From A (AIX) to Z (Linux/z):

A Customer Experience

Feb 2008

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Session: 9206

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What is NCCI?

- National Council on Compensation Insurance, Inc. – Boca Raton, FL.

- America's largest workers compensation and health care informatics corporation.

- Owned by workers compensation insurers.

- Offices in 38 states, ~1000 employees, 200 in IT.

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Predicament

- Number of servers growing fast.

- Number of applications growing fast.

- Long delays in provisioning new servers.

- Flat budget and no relief in sight.

Introduction

- If this is your situation, we understand your pain.

- Agenda:
  - background
  - benchmarking for sizing hardware
  - business case
  - road map
  - Summary

2004 IT CSI

CIO: find out about Linux and report.

Background

- Centralization ← economies of scale.
- Decentralization ← least powerful computer capable of doing the work.
- Acquisition = $$ 20% of life cycle
- TCO = $$Investment + $$System Mgt.

Background

- Legacy Systems on MF:
  - high residual economic value
  - small investment to keep them running
  - high RAS

Background

- Recommendation:
  - Linux makes sense on MF only.
  - MF is needed for legacy systems.
  - MF is efficient in payroll costs.
  - Purchase 1 IFL for PoC application

Background

- In 2005, z890 with 1 IFL and 3 LPAR installed.
- The PoC ran for 1 year.
- In summer 2006, a mission critical application hit the wall and the Linux Benchmark was approved.
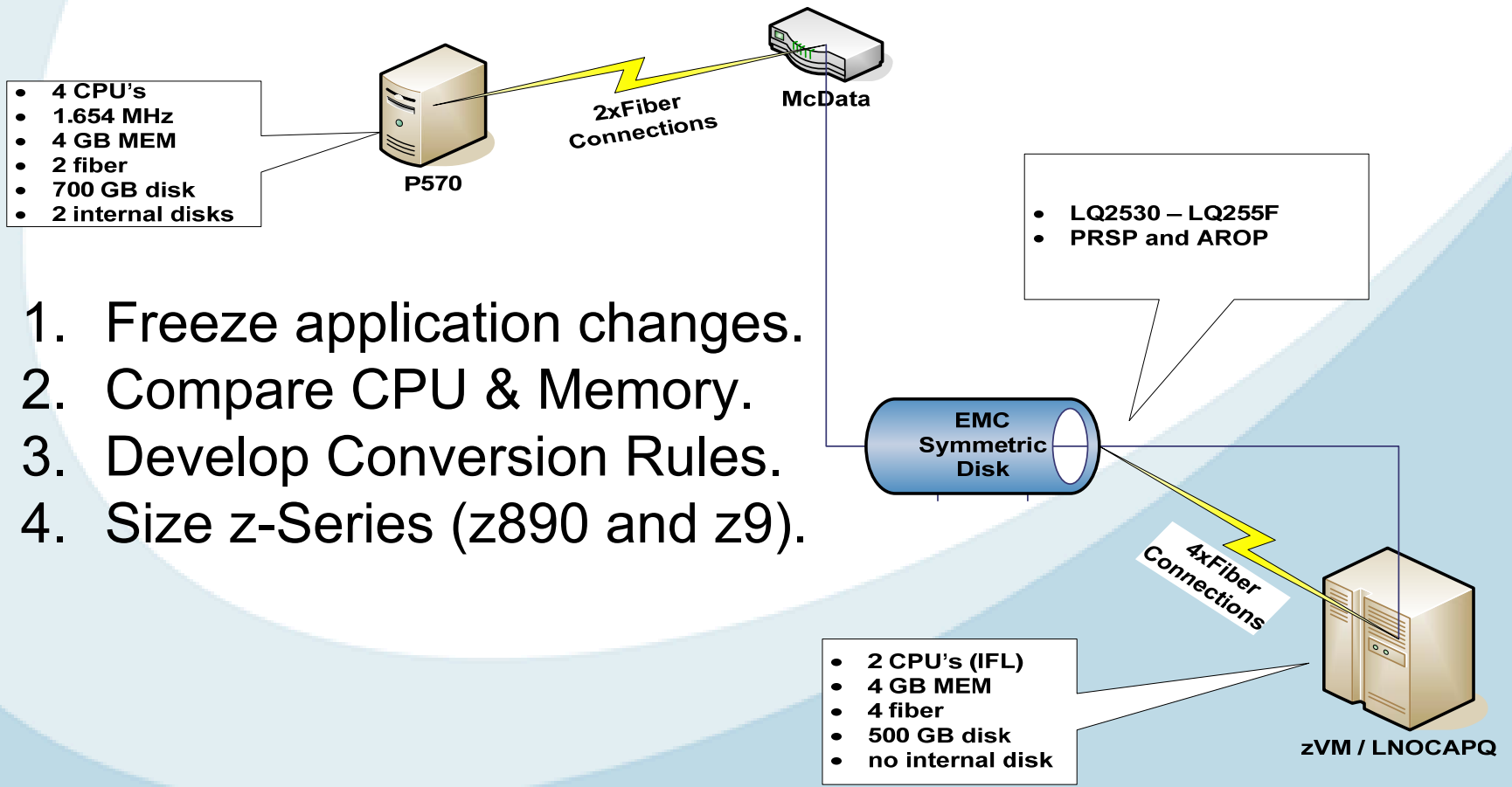
Benchmark

