

L76

Choose the Wrong Architecture and Waste Millions – A Customer Case Study

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Agenda

- **Disclaimer**
- **Caveats and Emptors**
- **Basic Scenario**
- **The First Project Meeting**
- **Internal Constraints**
- **High-level System Hardware Overview**
- **Other Hardware**
- **Software**
- **Power and Cooling**

Agenda (2)

- **Floor Space**
- **Wear and Tear on People**
- **How Busy Were Those Servers?**
- **The Mainframe Alternative**
- **Questions**
- **General Discusson, time permitting**

I'll take questions during the talk unless time gets tight

Disclaimer

- **My current employer (Novell) had nothing whatsoever to do with the project I will be describing.**
- **I will not be talking about which companies were involved, for obvious reasons.**
- **Costs for the mainframe version will be approximate, since IBM doesn't have list prices, per se, for z9 hardware (except IFLs). I was provided with cost figures (at the very high end), from someone who had access to them.**
- **I was involved in the project, and still have the scars...**

Caveats and Emptors

- **All hardware, software and maintenance costs are for 3 years.**
 - The numbers for the mainframe get even better over 5 years.
- **Not all hardware costs for the Intel deployment will be included in the dollar totals. (Don't worry, it's OK.)**
- **VMWare, although available at the time of the project, wasn't considered a viable option, so no virtualization was done.**
- **I'll only be talking about the Linux part of the project.**
- **z/VM will be configured to "over commit" real storage.**
 - Standard operating procedure for z/VM shops

Caveats and Emptors (2)

- **Storage will be configured with some percentage as expanded storage.**
- **Disk mirroring will be done in the DASD storage array, not by Linux or RAID controller.**
- **SAN costs are assumed to be equal between the two choices.**
- **People costs are assumed to be equal, even though managing mainframe Linux systems is less people-intensive.**
- **z/VM's Virtual Switch will be used to connect the Linux guests to the network.**

Basic Scenario

- **A new client required us to build ~50 Linux systems on Intel-based server class equipment.**
- **A much smaller number of Windows and Solaris systems were also to be built.**
- **Due to the client's promises to others, we had 2 months to get everything installed and in production.**
- **The systems were all going to be remote from where any of the Linux system administrators were located.**
- **A number of other bidders on the contract refused to commit to the 2-month timeframe.**
- **The project had upper management "visibility."**

The First Project Meeting

- **No hardware had been ordered**
 - This included racks, power distribution units, etc.
- **The account rep. working with the client refused to let us order only two server configurations, claiming the client would complain about the cost of over-spec'ing.**
- **Pushing the schedule out was not an option.**
- **All of the teams working on the project were "leveraged," i.e., not dedicated to one particular client.**
- **The network was still being designed.**
- **The requirements for system builds had not yet been received from the customer.**

Internal Constraints

- **We were to use a commercial system management product to provision and patch midrange systems. This worked best when the system was cabled directly to the provisioning network.**
 - We didn't have a place for that, so other measures were taken to get access to the provisioning network. They weren't terribly reliable/fast.
- **All servers had out-of-band remote management cards in them, connected via Ethernet, accessed via SSL-enabled HTTP (port 443).**

Internal Constraints

- **Remote access cards had to be configured by on site staff, and connected to switches. Firewall rules had to be written to allow connectivity.**
- **Racks could not be fully populated because of data center policies surrounding power distribution per square foot.**
- **Are we having fun yet?**

Development Systems

- **17 Systems**
 - Additional GIGe NICs - 17
 - RAM (total of 146GB)
 - 1 x 2GB
 - 6 x 4GB
 - 5 x 8GB
 - 5 x 16GB
 - Processors (3.33 and 3.4 GHz)
 - 2 x 1 CPUs
 - 5 x 2 CPUs
 - 10 x 4 CPUs
 - Internal 72GB SCSI disks - 10 x 4, 7 x 5 = 75

Test Systems

- **7 Systems**
 - Additional GIGe NICs - 7
 - RAM (total 96GB)
 - 2 x 8GB
 - 5 x 16GB
 - Processors (3.33 and 3.4 GHz)
 - 5 x 2 CPUs
 - 2 x 4 CPUs
 - Internal 72GB SCSI disks – 7 x 4 = 28

