# zEnterprise –
# An Ideal Basis For
# Smarter Computing

## The Reality Of Rehosting

# Competitors Tell Stories



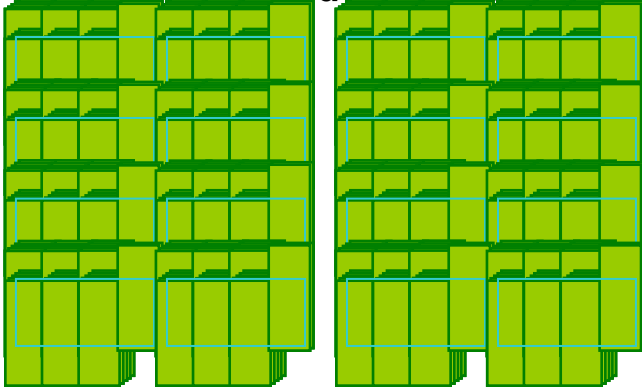Your competitor says I can save money by moving workloads off z196

Our competitor's claims are often false…. We've shown several cases where z196 was the lowest cost platform for core business workloads

**CIO**
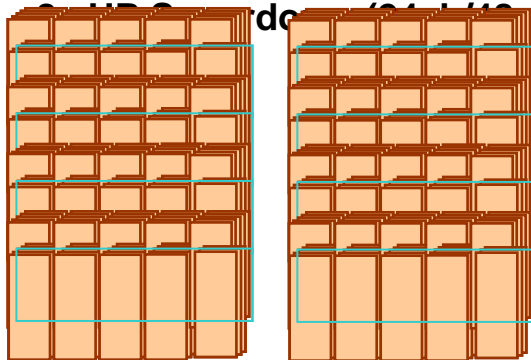
**IBM**

# Core Proliferation For A Large Workload

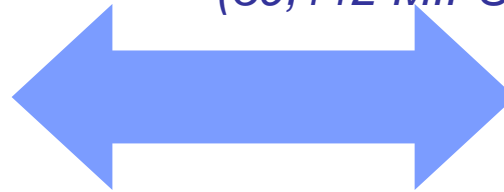**BaNCS Application Servers:**
**16x HP Superdome (16ch/32co)**

**TCS BaNCS**
**1x z196-741**
**with 8 zIIPs**

*49 processors*
*(41 GPs + 8 zIIPs)*

*(39,112 MIPS)*

**BaNCS Database Servers:**

*896 processors*

*(3,668,600 PerfUnits)*

**Total** (5yr TCA)   **$110M**

**18x more cores**

94 Performance Units
per MIPS

**Total** (5yr TCA)   **$180M**

NOTE: To cover DEV/QA capacity, add 100% servers for distributed servers, add 25% MIPS (8,000) to System z

# Core Proliferation For A Mid-sized Offload Project

6x 8-way Production / Dev
2x 64-way Production / Dev
   Application/MQ/DB2/Dev partitions
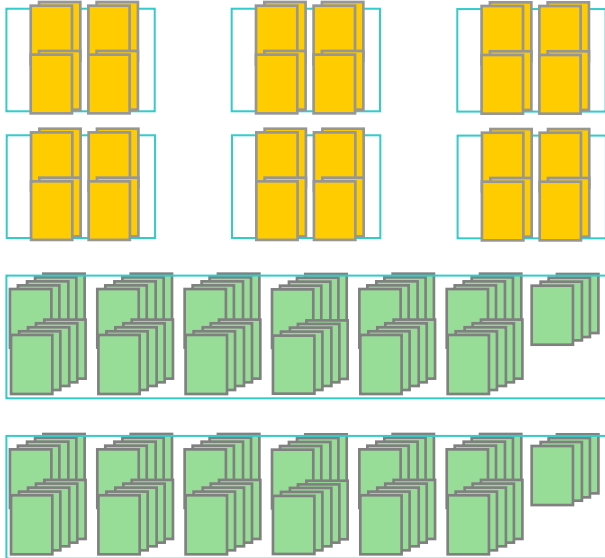
2x z900 3-way Production / Dev / QA / Test
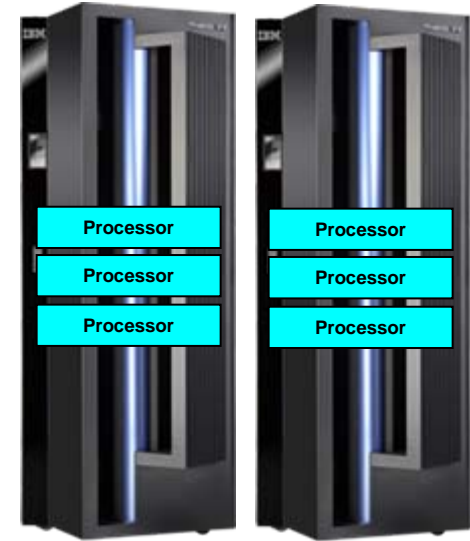
**6 processors**
*(1,660 MIPS)*

**176 processors**

*(800,072 Performance units)*

**29x more cores**

482 Performance Units
per MIPS

**$25.4M** TCO (5yr)

**$17.9M** TCO (5yr)

# Is There A Cross-Over Point?

Is a 500 MIPS workload small enough to offload from System z?

It depends on the *nature* of the workload, rather than the *size*!