- Objectives
  - Feasibility: can we port the application?
  - Performance: will it run faster than AIX?
  - Impact: financial, operational and customers?

Sizing the Target Hardware

Benchmark

- 4 CPU's
- 1.654 MHz
- 4 GB MEM
- 2 fiber
- 700 GB disk
- 2 internal disks

P570

2xFiber Connections

McData

- LQ2530 – LQ255F
- PRSP and AROP

EMC Symmetric Disk

1. Freeze application changes.
2. Compare CPU & Memory.
3. Develop Conversion Rules.
4. Size z-Series (z890 and z9).

4xFiber Connections

- 2 CPU's (IFL)
- 4 GB MEM
- 4 fiber
- 500 GB disk
- no internal disk

zVM / LNOCAPQ

Benchmark

- Findings:
  - The P570 slowest at 85% CPU.
  - The z890 faster at 65% CPU.
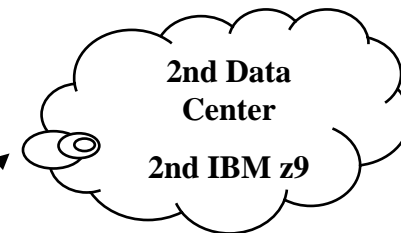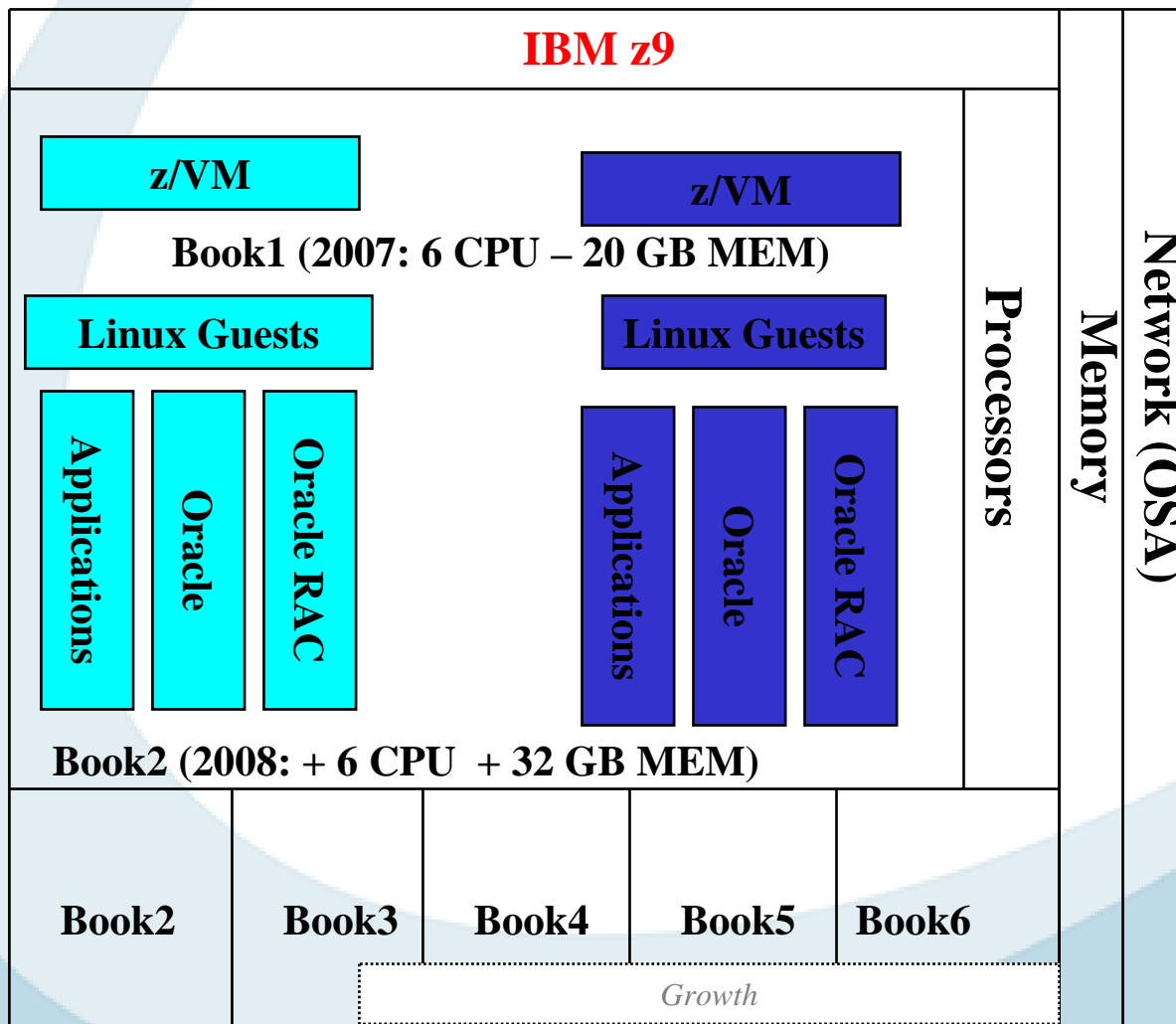 - The z9 fastest (x2) at 50% CPU.

