A Fresh Look at the Mainframe

Mainframe Total Cost of Ownership Issues

David Rhoderick
IBM Software Competitive Technology Lab

Key Points – Distributed Costs

- The cost of running additional workload on distributed servers goes up linearly
  - Labor is now the highest cost element in distributed environments
  - Administrative staff costs increase in proportion to the number of servers
  - New workload requires additional servers
  - Cost of additional servers is linear
  - Cost of software licenses is linear
  - Electrical and air conditioning costs also increasing

- Result – scale out strategies do not reduce the cost per unit of work as the workload grows

Owing to the nature of individual contracts, some details of this pricing discussion may be at variance with specific instances
Key Points – Mainframe Costs

- The cost of running incremental workload on the mainframe goes down as the total workload grows
  - Labor costs hold steady as workload grows
  - Mainframe design and pricing policies designed to favor the addition of more workload
  - Special hardware pricing for new workload types
  - Lower software costs per transaction as workload grows
  - Lower electrical and air conditioning consumption than server farms
  - Trade-in value is recoverable for growth customers

- Customers have learned that mainframes running high throughput workloads are the most cost-efficient platform

Owing to the nature of individual contracts, some details of this pricing discussion may be at variance with specific instances

Mainframe Cost Per Unit of Work Goes Down as Workload Increases
First National Bank of Omaha

<table>
<thead>
<tr>
<th>Servers</th>
<th>Reliability</th>
<th>Utilization</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First move</strong>: Implemented distributed computing architecture that became too difficult to monitor, maintain, upgrade and scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30+ Sun Solaris servers, 560+ Intel servers</td>
<td>Un-acceptable</td>
<td>12%</td>
<td>24 people growing at 30% year</td>
</tr>
<tr>
<td><strong>Next move</strong>: Consolidated back on the mainframe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>z990</td>
<td>Much improved</td>
<td>84% with additional reserve capacity on-demand</td>
<td>Reduced to 8 people</td>
</tr>
</tbody>
</table>

Where is the Cross Over Point?

It depends on your environment ...

- Most TCO benchmarks compare single applications
- Most businesses operate here

Mainframe

Distributed scale out

100 distributed servers according to Robert Francis Group

Typical large business runs 2,000-4,000 applications

Data Center Workload

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Here Are Some More Hints

- Growth by Large Customers
  - 95% of large mainframe customers (average installed MIPs from 13,000 to 15,000 have CAGR of installed MIPS by 21% to 31% since 2002

- Growth by mid size customers
  - 72% of mid size mainframe customers (average installed MIPS 1400) have CAGR of installed MIPS from 25% to 34% since 2002

- Growth by small customers
  - 70% of small mainframe customers (average installed MIPS 400 to 600) have CAGR of installed MIPS from 38% to 50% since 2002

Mainframe Growth of Installed MIPS

Source: IBM STG Finance
Let’s Break Down the Elements of Cost

Total Cost of Ownership =
Cost of hardware +
Cost of software +
Environmental +
Cost of labor +
Financial terms

Mainframe Hardware Cost is Decreasing

IBM Hardware price per MIP over time*

Price per MIP in $K

$600

$500

$400

$300

$200

$100

$0

Year

1980

1982

1984

1986

1988

1990

1992

1994

1996

1998

2000

2002

2004

2006

1990

1992

1994

1996

1998

2000

2002

2004

2006

$15

$10

$5

$0

Hardware prices are one time charge

Source: Gartner

* Memory and I/O capacity are additional feature charges
"Price Per MIP" Does Not Tell The Whole Story

54 way SMP

Pay for these general purpose processors
"Price per MIP"

Pay for zAAP, zIIP, and IFL processors at a reduced rate (~9% of price per MIP)

Do not pay for SAPs, spares, pre-installed capacity on demand processors until used

Disaster Recovery – Fast Failover For Less

Primary Site
54 way SMP

Pay regular price for one active processor to enable fast failover

Pay $30K for each dormant processor to maintain capacity back up on demand ~2% of price per MIP

Alternative Site
54 way SMP

Pay regular price for frame

Site Failover With GDPS

Note: other scenarios can reduce the price further
Datacenter in a Box

- A pre-integrated data center in a box
- Hundreds of processors
- Robust interconnectivity
- Built-in networking
- Shared Everything Model with Extreme Virtualization
- Billions in Engineering and Software Development

- Building your own datacenter is costly and complex
- Install and configure hundreds of devices
- Networking
- Data Silos and Synchronization
- Power consumption
- Linear Staffing Costs
- Frequent Outages

Resulting in tremendous efficiencies
No extra charge for this deep pre-integration!

System z Virtualization, Workload Management, and Storage Bandwidth Achieve High Levels of Utilization

20 processors - Provision for capacity on demand, don’t pay until use

Pay for capacity of 14 processors

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”
Storage Costs Are Different

The Total Cost of Storage is Typically Three Times More in Distributed Environments

- Application specific data silos create redundant data
- Data copies are often used to separate “batch” style workloads from online
- Storage utilization of 25-30% or less is typical in distributed environments
- Mainframe fine grained allocation and data sharing yield typical storage utilizations of 80% *
- Cheap disks cannot be used by high RAS workloads in distributed environments

IBM Software Price Per Transaction is Also Going Down

57% decrease in past 60 months
- 17% decrease per year

What makes the price go down?
- Pricing curves favor growth
- Specialty processors (zAAPs, zIIPs, IFLs)
- Technical pricing allowances

Source: IBM SWG Finance
Data is WW customer revenue only (not IGS)
Data includes specialty engines
‘Highway conditions . mileage may vary’
**Software Pricing Curves Favor Growth**

- Incremental cost per MIP = $28
- Incremental cost per MIP = $12

**Overall Software Price Per MIP Decreases as System Size Increases**

- Lower incremental costs for large users
- Server consolidation to fewer, bigger boxes
- Sysplex Aggregation allows customers to take advantage of these slopes