**CIO**

**IBM**

# Core Proliferation For A Small Offload Project

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

z890 2-way Production / Dev / Test / Education
App, DB, Security, Print, Admin & Monitoring
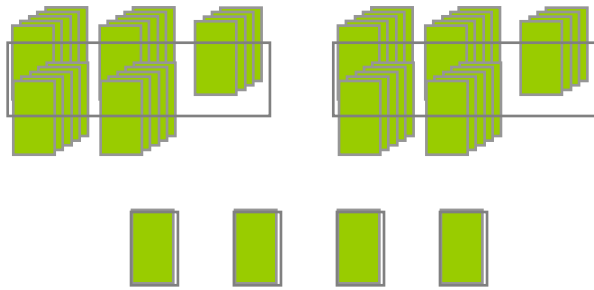
**0.88 processors**
*(332 MIPS)*

**36 Unix processors**
*(222,292 Performance Units)*

**$17.9M TCO (4yr)**

**$4.9M TCO (4yr)**

Processor
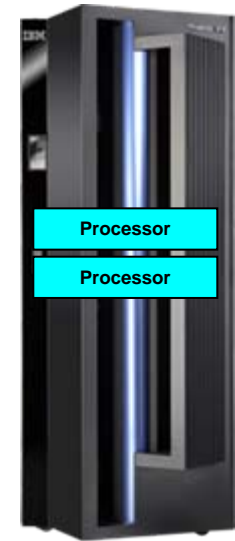
Processor

**41x more cores**

670 Performance Units
per MIPS

Plus:
2x HP SAN Servers (existing)
Many (existing) Windows servers

No Disaster Recovery

# Core Proliferation For A Smaller Offload Project

4x p550 (1ch/2co)
Application and DB
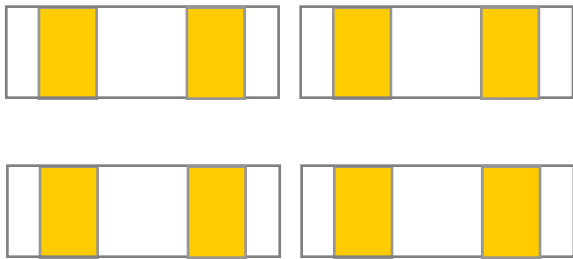
1x z890
(production + test)

**0.24** *processors*
*(88 MIPS)*

**8** *Unix processors*
*(43,884 Performance Units)*

**$8.1M TCO (5yr)**

**$4.7M TCO (5yr)**

## 33x more cores

499 Performance Units
per MIPS

Migration duration 3 years

# What Is System z Optimized For?

- **Transaction processing and master data base**
  - ▶ Linear scalability with Parallel Sysplex and streamlined middleware

- **High I/O bandwidth workloads like batch**
  - ▶ Dedicated I/O processing plus DS8000 and Easy Tier

- **Making full use of processing resources**
  - ▶ Intelligent prioritization of multiple workloads to service objectives, reduced TCO

- **Efficient system management tools**
  - ▶ Hard to replace equivalent function in distributed environments

- **Ultra-high availability**
  - ▶ Multi-layered strategy for reliability and serviceability

- **Business critical workloads**
  - ▶ Centralized data mirroring and systematic disaster recovery

- **Easy growth in processing capacity**
  - ▶ Elastic scaling through Capacity On Demand

- **Strong security to protect data**
  - ▶ Centralized, universal Resource Access Control Facility (RACF)

# Moving Transaction Processing Off System z Rarely Reduces Cost

*Typical Eagle TCO Study For A Financial Services Customer*

## 4 HP Proliant DL 980 G7 servers

Production          Development

256 cores total

| 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

2,800 MIPS

| 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**

# Some Typical Eagle Studies Under 3,000 MIPS – Most Stayed On System z

| Customer | z (MIPS) | distributed (PUs) | 5-Year TCO | | |
| --- | --- | --- | --- | --- | --- |
| | | | 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 | 163744 | 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% |

**Typical Decision Factors: Cost and Risk**

# Re-hosting Dynamics

- **Competitors team up to promise substantial cost savings by offloading**
  - ▶ Oracle, HP, Micro Focus, Clerity, TmaxSoft, Microsoft…
  - ▶ Projections of cost savings and benefits are unproven
  - ▶ Benefits of successful projects often glorified

- **Clients likely to be approached for re-hosting**
  - ▶ Outdated hardware and software (less cost-effective)
  - ▶ Smaller footprints
  - ▶ Poor understanding of mainframe cost and value
    - − Inaccurate charge backs
    - − High mainframe costs due to high cost ISV software
    - − Failure to exploit price concessions (e.g., specialty engines)

# What Happens When You Try To Move A Best-Fit Workload On System z To Another Platform?

1. Core Proliferation

   ▶ Long-term costs go up

2. Missing Function and Processes

   ▶ Long-term costs go up

3. Sub-optimized Performance

   ▶ Long-term costs go up

4. Risks – Failure, Delay, Degraded Qualities Of Service

   ▶ Business case does not close

## Bottom line – you spend MORE, not less

# 1. Why Core Proliferation Happens

- ## De-consolidation of applications to dedicated servers
  - ▶ Dedicated servers for functional roles - application, database, security, batch, systems management
  - ▶ Separate servers for production, development, quality assurance test
  - ▶ Low utilization due to provisioning for the peak on each server and pre-provisioning for growth

- ## Disaster Recovery
  - ▶ 100% coverage doubles the number of cores required

- ## Processing comparisons
  - ▶ Mainframe has dedicated processors for I/O operations, distributed does not
  - ▶ Language expansion (CICS/COBOL path lengths are highly optimized)
  - ▶ Converting IMS hierarchical database to relational results in a 3x expansion
  - ▶ Zero network on mainframe reduces computation (and latency)

# 2. Missing Function

- **No distributed alternatives to handle large transactional workloads against a single-image database**
  - ▶ Oracle RAC has a "glass ceiling" on scalability

- **Systematic error and disaster recovery is not well-supported in distributed environments**
  - ▶ HyperSwap, scripted failover, system automation may be missing
  - ▶ No discounts for dark standby processors