Benchmark

- Batch: from ~7 hours to 1.5 hours (P570 to z9)

- CPU = 3:1 (P570 to z9)

- Memory = 2:1 (P570 to z9)

- Assumptions:
  - Oracle 10.2g
  - Java 1.4.3
  - zVM 5.3
  - SLES 9.3

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Benchmark

- Findings:
  - Application converted in 1 week
  - No impact to DBA's
  - We lacked zVM skills
  - Systems management centralization
  - Switched from telnet to ssh
  - Size effort to get ready for production

Architecture

IBM z9

z/VM

z/VM

Book1 (2007: 6 CPU – 20 GB MEM)

Linux Guests

Linux Guests

Applications

Oracle

Oracle RAC

Applications

Oracle

Oracle RAC

Processors

Memory

Network (OSA)

Book2 (2008: + 6 CPU + 32 GB MEM)

Book2	Book3	Book4	Book5	Book6

Growth

2nd Data Center

2nd IBM z9

Points of Failure	Risk Mitigation
Whole Frame	Redundant Frame (Not today)
Physical Components	Redundant Hardware
z/VM LPAR	2nd z/VM LPAR
Linux Guest	2nd Linux Guest on 2nd z/VM (VRRP)
Database	Oracle RAC/ 2nd Guest on 2nd z/VM
Application	2nd Guest

Architecture

- DEV, QA and PROD servers
- KeepAlive (VRRP) for HA
- Cluster File System (IBM Global File System)
- RAC for Oracle
- Each DB instance on a guest
- Each Java application on a guest

Develop the Business Case

- Impact on software licenses.

- Find software not supported on Linux/z.

- Transition costs.

- Automate provisioning process.

- Centralize systems management.

- Re-calculate servers to staff ratio.

- Buy-in from customers and IT.

- Prepare TCO and ROI (versus status quo).

Develop the Business Case

- Benefits:
  - HA and Customer Satisfaction.
  - Flexibility due to virtualization.
  - Workload manager to handle peaks.
  - Capacity and business cycles.

- Disadvantages:
  - New skills for new operating system.
  - Some 3rd party software not supported.
  - Transition costs.

- Decision: Go/no-GO.