**Move Past The Sweet Spot!**
**z/TPF Cost per Transaction**

- Workload based on banking authorization profile
- z/TPF WLC (workload charging) used
- HPO feature for high availability
- CPU configurations such that a loss of a single box never causes and outage
- Cost include z/TPF license, HW costs spread over three years and full time equivalents (FTEs) for operations staff (DASD & Tape not included)

IBM Actually Charges on the Basis of MSUs (Millions of Service Units Per Hour)

- 1 MSU currently is equal to about 7.3 MIPS (for a z9 EC)

  **So...**

- Software for a 580 MIPS machine will be charged at a rate of 81 MSU’s

Various ratings online at:
“Technology Dividend” = ~10% MSU Reduction Each Generation

Example of Sub-Capacity Pricing, Saving ~ $16K MLC

FULL-CAPACITY PRICING

z900 Model 1C7

LPAR A

DBZ

Use 139 MSUs

Pay 247 MSUs

247 MSUs

Total cost = $106,915/mo

LPAR B

Z/OS

Use 219 MSUs

Pay 247 MSUs

LPAR C

SUB-CAPACITY PRICING

z900 Model 1C7

LPAR A

DBZ

Use 139 MSUs

Pay 139 MSUs

LPAR B

Z/OS

Use 219 MSUs

Pay 219 MSUs

LPAR C

247 MSUs

Total cost = $91,011/mo

System z and z/OS are prerequisites

Only 30% of customers take advantage of sub-capacity pricing

Make sure you take advantage of this!
Technology Dividend Helps Offset Software Upgrade Increases

G5 S/390 processor 9672-R56
Purchased in 3Q98
Back level 4 generations
540 MIPS (5 CPU’s)
93 MSU’s

Upgrade to current generation z9 Enterprise Class 2004-701
Tech Div and sub capacity
540 MIPS (<1CPU) 76 MSU’s
If No Tech Div
540 MIPS (<1CPU) 93 MSU’s

<table>
<thead>
<tr>
<th>Database (-3 Generations)</th>
<th>MLC (PSLC)</th>
<th>DB2 UDB V6</th>
<th>DB2 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15,378</td>
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</table>

<table>
<thead>
<tr>
<th>Transaction Processing (-3 Generations)</th>
<th>CICS ESA V4</th>
<th>CICS TS V1.1</th>
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<tbody>
<tr>
<td>$14,733</td>
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<td>$22,061</td>
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<td></td>
<td></td>
<td>$24,220</td>
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</table>

<table>
<thead>
<tr>
<th>Operating System (-2 Generations)</th>
<th>OS/390 Base</th>
<th>J/DS VI Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>$46,485</td>
<td></td>
<td>$27,633</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$32,631</td>
</tr>
</tbody>
</table>

|$76,596 | $69,562 | $78,810 |

* PSLC – Parallel Sysplex Licensing Charge, VWLC – Variable Workload Licensing Charge (newer)

z/TPF + z/TPFDF Relative Price/MSU

Sample workload at equivalent predicted workload
### Example of Sysplex Aggregation, Saving >$82K MLC

<table>
<thead>
<tr>
<th></th>
<th>NO AGGREGATION</th>
<th>AGGREGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>z900 Model 305</td>
<td>z900 Model 1C8</td>
</tr>
<tr>
<td>COBOL</td>
<td>302 MSUs</td>
<td>302 MSUs</td>
</tr>
<tr>
<td>Fortran</td>
<td>302 MSUs</td>
<td>302 MSUs</td>
</tr>
<tr>
<td>REXX</td>
<td>302 MSUs</td>
<td>302 MSUs</td>
</tr>
<tr>
<td>CICS TS</td>
<td>302 MSUs + 276 MSUs</td>
<td>578 MSUs</td>
</tr>
<tr>
<td>DB2</td>
<td>302 MSUs + 276 MSUs</td>
<td>578 MSUs</td>
</tr>
<tr>
<td>z/OS</td>
<td>302 MSUs + 276 MSUs</td>
<td>578 MSUs</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td><strong>$321,596/mo</strong></td>
<td><strong>$239,090/mo</strong></td>
</tr>
</tbody>
</table>

### TCO Comparisons

- **Consolidation**
- **Offload**

*Benefit of price savings*
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

Two Kinds of Workload Consolidation

- **Roll-up**: Migrate to achieve lower costs
- **Strategic Hosting**: Incremental growth on System z
“Specialty Engines” Make Consolidation Even More Attractive

- Special assist processors for System z
  - For Java workloads (zAAP)
  - For selected DB2 workloads (zIIP)
  - For Linux workloads (IFL)

- Attractive pricing
  - Hardware is $125K per processor one time charge
    - $125K for a 580 MIP processor
    - ~ 9% of the normal price
  - No charge for IBM software running on zAAP/zIIP
    - IBM software running on IFL pays 100 PVU’s (same as Intel dual core)
  - Free upgrade to next generation!

- Requirements
  - Max number of zAAP <= number of general purpose processors
  - Max number of zIIP <= number of general purpose processors
  - No Limit on the number of IFL’s

How Much Workload is zAAP or zIIP- able?

- How much DB2 workload can typically be run on zIIP?
  - Parallel queries (Data Warehouse scenario)
    - Up to 40%
  - Queries received via DRDA Remote Access Protocol (Database Server scenarios)
    - Up to 80%
  - Some of index maintenance utilities

- How much Java workload can typically be run on a zAAP?
  - WebSphere scenario
    - Up to 85% of a WebSphere workload

- How much Linux workload can typically be run on an IFL?
  - 100% of Linux workload

- Offloads to specialty processors reduce software load and charges on general purpose processors
  - For sub capacity pricing, the offload must occur at a time that will reduce billable rolling average

Results may vary
Example: Consolidate Data Server For SAP On Mainframe

Existing Mainframe

Add 1 LPAR for New SAP Data Server w 42 TB Storage

Add two processors:
- 1 zIIP (386 MIPS, 40%)
- 1 General purpose (590 MIPS, 60%)