- **Storage capabilities of DFSMS and DS8000 may be missing**
  - ▶ Shared virtualized storage across a sysplex environment
  - ▶ Hierarchical Storage Management, Hyper Swap disk mirroring, Easy Tier SSD optimization

# More Missing Function

- Replacement technologies aren't always available
  - ▶ Hierarchical data base
    - − IMS DB and IMS DC
  - ▶ Languages
    - − PL/I, ASM …
  - ▶ Batch environments
    - − JCL with symbolic substitution, batch pipes, Generation Data Group files for batch recovery
    - − Scheduling capability
  - ▶ System management and database tools
  - ▶ 3270-style user interfaces, BMS maps, APIs…
  - ▶ File structures
    - − VSAM, QSAM and Partitioned Data Sets
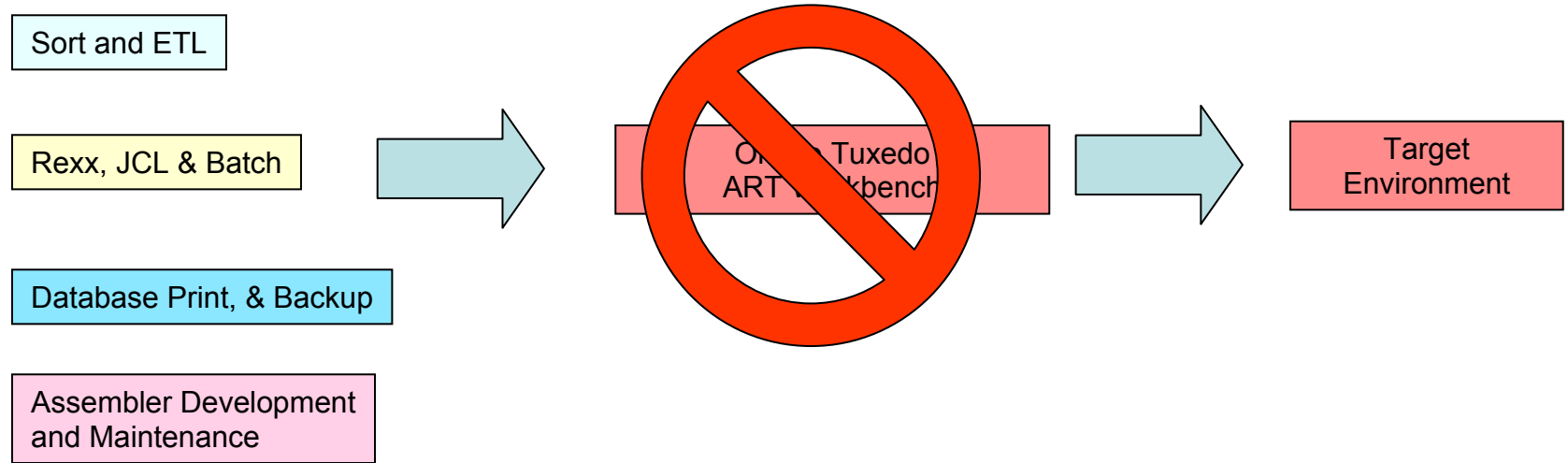  - ▶ Print
    - − PSF, AFP, Info Print Server, JES2/3 spool

# Missing Systems Management Function

- Case Study (US retailer):
  - 200 system management products used on the mainframe
  - Only 15 of them had distributed replacements (7.5% coverage)
  - Cost of those 15 products was $8.4M OTC plus $1.8M annual
  - Distributed system management pricing is generally based on the number of cores to be managed

- Case Study (another US retailer):
  - 261 system management products used on the mainframe
  - Initial analysis showed only 53 had distributed equivalents (20% coverage)

- Additional hidden costs:
  - Finding a replacement product
  - Re-writing the applications to not need it
  - Write code to perform the function from scratch
  - Adding operations labor to manually do the function
  - Adding hardware and software to run the additional code in the re-write
  - Adding hardware and software to run code written from scratch

# All Functional Elements Must Be Considered

- 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

Oracle Tuxedo ART Workbench

Target Environment

- Better understanding of z/OS and Mainframe Architecture needed

  Source: https://forums.oracle.com/forums/thread.jspa?threadID=2296851&tstart=0

# 3. Sub-Optimized Performance



- Offload project to move State of Montana Department of Motor Vehicles license registration system (MERLIN) from CICS to Microsoft

- Performed by Microsoft and Bearing Point

- CICS solid sub-second response times

- Microsoft 30 second response times

- Cost of project $28.3M, 3 years late

*"Transferring titles is taking two to three hours instead 15 minutes,"* Anderson said. One employee told him she had never heard so many "four-letter words" from customers.*
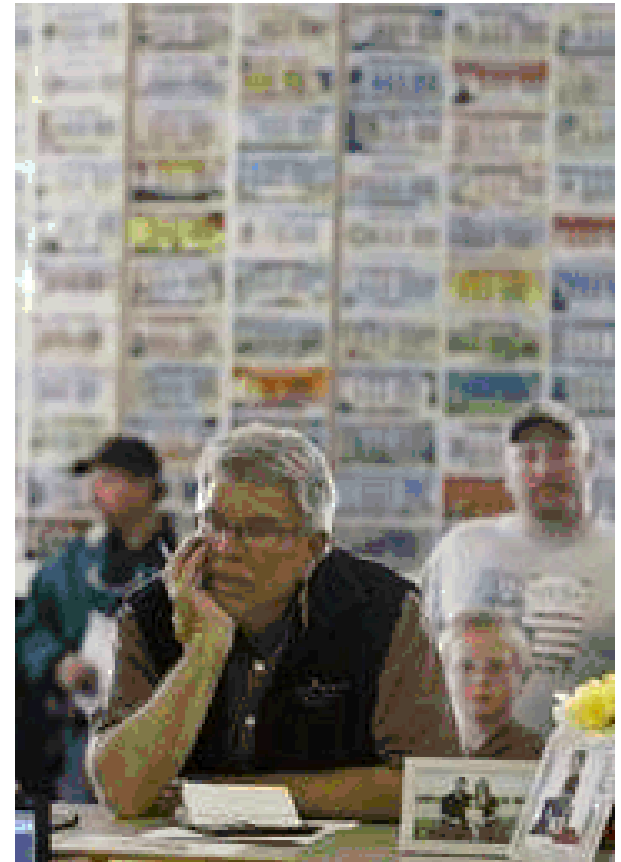
# COBOL Recompiled With Micro Focus Had Inferior Performance