From our CIO (fall 2006)

- Reach consensus

- Consider all implications

- Freeze budget for AIX

- Get customers onboard

Road Map

- New applications to Linux on z unless not supported, then to SUN.
- From AIX (2007 and 2008):
  - 22 CPU's for 5 PROD servers
  - 9 CPU's for 3 DEV servers
  - 11 CPU's for 3 QA servers
- From SUN (2009+):
  - 37 CPU's for 8 PROD servers
  - Plus DEV and QA servers

Road Map

- Identify and involve all affected groups.
- Assemble technical team to set up DEV, QA and PROD environments.
- Take to TASC (technical committee).
- Assign Migration projects (per application).
- Follow up, direct and control.

Summary

Linux runs on many platforms, but running it on a System z9 provides additional benefits in the following areas:

- High availability (HA) and customer satisfaction
- Flexibility
    - Virtualization to minimize scheduled downtime
    - Workload management to handle peaks
- Performance and capacity to grow the business
- Cost savings in terms of TCO

In Summary

- Your mileage may vary, run your own benchmark to size your new hardware requirements.

- Make sure your business case is understood and supported not only inside IT but also those users affected by the consolidation.

- Full commitment to the road map by senior management and all members of the team.

Additional Material

Results (Without Optimization)

PRO Benchmark Results

One Concurrent Job		Times for 3 Threads	
Step	**P570**	**z890**	**z9 (2IFL)**
PSL	1:24:00	1:17:54	0:28:26
SL	0:59:04	1:02:10	0:51:41
SP	0:15:30	0:11:28	0:03:21
PC	0:03:39	0:04:04	0:01:34
PM	1:02:29	1:09:32	0:54:48
CG	0:39:08	0:19:13	0:11:35
LP-DS	0:18:49	0:06:46	0:00:39
2SL	0:08:38	0:03:30	0:00:25
SMP	0:19:22	0:03:30	0:00:31
TRI	0:54:14	1:09:53	0:27:06
Total	6:04:53	5:28:38	3:00:06
End-to-End	**6:44:19**	**6:15:00**	**3:10:00**

Results (With Optimization)

z9 PRO Benchmark Results

One Concurrent Job	4 IFL	4 IFL	2 IFL
Step	**4 Threads**	**6 Threads**	**3 Threads**
PSL	0:19:14	0:21:35	0:32:16
SL	0:15:23	0:28:50	0:19:03
SP	0:02:39	0:02:53	0:03:02
PC	0:01:07	0:01:12	0:01:15
PM	0:14:02	0:14:29	0:21:23
CG	0:04:42	0:03:41	0:07:00
LP-DS	0:00:24	0:00:21	0:00:36
2SL	0:00:18	0:00:15	0:00:26
SMP	0:00:24	0:00:26	0:00:26
TRI	0:24:25	0:24:39	0:24:14
Total	1:22:38	1:38:21	1:49:41
End-to-End	**1:32:04**	**1:47:52**	**2:00:00**

Linux on System z9 Virtualization

- Consolidation—fewer servers doing more work
- Greater utilization—ability to handle increased workloads and multiple applications on a single machine
- Standardization—ability to apply standard management tools across a diverse work environment
- Application workloads are shared for better utilization
- Server resources are allocated dynamically based on demand

Linux on System z9 Flexibility

- Simplifies systems management through centralization

- Prioritizes workloads

- Prevents runaway processes from degrading performance of other applications

- Increases capacity to handle unpredictable fluctuations, as well as planned increases

- Provides a low level of granularity for resource allocation and control

Linux on System z9 Performance

- Separate I/O processors allow for parallel processing for I/O and application at the same time
    - Our tests showed I/O rates of 1ms on z9 compared to 9ms on z890 and 11ms on AIX
- Deployment of new server/LPAR from days/weeks to hours
- True shared resources (processors, memory, I/O, network, z/VM)
- Internal communications between LPARs via Hypersockets™ (dedicated 10GBs compared to 1GB)
- Faster recovery time at DR—Linux and all LPARs come up with the mainframe

Hypersockets™ is an IBM product.