Or add HP Integrity rx8640 Server w 75 TB storage

zIIP Processor and Storage Compression Lowers the Cost of Acquisition

Mainframe Cost Analysis

Oracle on Distributed Cost Analysis

Total cost = $3,395,389

Total cost = $5,448,404

1.6 times more expensive
SAP Data Server Incremental Cost Breakdown

Mainframe Hardware

<table>
<thead>
<tr>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 General Processor</td>
<td>$1,452,500</td>
</tr>
<tr>
<td>1 J2IP Processor</td>
<td>$125,000</td>
</tr>
<tr>
<td>IBM Storage (42TB)</td>
<td>$1,449,801</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$3,027,301</td>
</tr>
</tbody>
</table>

Mainframe Software

<table>
<thead>
<tr>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities</td>
<td>$0</td>
</tr>
<tr>
<td>DB2 MLC</td>
<td>$33,840</td>
</tr>
<tr>
<td>zOS MLC</td>
<td>$34,944</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$68,784</td>
</tr>
</tbody>
</table>

Distributed Hardware

<table>
<thead>
<tr>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Processors</td>
<td>$603,939</td>
</tr>
<tr>
<td>HP storage (75TB)</td>
<td>$3,107,469</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$3,711,408</td>
</tr>
</tbody>
</table>

Distributed Software

<table>
<thead>
<tr>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle EE</td>
<td>$640,000</td>
</tr>
<tr>
<td>Unix</td>
<td>$126,048</td>
</tr>
<tr>
<td>Unix S&amp;S</td>
<td>$107,456</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$991,146</td>
</tr>
</tbody>
</table>

DB2 – Better Compression Ratio Than Oracle

- TPC-H is a well known data warehouse benchmark
  - Each vendor uses the same tables and same data
  - Oracle published their compression rates for TPC-H tables at the VLDB conference in 2003
  - IBM ran the same tests on the same tables

- Test results

<table>
<thead>
<tr>
<th>Table</th>
<th>Compression Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oracle</td>
</tr>
<tr>
<td>LINEITEM</td>
<td>38%</td>
</tr>
<tr>
<td>ORDERS</td>
<td>18%</td>
</tr>
<tr>
<td>Entire Database</td>
<td>29%</td>
</tr>
</tbody>
</table>
Example: Consolidate New Data Warehouse Application on Mainframe

- **Existing Mainframe**
  - Existing processors: 2 general purpose

- **Existing Disaster Recovery Site**
  - Existing processors: Pay for one general purpose processor for hot disaster switch over and one “dark” DR processor at $30K

- **Add 1 LPAR for New Data Warehouse w 42 TB Storage**
  - Add four processors:
    - 3 zIIPs: 1,664 MIPS (79%)
    - 1 General purpose: 489 MIPS (21%)
  - Pay for Capacity Backup 4 processors $30K each

- **And Add Disaster Recovery**
  - 3 year cost of acquisition $4.90M

- **Or add Superdome 9000 Server w 75 TB storage**
  - Disaster Recovery typically not considered
  - 3 year cost of acquisition $8.24M

  *Production RPE’s required = 1954 x 87 = 169,998

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zIIP Processors and Storage Compression Lower the Cost of Acquisition

### Mainframe Cost Analysis

<table>
<thead>
<tr>
<th>Hardware OTC $3,836,270</th>
<th>Software OTC $1,343,491</th>
<th>Year 1 Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$353,526</td>
</tr>
</tbody>
</table>

- **Year 1 Annual Operating Cost**
  - $353,526

- **Year 2 Annual Operating Cost**
  - $353,526

- **Year 3 Annual Operating Cost**
  - $353,526

**Total cost = $4,896,848**

### Distributed Cost Analysis

<table>
<thead>
<tr>
<th>Hardware OTC $4,898,201</th>
<th>Software OTC $1,781,928</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$550,641</td>
</tr>
</tbody>
</table>

- **Year 1 Capital Cost**
  - $550,641

- **Year 1 Annual Operating Cost**
  - $550,641

- **Year 2 Annual Operating Cost**
  - $550,641

- **Year 3 Annual Operating Cost**
  - $550,641

**Total cost = $8,242,052**

1.7 times more expensive
Data Warehouse Incremental Cost Breakdown

<table>
<thead>
<tr>
<th>Mainframe Hardware</th>
<th>Mainframe Software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OTC</strong></td>
<td><strong>ANNUAL</strong></td>
</tr>
<tr>
<td>Z Processors</td>
<td>Processor Maintenance</td>
</tr>
<tr>
<td>$1,825,000</td>
<td>$123,540</td>
</tr>
<tr>
<td>4 DR Processors</td>
<td>Storage Maintenance</td>
</tr>
<tr>
<td>$120,000</td>
<td>$0</td>
</tr>
<tr>
<td>IBM Storage</td>
<td></td>
</tr>
<tr>
<td>(42TB)</td>
<td>$1,449,801</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>TOTAL</strong></td>
</tr>
<tr>
<td>$3,394,801</td>
<td>$123,540</td>
</tr>
</tbody>
</table>

| **OTC**            | **ANNUAL**         |
| Utilities          | Utilities S&S      |
| $441,469           | $44,454            |
| DB2 MLC            | $72,240            |
| QMF MLC            | $34,716            |
| zOS MLC            | $78,576            |
| **SubTotal MLC**   | **TOTAL**          |
| $185,532           | $299,986           |

<table>
<thead>
<tr>
<th>Distributed Hardware</th>
<th>Distributed Software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OTC</strong></td>
<td><strong>ANNUAL</strong></td>
</tr>
<tr>
<td>HP Processors</td>
<td>Processor Maintenance</td>
</tr>
<tr>
<td>$1,700,735</td>
<td>$164,044</td>
</tr>
<tr>
<td>HP storage (7TB)</td>
<td>Storage Maintenance</td>
</tr>
<tr>
<td>$3,107,469</td>
<td>$30,951</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>TOTAL</strong></td>
</tr>
<tr>
<td>$4,808,204</td>
<td>$194,995</td>
</tr>
</tbody>
</table>

| **OTC**              | **ANNUAL**            |
| Oracle EE & Utilities| Oracle S&S            |
| $1,352,000           | $297,440              |
| Unix                 | Unix S&S              |
| $204,828             | $58,205               |
| HP Storage SW        | $225,100              |
| **TOTAL**            | **TOTAL**             |
| $1,781,928           | $355,645              |

85%+ of WebSphere is zAAP-able, saving $Ms

- Only 2.6% overhead
- HW savings = $2.8M
  - Savings of 1,914 GP MIPs (425% of a z990)
- WAS OTC savings = $200K
  - 2,250 MIPS (340 MSUs) = $258K
  - 338 MIPS (53 MSUs) = $58K
  - Plus $40K p.a. S&S savings
  - Plus $228K p.a. zNALC savings
  - Then add in DB2 MLC savings ...