- Offloads require a different COBOL compiler

- IBM Enterprise COBOL on z/OS performed best in customer benchmarks

- Micro Focus COBOL is a COBOL interpreter, so 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

**Performance Comparison Run Time**

CPU time normalized to IBM Enterprise COBOL on z/OS

Lower is better

IBM Enterprise COBOL on z/OS | Micro Focus COBOL compiler on zLinux | ACUCOBOL compiler on zLinux
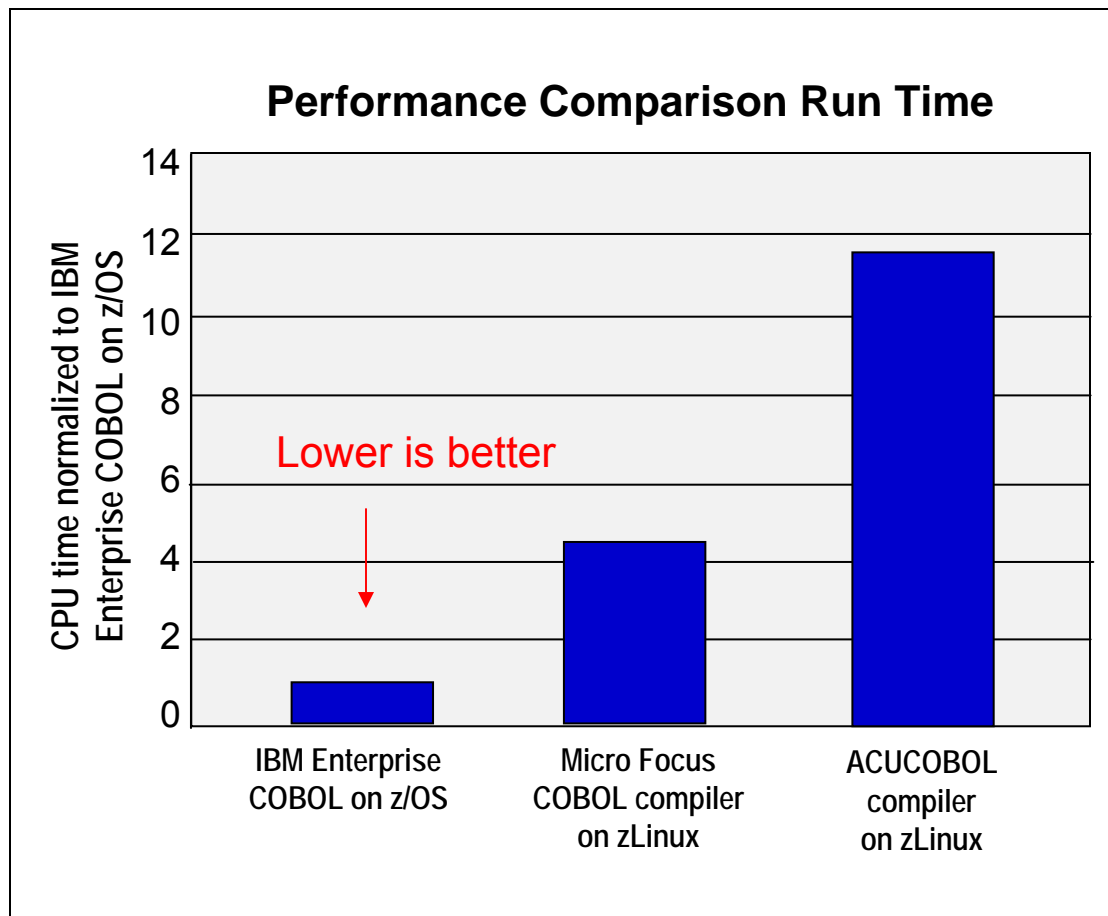
# Some Applications Originally Designed With Co-located Data