Linux on System z9 Cost Avoidance

- Software Licensing
  - Multiple servers on one physical engine
  - Oracle pricing by engine (AIX 40 engines, System z approximately 1/3 required)

- Environmental
  - Reduction on external cabling, routers, hubs, switches, energy, and floor space

Linux on System z9 Redundant Hardware

- Transparent CP sparing
- Fault-tolerant interconnect design
- Dynamic memory sparing
- Enhanced firmware simulation
- Remote operations support
- N+1 power supply technology
- Concurrent channel, OSA-E, and coupling link maintenance
- Dynamic I/O reconfiguration
- FICON purge path extended
- Enhanced book availability
- System Assist Processor (SAP) reassignmentand sparing
- Sparing for storage protect preservation keys
- Partial memory restart

- Dual support elements
- Hybrid cooling
- Concurrent hardware management console (HMC) and support element
- Redundant I/O interconnect
- Enhanced driver maintenance
- Dynamic oscillator switchover
- Enhanced application preservation
- Failure containment for MBA
- Concurrent book add
- Dynamic channel path management
- Concurrent power and thermal maintenance
- Enhanced dynamic reconfiguration management

Single points of failure exist, but mean time between failure = 100 years.

Linux and Our Environment

Areas that Linux may impact:

- Application Development

- Change Management

- Security

- Languages and Integration

- Linux Management Tools

- Risks

Linux and Our Environment: Application Development

Development Platforms	Note	
Visual Studio	Not Impacted	
PL/SQL Developer	Not Impacted	
J Developer	Not Impacted	
Development Languages	Linux Supported	Note
Java	YES	
C/C++	YES	
Cobol	YES	
Stored Procedures	YES	
Perl	YES	
Ksh Shell	YES	
SAS	NO	Code can be developed on SUN or Mainframe and access data on Linux.

Note: Have the ability to install VMWare Virtual Server on PC desktop to load Linux and have a local development environment on PC.

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Linux and Our Environment: Change Management

Same tools and processes as current Change Management.

Tools Used	Supported on Linux	Function
TeamTrack	NA	Migration Requests and Special Run Request
ChangeMan DS	Yes	Code Repository, Check-in/Check-out/Promote

Linux and Our Environment: Security

- Batch Application Security Architecture
  - Will be the same as on AIX

- Batch Application Security Administration
  - Will be the same as on AIX

- End User Security Administration
  - Password Synchronization and Group Membership Management
    - BMC has reported that they will provide a connector that supports SuSE Linux on zVM by February 2007. This connector will allow us to manage end user security in the same manor as currently on AIX.

- Monitoring
  - BindView does not currently support Linux on zVM
  - Will need to procure the BindView Agentless version to get functionality

Linux and Our Environment: Languages and Integration

Software	Function
Database Connectivity	
Oracle TNS	Access Oracle
DB2 Connect	Access DB2
Messaging	
MQ Series	Messaging between DBs and Systems
Languages	
Cobol, C/C++, Java, Perl, KSH, PL*SQL	Coding between DBs and Systems
Extract/Transform/Load (ETL)	
DTS, SSIS (Microsoft)	Integrated Development Platform

Linux and Our Environment: Linux Management Tools

Tool/Process	Function
Database	
Grid Control	DBMS Administration
DBArtisan	DBMS Administration
Security	
Contol-SA	1st Qtr 2007—Password Sync
BindView	Procure Agentless Version—Reporting
MANUAL/YaST	ID Setup
Scheduling	
UC4	Scheduling
Change Management	
ChangeMan DS	Source Code Migration and Control
System Administration	
YaST	Linux Administration, Installation
SAR	Linux Performance/Accounting
VMWare	VM System Management
Backup and Recovery	
Netbackup	Backup/Restore/Recovery

Linux and Our Environments:
Risk Mitigation

Risks	Risk Mitigation
Vendor Support	• **Vendor does not support Linux but can use Sun/Solaris**
Legacy System Rewrite	• **We own our current AIX environment** • **Only stopping further growth and development at this time** • **Migration from AIX can be scheduled with planned system rewrites** • **Not forcing migrations today**
Virtual Mind Set/VM Administration	• **VM training** • **Cross-training for system administrators** • **Linux is just another flavor of Unix, and all basic skills exist today**
Security—Linux Open Source	• **We currently receive all Linux alerts and separate documentation on high alerts** • **Linux out of box comes with the doors closed and we have to open it up**
Single Hardware Platform	• **Create 2 z/VMs to support fail-over for microcode, z/VM, Linux, and application failover** • **Implement Oracle RAC for database fail-over** • **Implement Linux HA for application fail-over** • **Future—If we decide to have separate data centers, we can set up fail-over between sites, eliminating single hardware risk**