O per transaction**

1 workload per 16-core x86 blade



Virtualized on x86 16 core HX5 Blade

48 workloads per 32-way z/VM



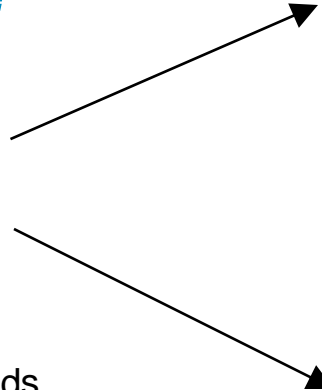
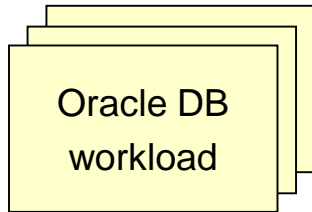
I/O bandwidth large scale pool

Virtualized on z/VM on zEC12 32 IFLs

24x more workload density

Customer data demonstrates consolidated Oracle database workloads benefit from System z's high I/O bandwidth

Which platform provides the lowest TCA over 3 years?



3 Oracle RAC clusters
4 server nodes per cluster

12 total HP DL580 servers
(192 cores)

\$13.2M (3 yr. TCA)

Customer Database Workloads
each supporting 18K tps

Oracle Enterprise Edition
Oracle Real Application Cluster



3 Oracle RAC clusters
4 nodes per cluster

Each node is a Linux guest
zEC12 with 27 IFLs

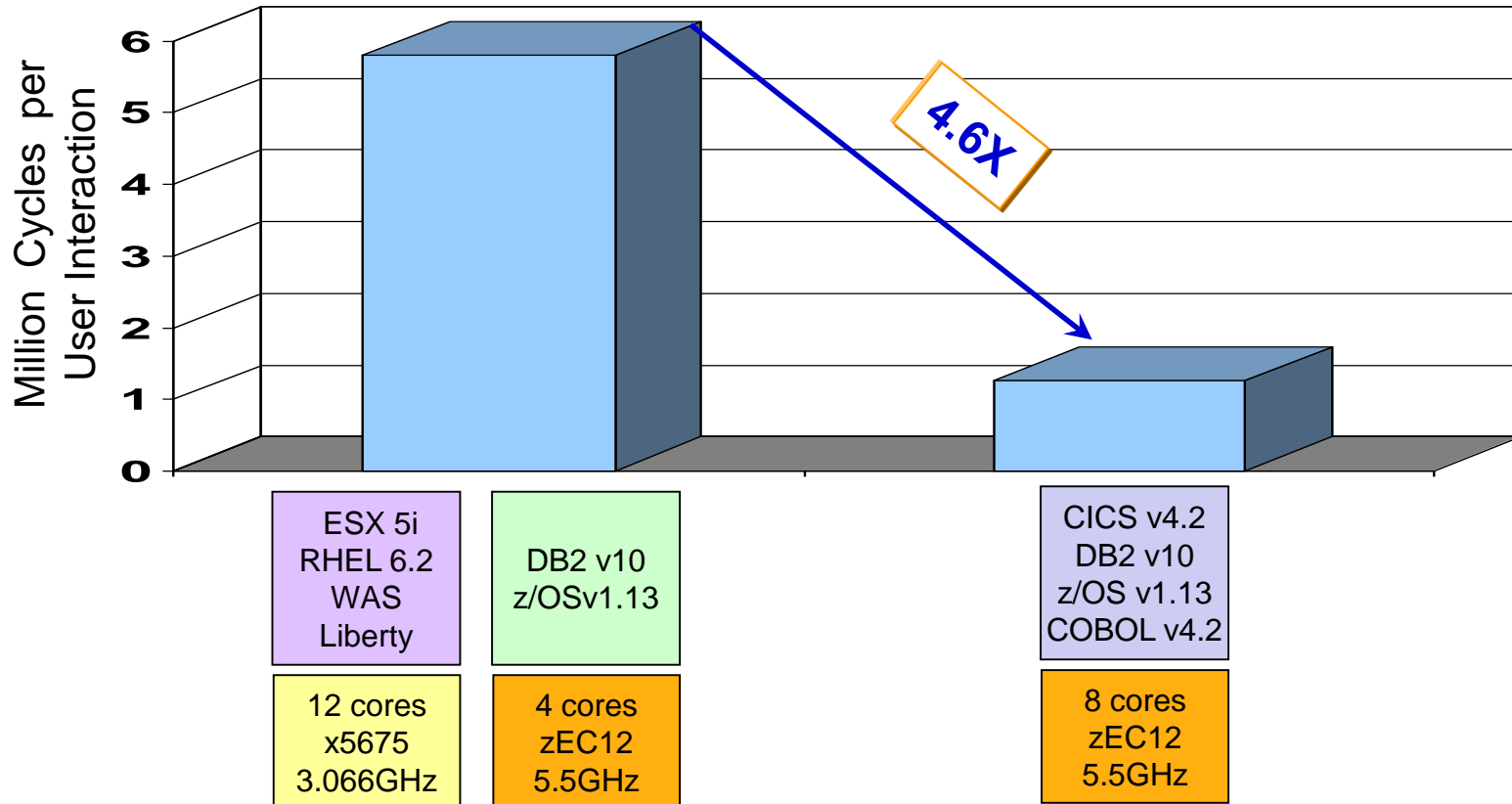
\$5.7M (3 yr. TCA)