- A large insurance company rehosted a portion of an application as a Proof Of Concept
  - *"When folks wrote screen-based transactions many years ago, they wrote it at a business function viewpoint…"* = very 'chatty' (and no separation of presentation, business logic, data logic)
  - SQL sub-optimized for networking (comms performance wasn't originally an issue)
- Various tuning/tweaking done for several months, but ultimately the POC was stopped
- TCP/IP stack consumes considerable CPU overhead/resource AND introduces security considerations (firewalls … ) and latency (network delay)
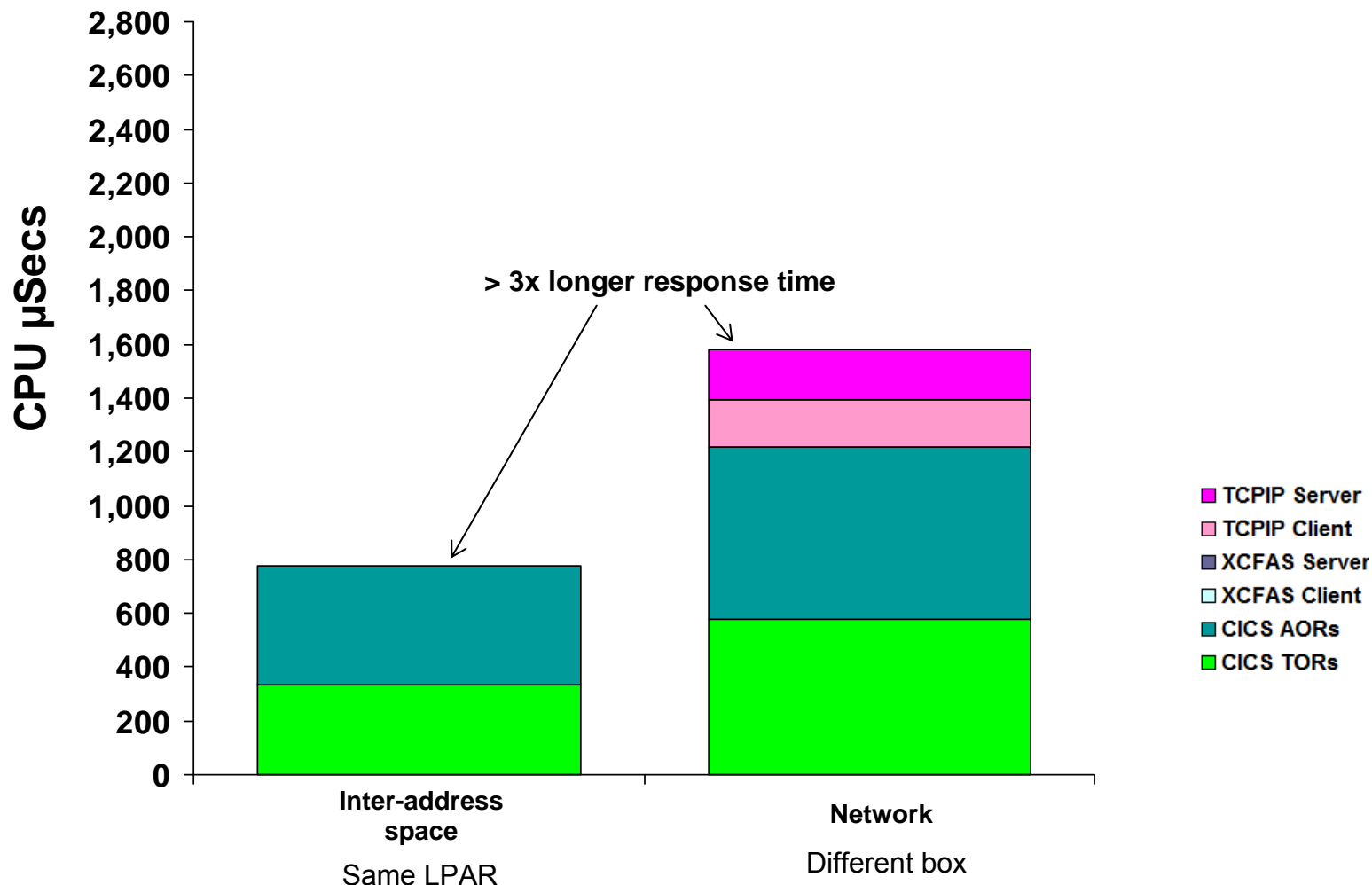
**Single z/OS LPAR**

CICS/COBOL                    DB2 for z/OS
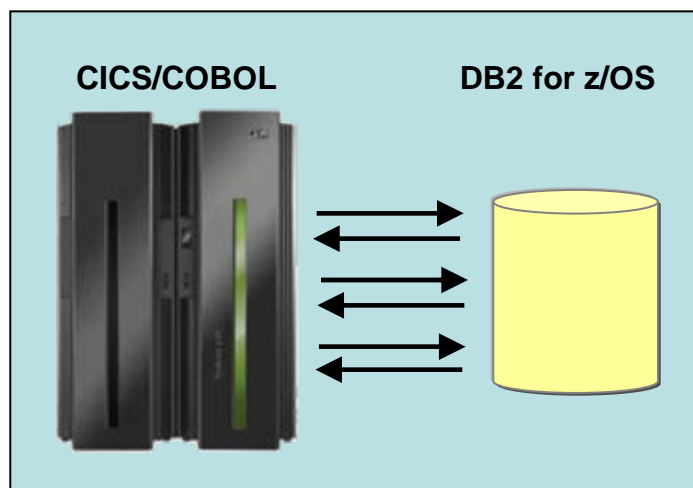
**Distributed architecture**

CICS-like emulator          TCP / IP          DB server
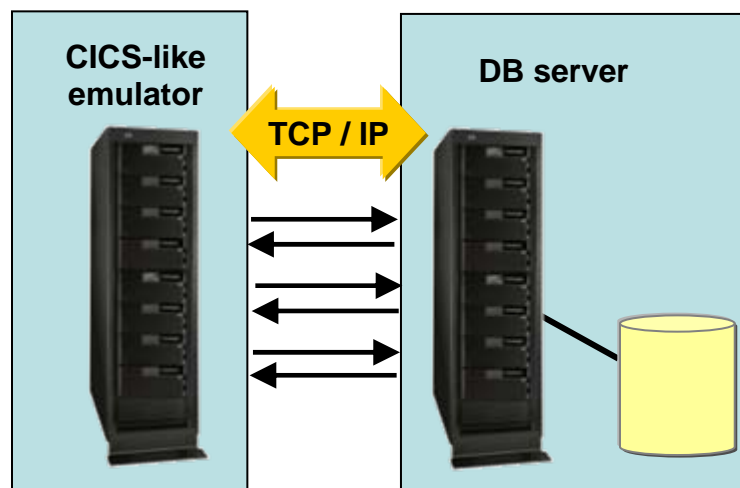
## *Some transactions are not easily moved*