One customer has achieved 92% Java offload to zAAPs!

From the Redbook Implementing an SOA on the IBM zSeries Platform (ZG24-6752)
Example: Consolidate New WebSphere Application on Mainframe

**Existing Mainframe**
- Existing processors: 2 general purpose
- Pay for one general purpose processor until disaster switch over

**Existing Disaster Recovery Site**
- Existing processors: 2 general purpose
- Pay for one general purpose processor until disaster switch over

**Add 3 LPARs for New Web Application**
- Add two processors:
  - one zAAP
  - 530 MIPS WAS (85%)
  - one General Purpose
  - 300 DE2 MIPS
  - 90 WAS MIPS (15%)
- 900 MIPS additional workload

**And Add Disaster Recovery**
- Pay for Capacity Backup:
  - two processors $30K each
- 3 year cost of acquisition: $3.11M

**Or add Superdome 9000 Servers**
- 16 Chip 32 Core
- 82,531 RPE's

**And Add Disaster Recovery**
- 16 Chip 32 Core
- 82,531 RPE's
- 3 year cost of acquisition: $3.89M

* Assume dev and QA is 25% of 900 MIPS total. Then production RPE’s required = 900 x .75 x 122 = 82,350

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**zAAP Processor Lowers the Cost of Acquisition**

**Mainframe Cost Analysis**

- **Software OTC:** $506,140
- **Hardware OTC:** $1,635,000
- **Total Year 1 Capital Cost:** $2,191,140
- **Year 1 Annual Operating Cost:** $307,278
- **Year 2 Annual Operating Cost:** $307,278
- **Year 3 Annual Operating Cost:** $307,278
- **Total cost:** $3,112,974

**Distributed Cost Analysis**

- **Software OTC:** $1,116,272
- **Hardware OTC:** $1,451,817
- **Total Year 1 Capital Cost:** $2,668,089
- **Year 1 Annual Operating Cost:** $408,116
- **Year 2 Annual Operating Cost:** $408,116
- **Year 3 Annual Operating Cost:** $408,116
- **Total cost:** $3,892,437
- **1.3 times more expensive**

TCOberlin DR 4-23-07.ppt
### WebSphere Application Server Incremental Cost Breakdown

#### Mainframe Hardware

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<thead>
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<tbody>
<tr>
<td>1 GP Processor</td>
<td>$1,450,000</td>
<td></td>
</tr>
<tr>
<td>zAAP</td>
<td>$125,000</td>
<td></td>
</tr>
<tr>
<td>2 DR Processors</td>
<td>$60,000</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1,635,000</strong></td>
<td><strong>$88,500</strong></td>
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</tbody>
</table>

#### Mainframe Software

<table>
<thead>
<tr>
<th></th>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities + WAS</td>
<td>$556,140</td>
<td></td>
</tr>
<tr>
<td>DB2 MLC</td>
<td>$72,240</td>
<td></td>
</tr>
<tr>
<td>QMF MLC</td>
<td>$34,716</td>
<td></td>
</tr>
<tr>
<td>z/OS MLC</td>
<td>$67,368</td>
<td></td>
</tr>
<tr>
<td><strong>SubTotal MLC</strong></td>
<td><strong>$174,324</strong></td>
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#### Distributed Hardware

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<tr>
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<td>$1,451,817</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1,451,817</strong></td>
<td><strong>$123,139</strong></td>
</tr>
</tbody>
</table>

#### Distributed Software

<table>
<thead>
<tr>
<th></th>
<th>OTC</th>
<th>ANNUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle EE &amp; Utilities</td>
<td>$658,000</td>
<td></td>
</tr>
<tr>
<td>WebSphere</td>
<td>$259,875</td>
<td></td>
</tr>
<tr>
<td>Unix</td>
<td>$98,397</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1,216,272</strong></td>
<td><strong>$284,977</strong></td>
</tr>
</tbody>
</table>

---

### Linux Consolidation

**IBM Global Services Consolidated 62 Linux Servers onto one IFL**

**UNIX to zLinux Cost Savings**

(\textit{Costs Savings are driven primarily by $89K monthly labor savings})

- **Broke-even after 6 months**
- **>$2.5M saved in 3 years**

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TCOBerlin DR 4-23-07.ppt

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TCOBerlin DR 4-23-07.ppt

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The Economics of Linux Workload Consolidation

62 Linux servers with low utilization
62 @ $5,000 = $310,000
Plus 62 middleware licenses
Plus $6,500 x 62 = $403,000/yr labor

One IFL processor with high utilization
1 @ $125,000 = $125,000
Plus one middleware license
Little additional labor