TCA includes hardware, software, maintenance, support and subscription.
Workload Equivalence derived from a proof-of-concept study conducted at a large Cooperative Bank.

Tests show COBOL/CICS workload on System z uses 4.6x fewer cycles than on Java on Intel

IBM internal core banking transactional workload

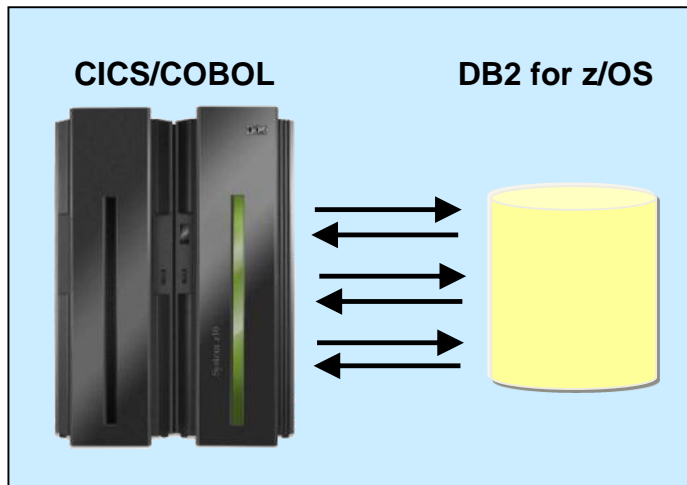


Source: IBM Internal Study. Results may vary based on customer workload profiles/characteristics.

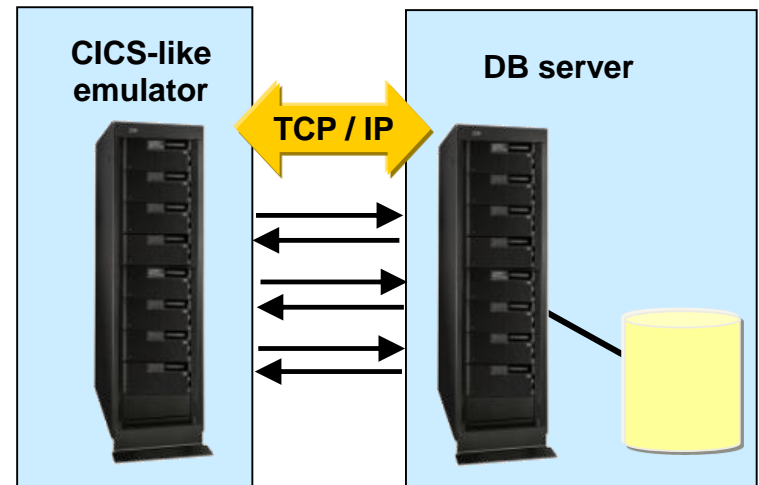
Eagle studies show some applications originally designed with co-located data are not good offload candidates