# Co-locating In The Same Address Space Is More Efficient

**CICS requests using different communication techniques**



Chart: CPU μSecs (y-axis 0 to 2,800)

- Inter-address space (Same LPAR): ~780 total — CICS TORs ~330, CICS AORs ~450
- Network (Different box): ~1,580 total — CICS TORs ~580, CICS AORs ~630, TCPIP Client ~180, TCPIP Server ~190

> 3x longer response time

Legend:
- TCPIP Server
- TCPIP Client
- XCFAS Server
- XCFAS Client
- CICS AORs
- CICS TORs

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

# 4. Risk Of Migration Failure – Tuxedo ART
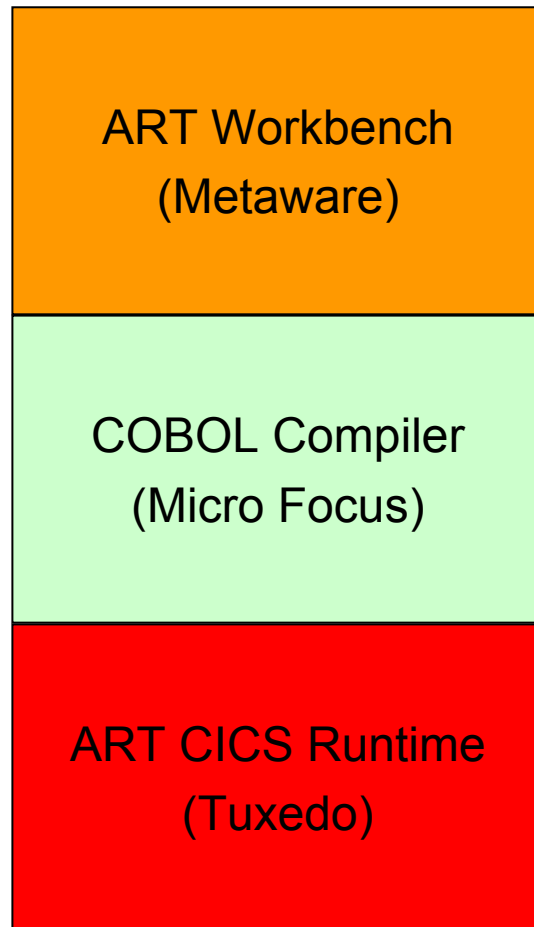
| ART Workbench (Metaware) | Qualities of Service |
|---|---|
| COBOL Compiler (Micro Focus) | Qualities of Service |
| ART CICS Runtime (Tuxedo) | Unstable |

- **Workbench:**
  - ▶ Workarounds needed for certain migration tasks
  - ▶ Incorrect code generated that leads to compilation problems
- **Micro Focus Compiler/Runtime:**
  - ▶ Poor integration with Tuxedo
  - ▶ Very limited scope of debugging when running on Tuxedo
- **ART CICS Runtime**
  - ▶ Service crashes with memory errors
  - ▶ Behavior of application not the same after porting

# Compiler Differences May Lead To Changed Behavior

- Even the closest COBOL compiler has differences:

> ## Appendix B. Summary of differences from host COBOL
>
> IBM COBOL for AIX implements certain items differently from the way that Enterprise COBOL for z/OS implements them. See the related references below for details.
>
> **RELATED TASKS**
> Chapter 25, "Porting applications between platforms," on page 475
>
> **RELATED REFERENCES**
> "Compiler options"
> "Data representation"
> "Runtime environment variables" on page 595
> "File specification" on page 596
> "Interlanguage communication (ILC)" on page 597
> "Input and output" on page 597
> "Runtime options" on page 598
> "Source code line size" on page 598
> "Language elements" on page 598

From SC27-3601-00 http://publib.boulder.ibm.com/epubs/pdf/cob4pg00.pdf
Potential collation problems (EBCDIC vs. ASCII) especially with VSAM keys

- What about Micro Focus COBOL?

  ▶ *"Indeed, some of the Micro Focus COBOL compiler options do change the behavior of the executed code."*
  http://download.oracle.com/docs/cd/E18050_01/artwb/docs11gr1/wbref/CobolConverter.html

# Risk Of Migration Failure

Lombard Canada Ltd., one of the oldest property and casualty insurance operations in Canada, partnered with Micro Focus to replace old mainframe

- 200 MIPS
- CICS, COBOL, VSAM, DB2

*"We estimate this project will save us in excess of $1 million a year, but more importantly, it will enable us to become more competitive in our industry both today and in the future."*