Production Systems

- **27 Systems**
 - Additional GIGe NICs - 27
 - RAM (total 254GB)
 - 3 x 2GB
 - 2 x 4GB
 - 14 x 8GB
 - 8 x 16GB
 - Processors (3.33 and 3.4 GHz)
 - 3 x 1 CPU
 - 12 x 2 CPUs
 - 12 x 4 CPUs
 - Internal 72GB SCSI disks – 20 x 4, 7 x 5 = 115

Other Hardware

- HBAs for SAN storage – 56
- Fibre cables for SAN – 56
- RAM expansion boards – 37
- External 72GB disks for alternate boot drives – 37
- External disk enclosures - 19
- SCSI cards for external disk access – 37
- Mezzanine riser cards – 37
- Rack units (42u) – 13 (78 sq. ft.)
- Power distribution units – 26

Other Hardware (2)

- Switch ports – 204
- Ethernet cables – 204
- SAN switch ports - 56
- Hardware support 24x7 – 27 (+10 for ext. storage)
- Hardware support 13x5 – 24 (+9 for ext. storage)

Not including the costs of switches, routers, etc.

- They were leveraged (shared with other clients)
- I don't know how many were used, what kind they were, etc.

Hardware Costs for 3 Years

- **\$1,212,130.55**
 - Doesn't seem too bad for 3 years, does it?

- **Total Cost so far:**
\$1,212,130.55

Software Licensing

- **Test and Development**
 - 29 Oracle database (per processor)
 - Oracle maintenance 22% of purchase price per year
 - 24 (3-year) Linux, including 9x5 support
- **Production**
 - 44 Oracle database (per processor)
 - Oracle maintenance 22% of purchase price per year
 - 27 (3-year) Linux, including 24x7 support
 - 2 clustering software

Software Costs for 3 Years

- **\$5,077,789.74**
 - Ooh, that's gotta hurt.
 - And it doesn't even include all the costs, because I didn't have access to some of them. (Powerpath, for example.) But, it was the majority of them, so good enough.
- **Total Cost so far:**
\$6,289,920.29

Power and Cooling at Idle

- **5 x 1 CPU, 4GB RAM, 5 disks**
 - 258 watts
 - 881 BTUs/hr
- **4 x 2 CPUs, 2GB RAM, 5 disks**
 - 337 watts
 - 1150 BTUs/hr
- **5 x 2 CPUs, 4GB RAM, 5 disks**
 - 341 watts
 - 1163 BTUs/hr

Power and Cooling at Idle (2)

- **3 x 2 CPUs, 4GB RAM, 4 disks**
 - 473 watts
 - 1614 BTUs/hr
- **10 x 2 CPUs, 8GB RAM, 4 disks**
 - 476 watts
 - 1622 BTUs/hr
- **12 x 4 CPUs, 8GB RAM, 4 disks**
 - 626 watts
 - 2134 BTUs/hr
- **12 x 4 CPUs, 16GB RAM, 4 disks**
 - 642 watts
 - 2191 BTUs/hr

Power and Cooling Costs for 3 Years

- 25,738 watts
- 87,782 BTU/hr
- At \$0.0936 (US average for 2006) for electricity
 - $25,738 * 24 * 365 / 1000 * 0.0936 = \$21,103.51$ per year
 - For 3 years, \$63,310.53
- At 0.7 of power costs for HVAC:
 - \$44,317.37
- Total Cost so far:
\$6,397,548.19

Floor Space Costs for 3 Years

- Including service clearance, each rack requires ~17.5 sq. ft.
- At \$220 per square foot per year:
 - 13 racks: $17.49 * 13 * 220 = \$50,021$ per year
 - For 3 years = \$150,064

Midrange Totals

- **Hardware** - \$1,212,130
- **Software** - \$5,077,789
- **Power and Cooling** - \$107,627
- **Floor Space** - \$150,064

- **Midrange Total** - \$6,547,610

Wear and Tear on People

- **Getting the remote access cards configured so they could be used remotely**
- **Configuring the RAID arrays using the internal disks**
- **Firewalls blocking access to the remote access cards**
- **Firewalls blocking access to the systems**
- **Wrong system build information**
- **Wrong network information (IP addresses, network masks, default gateways)**
- **Getting network connections made in the first place**
- **Getting correct network connections made**

Wear and Tear on People (2)

- Getting “final” go ahead to actually build a particular set of systems on Friday afternoons
- System builds and hardening taking hours instead of minutes due to unreliability of provisioning software workaround
- Hardware failures
- Verifying servers were assembled with the correct combination of hardware
- Confusion about what servers were named what, and what rack they were in. (Inventory control.)