Example Analysis of Linux Consolidation TCO Savings

$1M saving over 3 years

<table>
<thead>
<tr>
<th></th>
<th>Distributed Linux/Intel @ low utilization</th>
<th>Mainframe IFL @ high utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit cost</td>
<td>Quantity</td>
</tr>
<tr>
<td>Hardware &amp; OS - every 3 years</td>
<td>$4,000</td>
<td>60</td>
</tr>
<tr>
<td>Additional Memory</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>HW Maintenance</td>
<td>Included</td>
<td></td>
</tr>
<tr>
<td>VM virtualization</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>VM S&amp;H (25%)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Annual Linux support</td>
<td>$1,000</td>
<td>60</td>
</tr>
<tr>
<td>OTC Software license -- WAS*</td>
<td>$4,000</td>
<td>60</td>
</tr>
<tr>
<td>WAS S&amp;H for 2 years</td>
<td>$800</td>
<td>60</td>
</tr>
<tr>
<td>Annual labor for support</td>
<td>$3,333</td>
<td>60</td>
</tr>
<tr>
<td>Annual power &amp; cooling</td>
<td>$900</td>
<td>60</td>
</tr>
<tr>
<td>Grand Total</td>
<td>$1,521,564</td>
<td></td>
</tr>
</tbody>
</table>

*IBM WebSphere Application Server for Linux
Hannaford Supermarket Chain Goes Real Time with Linux on System z

- North-eastern United States supermarket chain
- Reduced costs while improving customer and partner satisfaction using Linux on System z
- Consolidated 300 store servers onto a single mainframe
  - Running 62 virtual servers instead
  - Orders now direct from the aisles, just-in-time inventory management
  - Introduced new web portal for business partners
  - Significant labor savings across the IT organisation

"The only way we’d consider consolidating critical data from hundreds of servers onto one system was by choosing an IBM mainframe for its legendary reliability and availability."

Bill Homa, senior vice president and CIO of Hannaford

Nationwide® 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 IFLs (z990)
    - 12 mission critical applications with 100,000+ users/day
    - supported by 3 staff
  - 50% reduction in Web hosting monthly costs, 80% reduction in floor space & power conservation
  - 50% reduction in hardware & OS support efforts; significant savings on middleware costs
  - Fast deployment (4 months)
  - Significantly faster provisioning speed (months → days)
  - Simple, robust mainframe high availability & disaster recovery

Vastly improved TCO, Speed & Simplification
Québec Government Runs Oracle at IFL Prices

- Consolidated 190 Oracle Databases (9i and 10g) onto a z9-EC with IFL’s
  - Reduced cost of hardware and software by 30%
  - Better database loading performance due to higher I/O bandwidth
  - Each administrator could manage 100 database instances
  - Easy migration
    - One migration per day
    - Create new Linux server in 30 min (vs 1 week – 3 months)
    - Clone Oracle DB instance in 30-45 min (vs 10 – 14 hours)
    - Unload/load
  - Inherit benefits of z platform – workload management, availability, disaster recovery
  - Expect to migrate 200 more Oracle databases per year

NEW!

Execute .NET Code on the Mainframe at IFL Prices

Visual MainWin for J2EE

Contact: Ron Johnsen – VP WW Sales, ronj@mainsoft.com USA 408 200 4023
Replace Third Party Tools to Reduce Costs

- **LabCorp**
  - 35 products replaced - includes RMM, TWS, SCLM, and DB tools and AD tools
  - About 700 MIPS
  - $12M saved
- **Putnam Investments**
  - Over 20 products replaced at 2 sites - includes RACF, RMM, TWS, SCLM, SA390, GRS and DB2
  - Suite of tools
  - About 1500 MIPS
  - $Millions saved
- **Hennepin County**
  - Products replaced - includes RACF, TWS, SA390, DB2PM, TDS
  - About 1100 MIPS
  - $3M in savings
- **Major automotive manufacturer**
  - Doubled MIPS from 600 to 1200
  - Annual savings of $1.8M
- **Typically 30-50% lower run-rate after initial ROI period**

A typical customer engagement replacing BMC tools

<table>
<thead>
<tr>
<th>Original Product</th>
<th>IBM Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainview for z/OS</td>
<td>IBM Tivoli OMEGAXON XE for z/OS</td>
</tr>
<tr>
<td>Mainview for z/OS</td>
<td>IBM Tivoli OMEGAXON XE for z/OS</td>
</tr>
<tr>
<td>Mainview for DB2</td>
<td>IBM Tivoli OMEGAXON XE for DB2</td>
</tr>
<tr>
<td>Mainview for IMS</td>
<td>IBM Tivoli OMEGAXON XE for IMS</td>
</tr>
<tr>
<td>Image Copy Plus for IMS</td>
<td>IMS High-Performance Image Copy</td>
</tr>
<tr>
<td>Unload Plus for IMS</td>
<td>IMS High-Performance Unload V1</td>
</tr>
<tr>
<td>Prefix Resolution Plus for IMS</td>
<td>IMS High-Performance Prefix Resolution V3</td>
</tr>
<tr>
<td>Load Plus for IMS</td>
<td>IMS High-Performance Load</td>
</tr>
<tr>
<td>Secondary Index Utility / EP</td>
<td>IMS INDEX BUILDER V2.3</td>
</tr>
</tbody>
</table>

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TCOberlin DR 4-23-07.ppt

TCO Comparisons

CONSOLIDATION

Distributed

OFFLOAD

System Z
Asian Financial Services Customer Offload Project - Overall

3x HP 64-way Production Application and DB

1x HP 64-way Dev/Test / Batch

2x HP 32-way PL/1 (Mgmt, Dev&Test, and Batch)

17 processors (6,700 MIPS)

320 Unix processors (816,002 RPE’s)

2x z990 5-way (production)

z990 7-way (production + test)

122 RPE’s per MIP

Plus:
2x HP 16-way servers: external, HP rx8620
3x IBM p570 servers: Web Appl server

No disaster recovery

Telco Industry VOIP Benchmark (CommuniGate) Comparison

HP Superdome – 64 x 1.5GHz Itanium 2 processors

z9 24-way Benchmark

64 Unix processors (109,560 RPE’s)

24 processors (13,920 MIPS)

Call initiation rate on z9 is 6.5x more

52 RPE’s per MIP

Sources: CommuniGate-Superdome-VoIP-Benchmark.pdf & IBM-CommuniGate-z9.pdf from http://www.communicate.com/Papers
Asia Pacific Financial Services Customer Offload Project – Database

Production Oracle RAC cluster of 3 HP Superdome nodes (28 processors per node)

z90 Processors for DB2 (production and development)

7 processors (2,680 MIPS*)

100 Unix processors Oracle RAC (233,510 RPE’s)

87 RPE’s per MIP

No disaster recovery

* DB2 is estimated to be 40% of total workload

Did They Save Money by Offloading?