**VP of IT**
**Lombard Canada Ltd.**

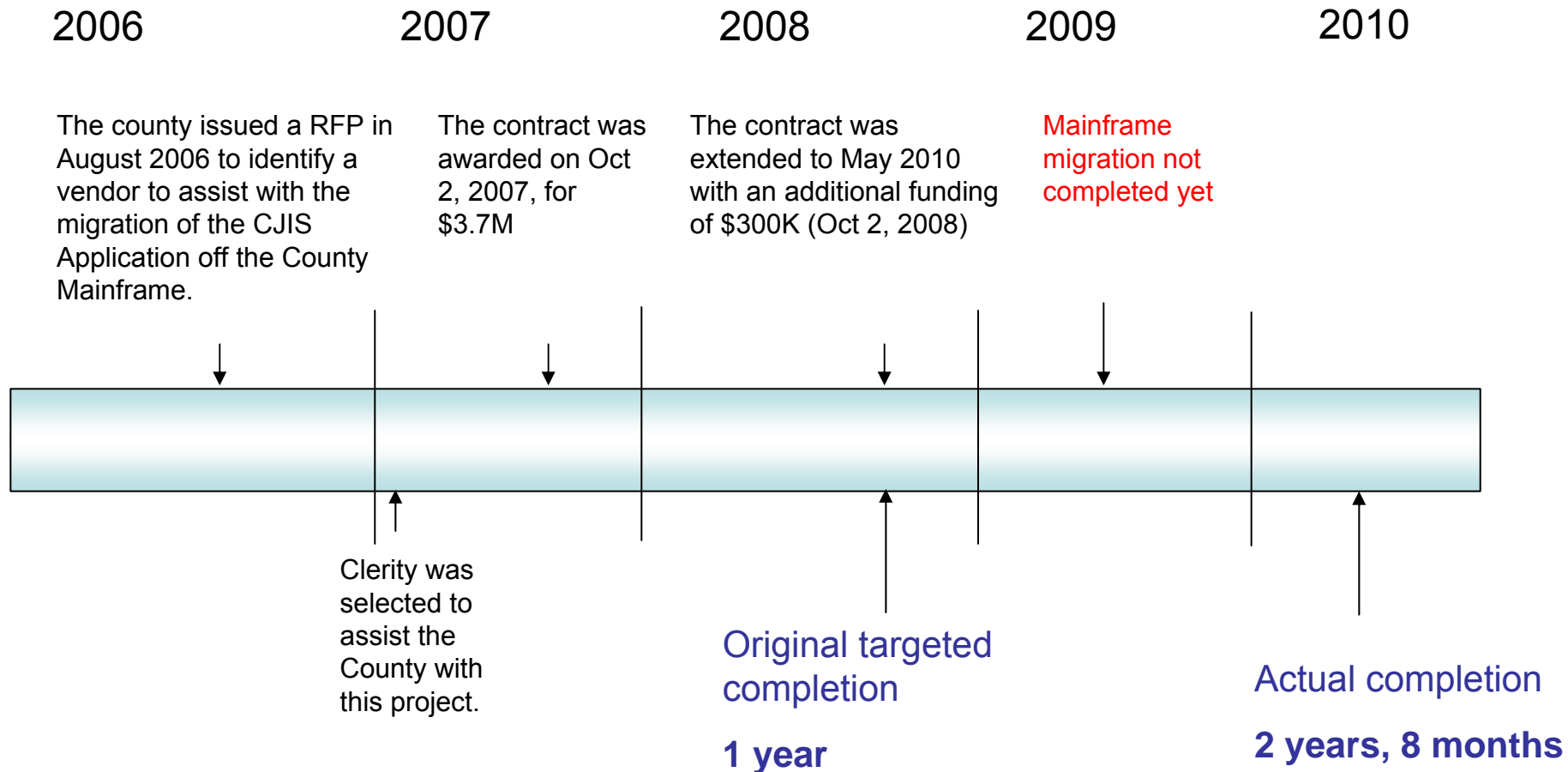**Project abandoned** one year later:
- System Integrator and Micro Focus did not have the skills
- Lombard spent millions on conversion with no results
- VP lost his position
- Installed new System z and re-architected front end to access CICS
- New VP stated Disaster Recovery capability of System z as a key benefit

Source of quote: http://www.finextra.com/news/Announcement.aspx?pressreleaseid=4858

# Project Delays Can Be Greater Than Anticipated – Small 88 MIPS Project

US County Government Offload Project Delayed By Complexity

| 2006 | 2007 | 2008 | 2009 | 2010 |
|------|------|------|------|------|

The county issued a RFP in August 2006 to identify a vendor to assist with the migration of the CJIS Application off the County Mainframe.

The contract was awarded on Oct 2, 2007, for $3.7M

The contract was extended to May 2010 with an additional funding of $300K (Oct 2, 2008)

Mainframe migration not completed yet

Clerity was selected to assist the County with this project.

Original targeted completion

**1 year**

Actual completion

**2 years, 8 months**

# Degraded Qualities – Risk Of Code Stability

- 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"