- 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



Before you start a rehosting project, make sure you have evaluated *all* the risks

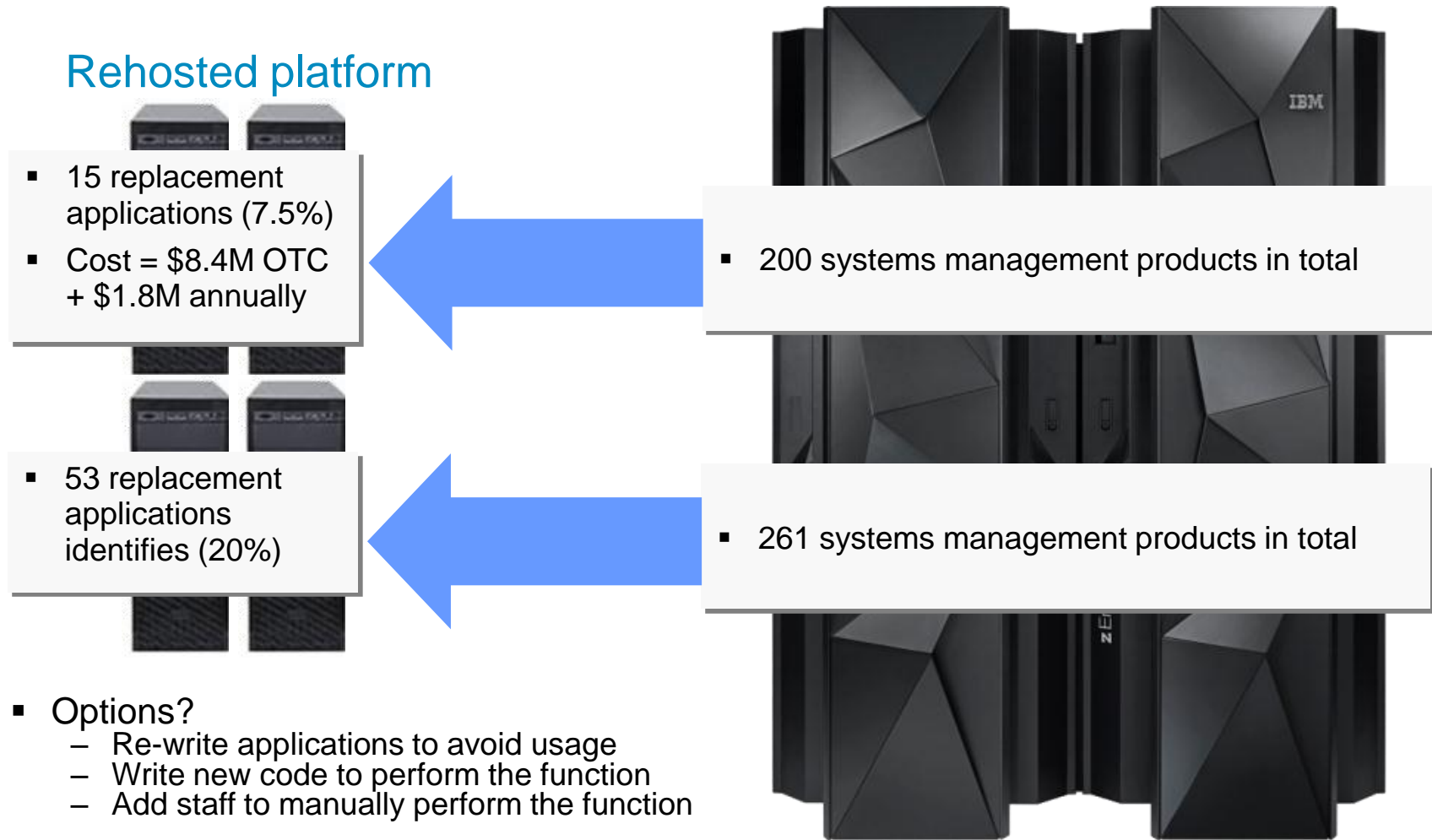
Look for hidden costs like:

- Missing functionality
- Sub-optimized performance
- Risks of failure



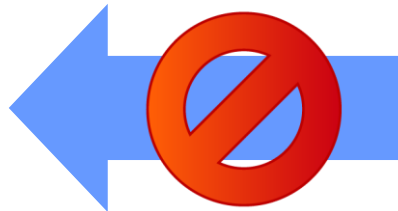
The IBM Eagle Team

Eagle studies for two US retailers highlight missing systems management functionality



Oracle Tuxedo rehosting platform lacks critical mainframe functionality

Rehosted platform



- Rehosting proposal to a major Bank
 - Tools to migrate CICS and Batch, but no tools for major z/OS utilities

Sort and ETL

Rexx, JCL & Batch

Database, Print, & Backup

Assembler Development and Maintenance

Offloading CICS application results in suboptimal performance

- Offload project to move State of Montana Department of Motor Vehicles license registration system from CICS to Microsoft
 - Performed by Microsoft and Bearing Point
 - Cost of project \$28.3M, 3 years late

	<i>Response time</i>
<i>Before offload</i>	Sub-second
<i>After offload</i>	30+ seconds



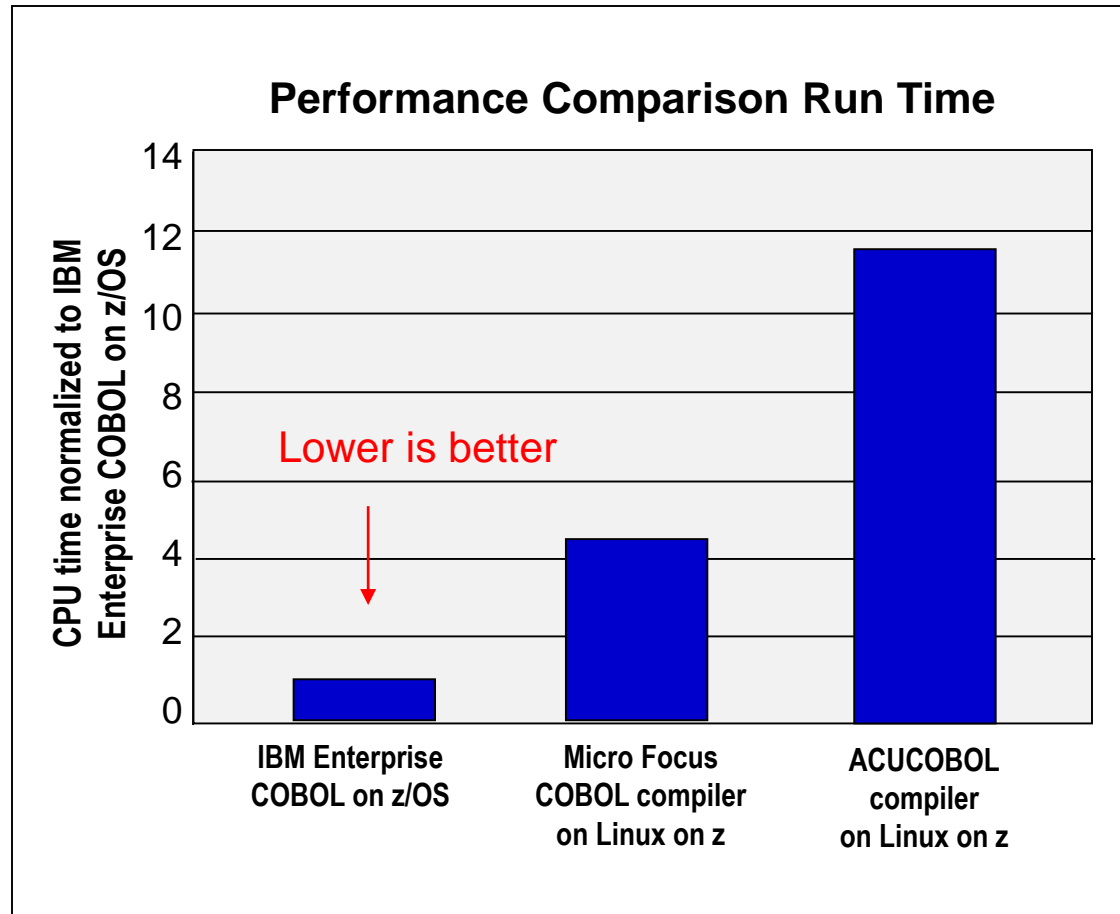
“Transferring titles is taking two to three hours instead 15 minutes.”