- Competitors told the customer they would save $22M over 4 years
- IBM analysis determined that the offload solution would actually cost $66M more than growing on z

Competitor’s 4 Year Cost / Savings Prediction

<table>
<thead>
<tr>
<th>Case A</th>
<th>Case C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Growth on z</td>
<td>Cost of Rehost</td>
</tr>
<tr>
<td>$6M</td>
<td>$43M</td>
</tr>
<tr>
<td>$22M Savings</td>
<td></td>
</tr>
</tbody>
</table>

IBM Analysis

<table>
<thead>
<tr>
<th>Case B</th>
<th>Case D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Growth on z</td>
<td>Cost of Rehost</td>
</tr>
<tr>
<td>$66M</td>
<td>$128.5M</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
</tr>
</tbody>
</table>

$22M Savings
Lessons Learned About the Promises Made by the Competitors

- They *over-estimated* the mainframe costs
  - Over-provisioned too early $\Delta 3.6M$
  - Used highest hardware purchase & maintenance list prices $\Delta 9.4M$
  - Continued using older software; no sub-cap pricing $\Delta 2.7M$
  - OVERESTIMATED BY $\Delta 15.7M$

- They *under-estimated* the offload costs
  - Forgot about mainframe coexistence during migration $\Delta 9.5M$
  - Forgot about high cost of power & cooling $\Delta 1.1M$
  - Forgot about the financing charges $\Delta 2.5M$
  - Added a test server $\Delta 2.1M$
  - Under-provisioned batch processing (15 % growth case) $\Delta 6.3M$
  - Failed to take into account technology updates $\Delta 14.6M$
  - Did not provide Disaster Recovery $\Delta 40.6M$
  - UNDERESTIMATED BY $\Delta 76.7M$

European Banking Customer Study

TCO Analysis to Offload CICS Transaction Workload

Conclusion: Same TCO with no benefit from additional migration cost
Why Do Servers Proliferate in Offload Scenarios?

- The following considerations contribute to server proliferation
  - De-multiplexing of applications to dedicated servers
    - One application workload per server group
    - Peak-to-average provisioning yields low utilization
    - Additional provision for expected growth in out years (no capacity on demand)
    - Batch workload may stress I/O capabilities
    - Separate servers for production, failover, development/test, disaster recovery
    - Infrastructure servers for systems management
  - Processing comparisons
    - Language expansion (CICS/COBOL path lengths are highly optimized)
    - Conversion factor (MIPS to TPM-C or RPE) worsens as I/O rates increase
    - Oracle RAC inefficiencies compared to DB2
- Other TCO considerations
  - 3 to 5 year lifetime for distributed servers requires repurchase
  - Dual environments during migration
  - Partial offloads eliminate the lowest cost MIPS first

Utilization of Distributed Servers

- Provision for expected growth
- Provision capacity for peak workload
- Average utilization
- Server dedicated to one application

- Typical utilization of Windows Servers 5 – 10%
- Typical utilization of UNIX Servers 10 – 20%
- Typical utilization of System z Servers 85 – 100%
Oracle RAC Inefficiencies Compared to DB2

- DB2 for z/OS provides near-linear scalability with relatively little overhead as nodes are added.
- With Oracle RAC, overhead increases rapidly as additional nodes are added and performance degrades after only 4 to 6 nodes.

Oracle RAC source: “Scale-up versus scale-out using Oracle 10g with HP StorageWorks”, Hewlett-Packard, 2005

DB2 for z/OS source: "Enterprise Data Base Clustering Solutions" ITG, October 2003

Let’s Consider The Other Elements of Cost

Total Cost of Ownership =
Cost of hardware +
Cost of software +
Environmentals +
Cost of labor +
Financial terms
Distributed Power Costs Have Become a Major Issue

- According to the Wall Street Journal, distributed server farms can generate as much as 3,800 watts per square foot (up from 250 in 1992)
  - By comparison, a System z9 consumes 107-312 watts per square foot – one tenth or less the amount
  - Turning on an IFL processor consumes 75 additional watts
  - Cooling cost is roughly an additional 60% of the power cost

- More than half of all serious outages are now caused by power problems*
  - Room temperatures averaging 92°F lead to erratic machine behavior

- Aside from cost, some data centers can’t obtain additional power from their providers

*Source: recent AFOM survey of 200

Mainframe Power and Scale Efficiency

- 10 Times Difference in Power Consumption
- 6.2 Times in Scalability

Source for HP Servers: Ideas International, Nov 06
Note: Uses equivalence ratio of 122 RPE’s per MIP
**Do the Math**

- HP Itanium 2 Superdome 9050 (64ch/128co) consumes a maximum of 24,382 watts
  - $24.382 \times 0.08 \times 24 \times 365 = \$17,087$ per year for electricity

- Mainframe with similar computing capacity consumes 2,500 watts
  - $1,752$ per year for electricity
  - Power cost is $15,335$ per year less

- Similar savings on cooling capacity
  - Cost of cooling is 60% to 80% the cost of power
  - Superdome total $\$27,339$ per year vs Mainframe $\$2,803$

---

**People Expense has Become the Dominant Component of TCO**

*Based on IBM Scorpion customer analyses*
Since 2000, Labor Costs Have Exceeded the Cost of All Servers ... and are Still Growing

Data Center Staffing Levels for System z Have Not Increased Despite Large Increase in MIPS
### A Comparison of Labor Costs for Two Environments That Execute Roughly Equivalent Workloads