# Degraded Qualities – Patching, Security

**DB2 for z/OS Security**

- DB2
  41 security patches over 29 years

**Oracle's Security Exposures**

- Oracle.com – April 2012
  88 security patches, including 6 for the database

- Oracle.com – January 2012
  78 security patches, including 2 for the database

- Oracle.com – October 2011
  57 security patches, including 5 for the database

- Oracle.com – July 2011
  78 security patches, including 13 for the database

**On average 1.4 per year**

**In the last year Oracle has issued 301 security patches, 26 for the database**

Source: http://www.oracle.com/technetwork/topics/security
and IBM Internal

# Case Study – A Recent Migration Attempt

Let's see what problems come to light in a recent migration attempt using Clerity Unikix and Micro Focus COBOL
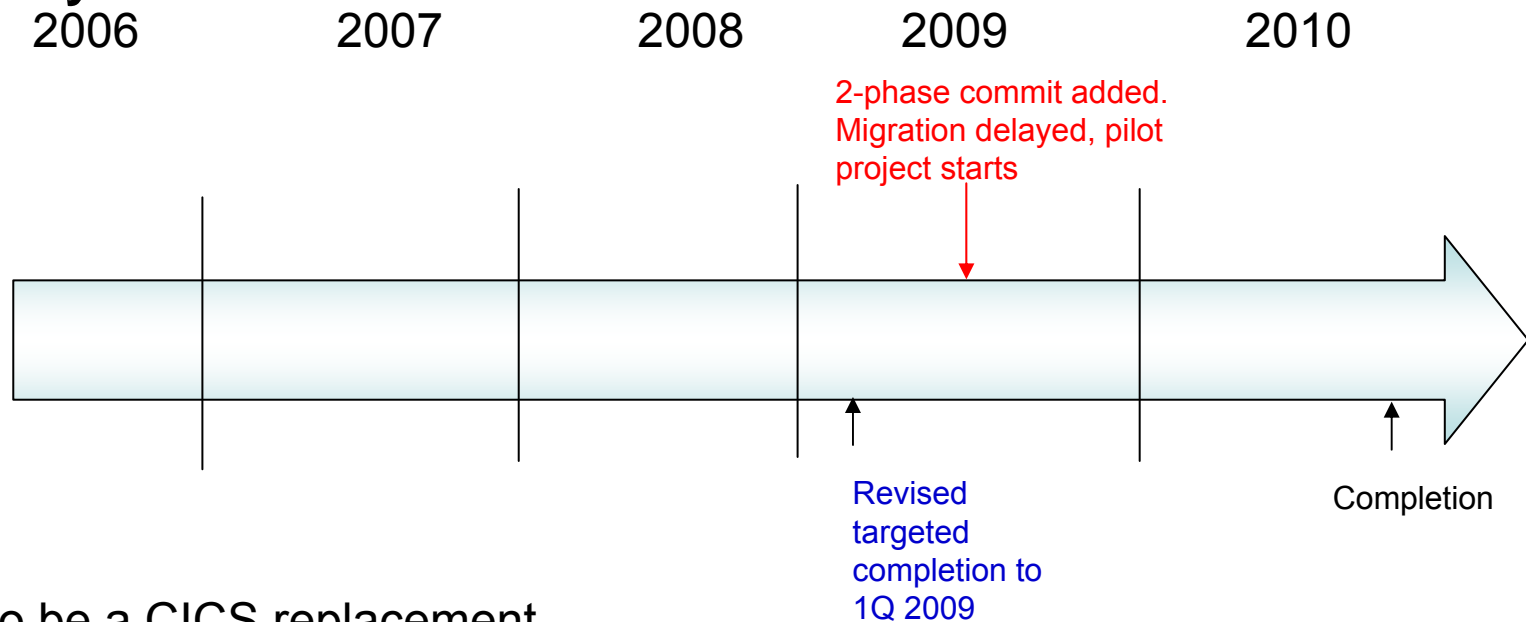
**IBM**

# Customer Feedback Confirms The Following

1. Core proliferation
   - ▶ 6X core growth, batch not included
   - ▶ Utilization rate dropped from 100% to 75%
2. Missing Function
   - ▶ Caused Micro Focus COBOL integrating/debugging problems
   - ▶ EBCDIC-to-ASCII conversion problems were a *"major technical challenge"*
   - ▶ 2,500 COBOL lines changed in 50 programs AND all Assembler rewritten
3. Sub-optimized performance
   - ▶ Micro Focus COBOL compiler less efficient and required more hardware
4. Risk Of Failure, Delays
   - ▶ Qualities of Service (Non Functional Requirements) compromised
   - ▶ Very costly extensive testing by professionals to protect against subsequent customer problems
   - ▶ First attempt failed using different COBOL compiler
   - ▶ This type of migration using UniKix had never been done before

# Delays Greater Than Anticipated

**Project History**

| 2004 | 2006 | 2007 | 2008 | 2009 | 2010 |
|------|------|------|------|------|------|

2-phase commit added. Migration delayed, pilot project starts

Revised targeted completion to 1Q 2009

Completion

- Claimed to be a CICS replacement

- Project delay upon discovery of missing 2-phase commit support

- 3+ months to switch compilers (estimated $1M labor)

- Change-management issues

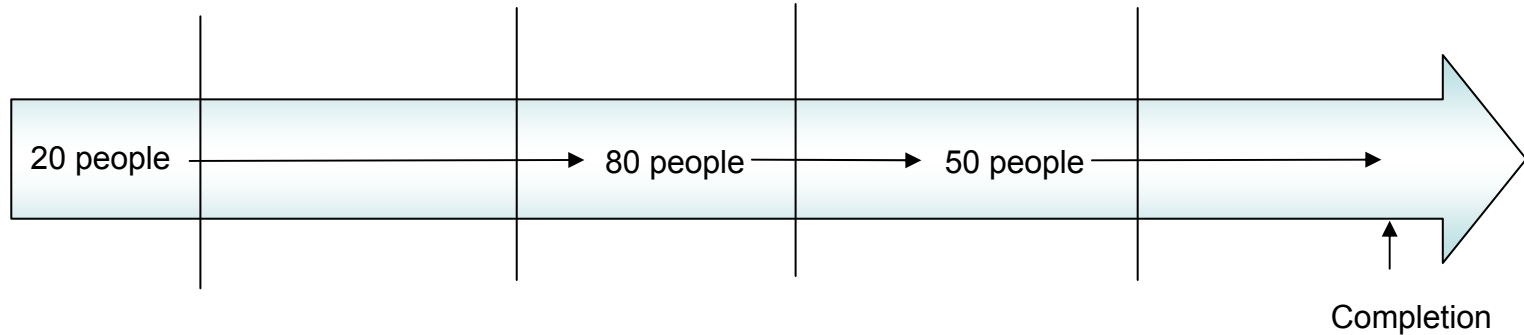# Bottom Line: Actual Costs Increased

**Project History**

| 2004 | 2006 | 2007 | 2008 | 2009 | 2010 |

Mandated cost
reductions of 10%

20 people → 80 people → 50 people →

Completion

- 170 person years @ $100K/PY  **$17M to migrate, $19.6M with hw/sw**

- Best-case estimate savings on operating cost  **$0.77M per year**

- Payback > **29 years**

- Better to have invested the money in the financial markets!

# Conclusions

- Offloading existing System z workloads rarely saves money, often increases risk, and freezes innovation

- Instead, zEnterprise enables a new strategy for cost reduction

  - ▶ Consolidate peripheral workloads using fit-for-purpose assignments to reduce cost of acquisition

  - ▶ Multiple virtualized architectures managed as a single system reduces operational costs

  - ▶ Private cloud capabilities

  - ▶ No other vendor offers these capabilities