One employee said she had never heard so many “four-letter words” from customers.

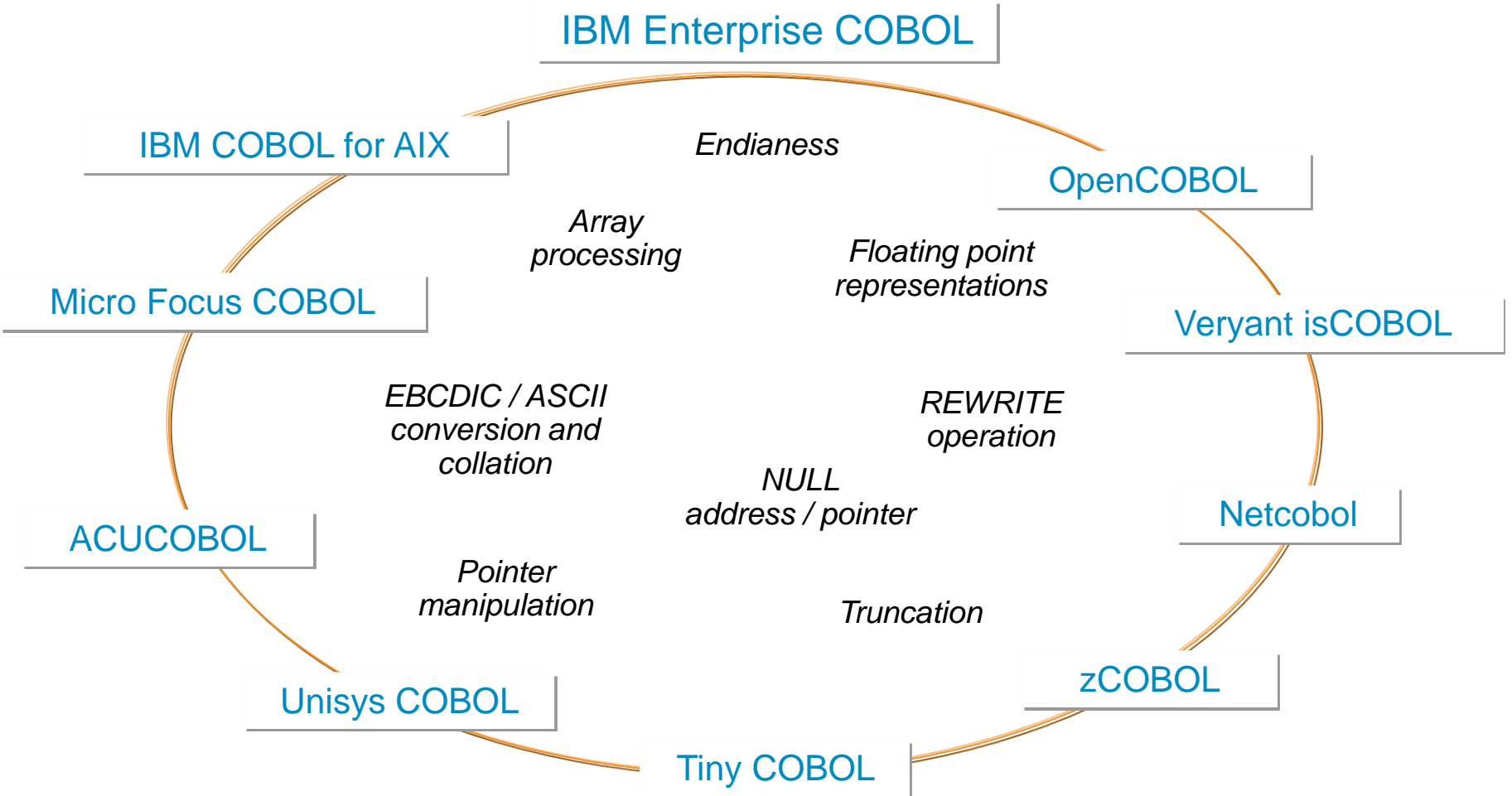


Customer tests show IBM Enterprise COBOL performs better than competition

- IBM Enterprise COBOL on z/OS performed best
- Micro Focus COBOL is a COBOL interpreter, and code is over 4.5 times less efficient
- ACUCOBOL, a compiler acquired by Micro Focus, was 12 times less efficient
- Micro Focus functional differences required additional debugging



Different compilers may potentially lead to different COBOL behavior



See http://download.oracle.com/docs/cd/E18050_01/artwb/docs11gr1/wbref/CobolConverter.html