<table>
<thead>
<tr>
<th>Topic</th>
<th>System z – 3,192 MIPS</th>
<th>900 Distributed Servers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>$105K …… 10% of 6 FTEs</td>
<td>none</td>
</tr>
<tr>
<td>Customer Engineers</td>
<td>$52K …… 0.3 FTEs</td>
<td>$400K SUN charges</td>
</tr>
<tr>
<td></td>
<td>$50K LAN charges</td>
<td>$300K LAN charges</td>
</tr>
<tr>
<td></td>
<td>$35K z- charges</td>
<td>$40K p- charges</td>
</tr>
<tr>
<td>Systems Engineers</td>
<td>$551K …… 3.15 FTEs</td>
<td>$5,250K …… 30 FTEs (Operations in the Systems charge)</td>
</tr>
<tr>
<td>Security Admin</td>
<td>None</td>
<td>$600K</td>
</tr>
<tr>
<td>Total</td>
<td>$793K</td>
<td>$6,690K</td>
</tr>
</tbody>
</table>

In this case, System z requires 1/8 the labor costs of the distributed environment

Source: IBM SWG Data Center

### Labor Cost Per Transaction on System z is Decreasing

![Graph showing labor cost per transaction decreasing over time](image)

**16.9% decrease per year**

*What makes the price go down?*

- Increasing workloads
- Data-center-in-a-box design reduces need for labor
- Scalability of the mainframe
- Ease of incremental upgrade
- Inherent reliability of the mainframe
- Fewer repairs and patches
- Intelligent Workload Management Including CICSplexSM
- Minimal security risks & breaches
- IBM integration, testing & support

Source: IBM Global Services UK
Conclusion: Total Mainframe Hardware, Software & Labor Costs Reduced by 62% in 5 Years

- 17% decrease per year
- Labor cost per transaction
- Software cost per transaction
- Hardware cost per transaction

Trade-In Value Reduces Mainframe Net Present Value Costs

- Upgrade to next generation mainframe
  - Specialty processors are upgraded to next generation free of charge
  - Growing customers typically receive credit for existing MIPS investment when upgrading to new generation
  - Full trade-in value applied to upgrade and growth MIPS

- Upgrade to next generation distributed systems
  - Life time of 3 to 5 years
  - Must repurchase existing processor capacity plus any growth

- Long term TCO implications can be important
Java Application Example Considering 100% Trade in on Processors

Mainframe Cost Analysis

<table>
<thead>
<tr>
<th>Year 1 Capital Cost</th>
<th>Year 1 Annual Operating Cost</th>
<th>Year 2 Annual Operating Cost</th>
<th>Year 3 Annual Operating Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software OTC $2,191,140</td>
<td>Hardware OTC $1,635,000</td>
<td>$307,278</td>
<td>$307,278</td>
</tr>
<tr>
<td>Software OTC $556,140</td>
<td>Hardware OTC $1,635,000</td>
<td>$307,278</td>
<td>$307,278</td>
</tr>
</tbody>
</table>

Total cost = $3,112,974 - $2,191,140 = $921,834
NPV cost (at 6%) = $1,222,056

Distributed Cost Analysis

<table>
<thead>
<tr>
<th>Year 1 Capital Cost</th>
<th>Year 1 Annual Operating Cost</th>
<th>Year 2 Annual Operating Cost</th>
<th>Year 3 Annual Operating Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software OTC $2,166,089</td>
<td>Hardware OTC $1,491,877</td>
<td>$408,116</td>
<td>$408,116</td>
</tr>
<tr>
<td>Software OTC $2,166,089</td>
<td>Hardware OTC $1,491,877</td>
<td>$408,116</td>
<td>$408,116</td>
</tr>
</tbody>
</table>

NPV Cost is 2.3 times more

Total cost = $3,892,437 - $1,216,272 = $2,676,165
NPV cost (at 6%) = $2,803,236

Tale of Two Customers

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Baldor</th>
<th>Welch's</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td></td>
<td>Dell</td>
</tr>
<tr>
<td>Moved From....</td>
<td>3 Mainframes and 8 Unix Servers</td>
<td>S/390 and AS/400</td>
</tr>
<tr>
<td>Moved to...</td>
<td>1 z900 System z Server</td>
<td>100 Intel Servers</td>
</tr>
<tr>
<td>Virtualization</td>
<td>z/VM</td>
<td>VMWare</td>
</tr>
<tr>
<td>Decision to Completion Time</td>
<td>Approximately 6 months</td>
<td>Started sometime before June 2005 “...project will continue into 2007”</td>
</tr>
<tr>
<td>IT Staff</td>
<td>Down to 38</td>
<td>50</td>
</tr>
<tr>
<td>IT Spending</td>
<td>1.2% of Sales (and still declining....now down to 0.9%)</td>
<td>About 2.5% of Sales</td>
</tr>
<tr>
<td>Max Power consumption</td>
<td>15.8 kW</td>
<td>48.4 kW</td>
</tr>
</tbody>
</table>

Three years ago, Baldor's IT director had investigated migrating to a Windows server environment with cluster fail-over. “We thought we were going to save a ton of money,” but the systems crashed all the time, he noted, and the idea was quickly abandoned.

“We have a very stringent requirement of being up all the time … Weighing heavily in support of the mainframe was its track record. There hadn’t been any mainframe downtime since 1997”
Case Study Summary

- Incremental Data Warehouse workload on System z costs **less** than Oracle RAC on HP Superdome
- Incremental Data Server on System z costs **less** than Oracle HP Superdome
- Incremental WebSphere workload on System z costs **less** than distributed deployment
- Consolidation of Linux servers onto System z **saves** big money
- System z uses less power and requires fewer operational staff

Inaccurate Charge Back Policies Can Distort User’s View of Cost

<table>
<thead>
<tr>
<th>Bad</th>
<th>Better</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Costs Allocated to the Mainframe</td>
<td>Fixed Allocation by Consensus</td>
<td>Actual Usage of Each Resource</td>
</tr>
<tr>
<td></td>
<td>(mainframe vs distributed)</td>
<td>(mainframe or distributed)</td>
</tr>
<tr>
<td>Incremental Mainframe Application Costs</td>
<td>All Incremental Mainframe Costs Extrapolated from Current Costs</td>
<td>Calculate Actual Incremental Mainframe Costs Considering Specialty Engines, Pricing Curves, On Demand Capacity, Disaster Recovery, Environmental, and Labor</td>
</tr>
<tr>
<td>Calculated as if Standalone (e.g. New Footprint)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental Distributed Application Costs</td>
<td>Calculations Also Include Development, Test, and Disaster Recovery Hardware and Software</td>
<td>Calculations Also Include Incremental Environmental and Labor</td>
</tr>
<tr>
<td>Include Only Production Hardware and Software</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Center Cost Recovery Model Based on Usage

