LE CENTRE DE SERVICES PARTAGÉS

How to Rise Above the Challenges of Deploying z/VM and Linux on the Mainframe and Thrive

SHARE User Events

Tampa , Florida

Session 9230

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In collaboration with

IBM Canada LTD

VM Resources LTD

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Client context

... DGTIC ...

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Client context
The DGTIC

- IT service provider for many Québec government offices (125)
  - Already a mainframe shop
  - 5 z/890 + 1 z/800 + 1 G5 on the floor on 3 sites
  - 1 z9-EC dedicated to Linux on z/VM
  - 450+ physical servers (750+ logical) (HP, SUN, pSeries, …)

- DGTIC orientations :
  - Promote the mainframe environment
  - z/VM is the prime choice for future projects
  - Server consolidation is a priority
  - This project is in line with the new « online government » policy

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Client context
Project origin

- Initial needs :
  - Must solve many issues with the intermediate platform
    - Many operation systems
    - Many versions
    - Unsupported software
    - Unsatisfactory DR
    - Fast growing (unprecedented growth)
  - Understaffed
  - Need a flexible solution with rapid deployment
- Mainframe is a stable and mature environment
  - Staff is available and at early stages of their careers
  - Solid and well controlled DR process (MVS-like)
- The conclusion : GO with z/VM

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Client context
Project origin

- The Oracle/DB migration project was the leader for all tasks around the Linux on z/VM environment, including :
  - Planning, Controlling and Executing of all the tasks
    - Installation, Cloning engine development, Initial architecture, Training, …
  - Communication plan
  - Change and risk management
- Senior mentors were brought in (on site) as project manager and system architects.
- In conclusion, the big project was a big melting pot !!! With a project manager who was responsible for everything !!!

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Client context
The first steps

- In 2003, beginning of the proof of concept (end-to-end)
  - A mainframe was available (z/800)
  - Installation of the software (z/VM, SuSE Linux, Oracle/DB, WAS, TAM and LDAP)
  - The objective was to prove the functionality and stability of the solution, plus the transportability of the tested applications

  … *performance characteristics were secondary*
- Spring 2005, first version of the business case which demonstrates benefits (financial, intangibles and human resources)
- Obtained approval from the board of directors : GO
- Autumn 2005, installation of the new mainframe (z9-EC)
- Start of the first phase of the project
  - Oracle/DB migration

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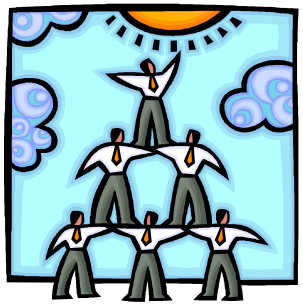
Client context
Teams

- Winning hearts and minds …
- Groups supporting physical servers (intermediate platform) worry about large box virtualization.
- Introduced (- or reintroduced -) S/370 through System z concepts emphasizing guaranteed isolation:
  - Privacy on the box while still sharing resources
  - Virtual storage since 1970
  - Virtualization of CPU, I/O, storage and networks
  - Securing resources through the operating system and RACF
    - Password and rules based authorizations
    - Separation of systems and security tasks by staff in different departments
- z/VM: over 35 years of virtualizing!



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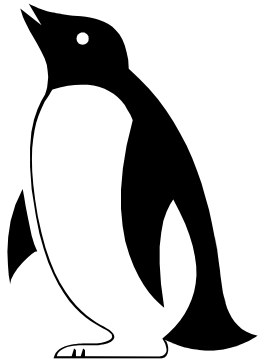
Client context
Environment

- 1 z9-EC mainframe with 5 IFLs (~ 3000 mips)
- 5 LPARs
  - Oracle/DB
  - WAS
  - TAM & LDAP
  - Service Zone
  - Lab Zone
- 40 internal networks
- Software
  - SuSE Linux (versions 8 & 9)
  - z/VM v.5.2 +
  - Oracle/DB (versions 9i & 10g)
  - Velocity Software Performance Tools
  - CA products (Automation, Scheduler)



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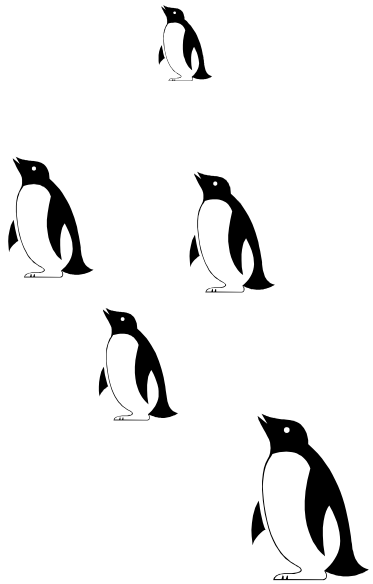
Client context
Environment

- Oracle/DB – Migration Project Status
  - Golden images
  - 165 Oracle instances with 125 Linux virtual machines
  - Growth of over 100 new instances planned per year for the next few years
  - 25 instances in production as part of the government portal
  - For the first migrations (~ 60), on average
    - 1 migration per day (20-25 databases per month)
- WAS – Beginning of the project
- TAM & LDAP – Beginning of the project
- Our current challenge is to synchronize the migrations with date restrictions imposed by our external clients



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Technical Challenges

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Technical Challenges

- As a new and rather large implementation we encountered many technical challenges:
  - Improving the technical skills of the project personnel.
  - Ensuring the system and applications are safe and secure.
  - Guaranteeing that the clients are isolated from each other while still capitalizing on resource sharing.
  - Implementing networks that integrate seamlessly into the existing topology and practices.
  - Tiers of redundancy based on cost and defined need.
  - Need to satisfy the application needs of multiple clients and their data.