Code stability is at risk on some distributed platforms

- Mature System z software is very stable
- Some distributed software is not...

```
A problem has been detected and windows has been shut down to prevent damage
to your computer.

The problem seems to be caused by the following file: SPCMDCON.SYS

PAGE_FAULT_IN_NONPAGED_AREA

If this is the first time you've seen this Stop error screen,
restart your computer. If this screen appears again, follow
these steps:

Check to make sure any new hardware or software is properly installed.
If this is a new installation, ask your hardware or software manufacturer
for any windows updates you might need.

If problems continue, disable or remove any newly installed hardware
or software. Disable BIOS memory options such as caching or shadowing.
If you need to use Safe Mode to remove or disable components, restart
your computer, press F8 to select Advanced Startup Options, and then
select Safe Mode.

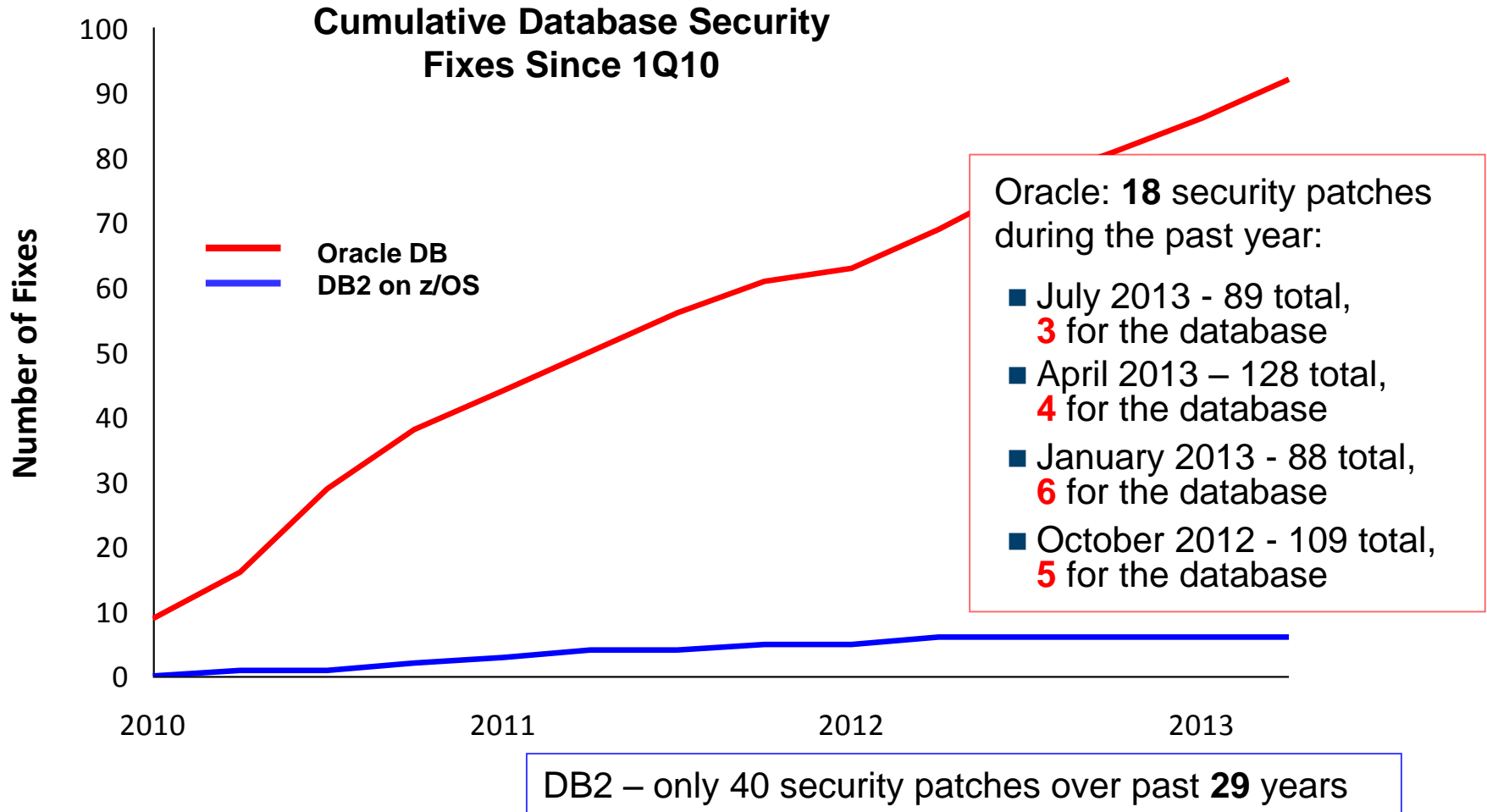
Technical information:

*** STOP: 0x00000050 (0xFD3094C2,0x00000001,0xFBFE7617,0x00000000)

*** SPCMDCON.SYS - Address FBFE7617 base at FBFE5000, DateStamp 3d6dd67c
```

Familiar Microsoft “Blue Screen Of Death”

Oracle patches far outnumber those for DB2 on z/OS



Source: <http://www.oracle.com/technetwork/topics/security>

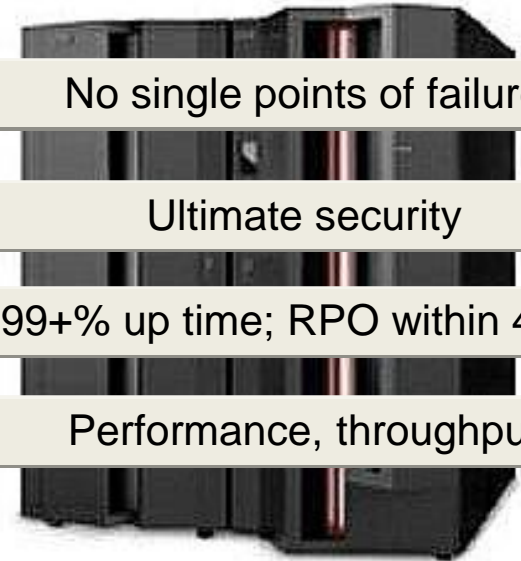
Can a rehosting vendor really meet your SLA requirements?