Wear and Tear on People (3)

- Having to rebuild systems multiple times due to client requested changes
- Assembling servers
- Racking servers
- Labeling and relabeling servers
- Moving parts around between servers
- Running and re-running Ethernet cables
- Testing Ethernet cables, connections to switches, etc.
- Configuring and re-configuring network switches
- Running and re-running fibre cables for SAN

Wear and Tear on People (4)

- Testing fibre connections
- Configuring and re-configuring firewalls

Just How Busy Were Those Systems?

- The operating systems were taking up about 16GB of the 72GB (x2 for mirroring) disk drives
 - This was only because we drastically over allocated space
 - Swap partitions took up another 4GB
- Once the systems were in production, I looked at several 24-hour periods during the week.
 - One system was running around 10-15%
 - The other 50 systems were running < 1%
 - None of them were doing any paging because of the large RAM sizes.
 - Almost all of them had no page space usage.

The Mainframe Alternative

- **z9 EC (2094-S18)**
 - 1 CP (Oddity due to IBM Pricing Policy)
 - 2 IFLs
 - 256GB RAM (16x16GB cards, requires 2 books)
 - 2 FICON Cards = 8 Ports/Channels
 - 2 FCP Cards = 8 Ports/Channels
 - 2 OSA-Express2 1000Base-T
- **DASD (DS8100)**
 - 4 TB ECKD

There was also a lower-cost DS6800 option, which I chose not to take.

The Mainframe Alternative

- **Other Hardware**
 - Hardware support 24x7 – 2 (The z9 and DASD)
 - Ethernet Switch Ports – 4
 - Ethernet cables – 4
 - Fiber cables for FICON DASD – 8
 - Fiber cables for SCSI over FCP - 8
- **Again, this isn't including switches, routers, etc.**

The Mainframe Alternative

- The totally unrealistic “reference price” hardware costs for 3 years, including maintenance
\$5,295,092
- The more realistic price:
\$3,575,096
- Again, this isn't including switches, routers, etc.

The IBM business partner who helped me didn't want to send me the reference price:
“I really hate to give you these prices. They are so out of line!”

The Mainframe Alternative

Software licensing, including support and maintenance

- 2 – z/VM
- 2 – Linux
- 2 - Oracle
- 2 - Dirmaint
- 2 - Performance Tool Kit (substitute your own favorite here)

- Software costs for 3 years:
\$309,080

The Mainframe Alternative

- **Power**
 - $6,300 * 24 * 365 / 1000 * 0.0936 = \$5,165.60$
 - Power for 3 years = \$15,496.80
- **Cooling**
 - $\$15,496.80 * 0.7 = \$10,847.76$ for cooling over 3 years
- **Floor Space Costs**
 - z9 BC: $58.7 * 220 = \$12,914 * 3 \text{ years} = \$38,742$

The Mainframe Alternative

Category	Unrealistic	More Realistic
• Hardware	- \$5,295,092	\$3,575,096
• Software	- \$309,080	\$309,080
• Power and Cooling	- \$26,345	\$26,345
• Floor Space	- \$38,742	\$38,742
• Mainframe Total	-	
\$5,669,259	\$3,949,263	
• Midrange Total	- \$6,547,610	

The Mainframe Alternative – 5 Years

Category	Unrealistic	More Realistic
• Hardware	- \$5,555,492	\$3,835,496
• Software	- \$458,960	\$458,960
• Power and Cooling	- \$43,908	\$43,908
• Floor Space	- \$64,570	\$64,570
• Mainframe Total	-	
\$6,122,930	\$4,402,934	
• Midrange Total	- \$8,204,091	

Questions?