- What Costs Need To Be Recovered?
- How Are Costs Associated With Applications? (ATM, Credit Card, Commercial Loans, Mortgages)
- Receive Recoveries From Departments
- How are Applications Associated With Departments And Resources?
- IBM Tivoli Usage and Accounting Manager (ITUAM)
- Create Department Invoices
- Determine Utilization

IBM Tivoli Usage and Accounting Manager (ITUAM)

- A cross-platform tool that determines and allocates the cost of providing IT system services
- Helps manage IT costs by appropriating costs to an organization’s products, services and business functions
- Measures, analyzes, reports, and bills the utilization and costs of different computing resources
  - servers, storage, networks, databases, virtualized environments, messaging, print servers, and subsystems
  - tracks mainframe and distributed platforms
- Internet enabled
  - Web-Based Reporting and Drill-Down
Example: Typical Data Center – A Mix of Mainframe and Distributed Servers

105 HP Integrity rx4640 (4U) Itanium2 servers
• 70 servers are running WebSphere
• 35 servers are running Oracle EE
Two (2) Mainframes (7,000 MIPS)
• 8 general processors
• 5 zAAP
• 1 z9IP
• WAS and DB2

What are the recoverable costs?

<table>
<thead>
<tr>
<th></th>
<th>OTC – Distributed (Annual Depreciation – 3 Year Straight Line)</th>
<th>OTC – Mainframe (Annual Depreciation 5 Year Straight Line)</th>
<th>Annual Distributed</th>
<th>Annual Mainframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>$2,213,219</td>
<td>$2,763,960</td>
<td>$445,806</td>
<td>$527,448</td>
</tr>
<tr>
<td>Software</td>
<td>$2,594,333</td>
<td>$76,210</td>
<td>$2,174,900</td>
<td>$1,875,902</td>
</tr>
<tr>
<td>Labor</td>
<td></td>
<td></td>
<td>$2,520,000</td>
<td>$1,680,000</td>
</tr>
<tr>
<td>Floor space</td>
<td></td>
<td></td>
<td>$75,600</td>
<td>$63,840</td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
<td>$143,000</td>
<td>$38,000</td>
</tr>
<tr>
<td>Network</td>
<td></td>
<td></td>
<td>$57,100</td>
<td></td>
</tr>
<tr>
<td>Total per year</td>
<td>$4,864,652</td>
<td>$2,842,170</td>
<td>$5,359,306</td>
<td>$4,185,190</td>
</tr>
</tbody>
</table>

Total Recoverable Costs
Annual: $17,251,318
Monthly: $1,437,610

Allocation of Monthly Recoverable Costs

<table>
<thead>
<tr>
<th></th>
<th>Old Allocation - Consensus</th>
<th>New Allocation - Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distributed</td>
<td>%</td>
</tr>
<tr>
<td>Power Cost</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Labor Cost</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Floor space</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Software OTC</td>
<td>$120,240</td>
<td>60</td>
</tr>
<tr>
<td>Software S&amp;S and MLC</td>
<td>$168,783</td>
<td>50</td>
</tr>
<tr>
<td>Hardware OTC</td>
<td>$103,691</td>
<td>25</td>
</tr>
<tr>
<td>Hardware</td>
<td>$20,276</td>
<td>25</td>
</tr>
<tr>
<td>Maintenance</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>$412,990</td>
<td>29</td>
</tr>
</tbody>
</table>

Total $1,437,610
IBM Charge-back Service Offerings

- IBM has standard service offerings that can help you implement best practices for charge-back using ITUAM
  - IT Accounting/Chargeback Assessment & Readiness Review (2 to 6 weeks)
  - IT Accounting/Chargeback System Design (1 to 3 months)
  - IT Accounting/Chargeback System Development & Implementation (4 to 12 months)
  - IT Accounting/Chargeback Planning & Consultation Assistance (As needed)
  - IT Accounting/Chargeback Migration Assistance from neuMICS, MXG, and SAS IT Charge Management

- Contact
  - US: Russ Egeland, Phone: 1-301-280-7546, E-mail: egeland@us.ibm.com
  - Europe: Richard Jarrett in UK, Phone: 44-1926-465027, E-mail: richard-j-jarrett@uk.ibm.com

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When Does 30% Incremental Workload Growth Cost Less?

3 Year TCO with Hi-RAS requirement

Source: Eric Kutcher, McKinsey Analysis
System z Delivers Cost Advantage as You Consolidate More

Consolidation Efficiency

Analysis based on Québec Government Scenario

Data Warehouse Example Considering 100% Trade in Value on Mainframe Processors

Mainframe Cost Analysis

Total cost = $4,896,848 - $2,386,469 = $2,510,379
NPV cost (at 6%) =$2,834,223

Distributed Cost Analysis

Total cost = $8,242,052 - $1,781,928 = $6,460,127
NPV cost (at 6%) =$6,654,173

NPV Cost is 2.3 times more
GAD TCO Study – a WebSphere Banking Example

Distributed servers have higher service, monitoring and support costs and cost more to develop and implement

The Economics of Workload Consolidation

- Distributed servers typically run at utilization levels in the range of 5% to 20%
  - Production servers, development servers, test servers
- Virtualization and workload management enable consolidation on the mainframe
  - Run multiple images on fewer processors
  - Achieve utilization levels of 85% or more
- Mainframe “specialty engines” further improve consolidation economics
  - WebSphere, Database, Linux

CONsolidation

5% to 20% utilization

Full utilization