Distributed



- Insist the solution includes the same levels of backup, availability and disaster recovery.
- Can the same levels and complexity be reached? What is the *cost*? How much testing will be involved?
- Is this attainable? Can this be *guaranteed*?
- How many *years* have you spent fine-tuning? Are you prepared to spend that again – maybe more – to reach the same levels?

Mainframe



No single points of failure

Ultimate security

99+% up time; RPO within 4 hrs

Performance, throughput

Know the risks! Know the costs!

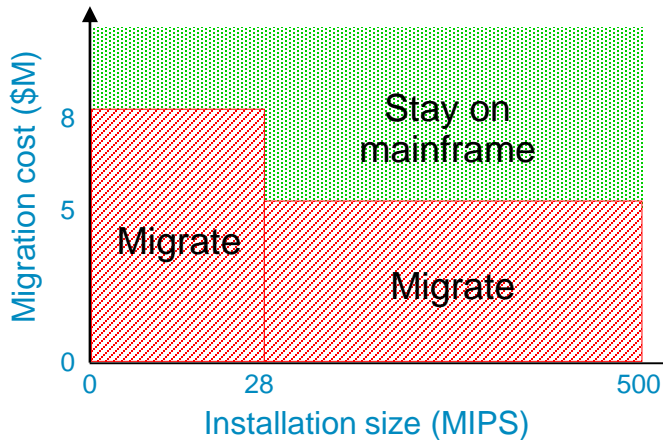
In some cases, rehosting *may* actually be justified...

1 **If:** Annual operating expenses are less than \$6,000 per MIPS,
Then: Stay on the mainframe

For customers with **low** incremental ISV costs:

2a **Else if:** Installation size is greater than 500 MIPS **Then:** Stay on the mainframe

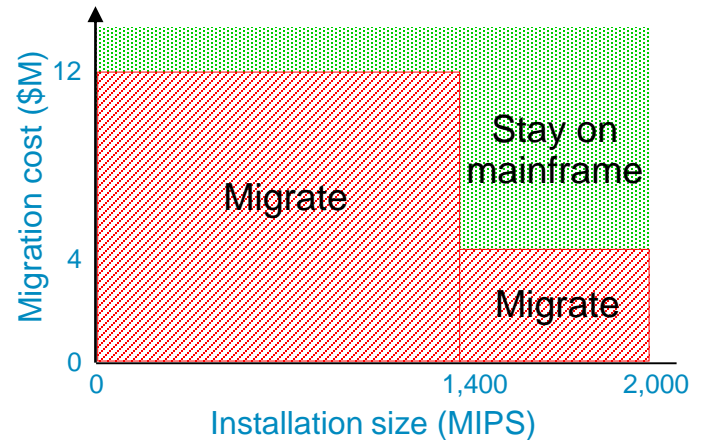
3a **Else if:** Migration cost is greater than a threshold **Then:** Stay on the mainframe



For customers with **high** incremental ISV costs:

2b **Else if:** Installation size is greater than 2,000 MIPS **Then:** Stay on the mainframe

3b **Else if:** Migration cost is greater than a threshold **Then:** Stay on the mainframe



4 **Else:** A migration is probably justified...

What's next?

- **IBM Sellers**

- Understand the value of the mainframe, and articulate that to customers
 - Be proactive in seeking out customers who might be considering a rehosting project
-

- **Mainframe customers**

- Re-examine your cost concerns; make sure chargebacks are accurate
- Examine the productivity of your mainframe compared to equivalent distributed platforms. Which generates more throughput in the least time? Which gives you best cost per unit of work? Make sure that you correctly account for all costs.

Remember:

Examine all costs and all risks; understand what the ROI will be
Consider upgrading the mainframe as a lower risk alternative

When talking to rehosting companies:

Ask for references of customers who have completed similar migrations... Then talk to them!