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Technical Challenges
Training … training … training …

Winning hearts and minds through training …

Challenge: acquiring technical skills

- Over 200 person days of training to staff:
  - Mainframe Systems programmers
  - Unix administrators
  - Security officers
  - Network administrators
  - Architects
  - Analysts

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Technical Challenges
Training sessions and …

Winning hearts and minds through training …

- Training sessions with lectures and labs:
  - Architecture seminar
  - z/VM Systems Workshop
  - Linux on the Mainframe Workshop
  - z/VM Networking and Security Workshop
- Briefings for team leaders and management
- Summary presentations to executives

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Technical Challenges
Security under z/VM

Challenge: securing the environment …

- Secured z/VM resources through standard commands and products:
  - Logons secured through RACF password protection.
    - Extended password checking with system exit.
  - Minidisk linkage, Vswitch membership, and other points of access controlled by RACF via rules database.

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Technical Challenges
Security of Linux on System z

Challenge: securing the environment …

- Secured Linux on z/VM access points by combining:
  - PAM authentication for logins
  - Removal of unneeded packages
  - Usage of secured facilities instead of weaker facilities (SSH versus TELNET)
  - File system changes secured and monitored with TRIPWIRE
  - Ethical hacking attempts to ensure compliance and fortress galvanizing

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Technical Challenges
Isolation of clients while still sharing resources

Challenge: Isolate the applications of over 100 offices and agencies

- Now, through the training client understands how System z and z/VM provides storage, CPU and I/O isolation.

  … and VM has been doing it for 35 years …

- Network isolation provided via using unique OSA ports and Vswitch technology.

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Technical Challenges
Providing high availability for production applications

Challenge: provide high availability access to data and applications.

- Rule: "*pay more get more*"
- Currently providing physical switch and OSA network redundancy to selected production applications.
- Considering providing redundant LPAR with mirrored databases for selected applications.
- Will possibly evolve to a multi-machine multi-site environment (if needed)

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Technical Challenges
Sharing & Cloning

- Capitalizing on z/VM virtual network technology
- Linux on z/VM replication mantra: « install once clone often »
- Creating the Linux golden images :
  - Linux Operating System = base golden image
  - Add administration tools = enhanced golden image
  - Add software = service golden image
  - Golden image certification before going to production
  - General deployment
- Responding to the Challenge: Guaranteeing Client Isolation
- Transcending Technical Cultures

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Technical Challenges
Multiple clients

Challenge: enabling clients to thrive with z/VM and Linux on System z.

- Many OSAs and Vswitches defined to support the different clients.
- Different physical networks map to Vswitch networks, which are associated with correct zone and application.

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Technical Challenges
Competing technologies

- **Intangibles :**
  - Backup/restore : mainframe strategy (via z/OS)
  - Disaster Recovery : mainframe stability with an external provider
  - Virtualization
  - Cloning
  - High availability
  - Performance (I/O) for Oracle
  - Security
  - Resource sharing
    - IPL pack
    - Linux Kernel
    - Oracle executables
    - Golden images
    - Partitioning (EAL 5 security level)
  - On demand

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Technical Challenges
Competing technologies

- **Intangibles :**
  - Flexibility of the solution
    - Fast track (no acquisition)
      - Creating/Installation a new server
        - Linux on z/VM : 30 min
        - SUN, AIX, Windows : between 1 week and 3 months (if RFP needed)
    - Cloning and deployment engine
    - Cloning/Installation an Oracle/DB instance
      - Under Linux on z/VM : 30-45 min
      - Under SUN : 10-14h
  - Adjustments to the cloning engine for a new service (ex. WAS) :
    - Coding changes done within 2 weeks

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Technical Challenges
Competing technologies

Category	Weight	z/VM Description	z/VM Level	Distributed platform Description	Distributed platform Level	Delta
Disciplin-ability (production mentality)	**50**		50		20	30
Change management	5	Formal & part of the culture	5	Formal	2	
Start-up disk	5	Unique IPL pack (like z/OS)	5	Starting a project for a cloning engine	2	
Performance hardware	**65**		56		26	30
Partitions	3	Partitions take only what they need (determine by the weight)	5	Partitions take everything available (determine by the weight)	3	
Processor(s) I/O	3	Dedicated processors	5	Same processors (CPU & I/O)	1	
Flexibility (ad-hoc demand)	3	A partition can use unused cycles from other partitions	4	Partition will always use all cycles available (determine by the weight)	2	
On demand	2	Annual cost for the service	3	Must purchase additional processors	2	
Experience (virtualization)	2	Close to 20 years	4	2 years +	2	
Performance software	**75**		61		26	35
Virtual machines	4	Virtual machines only use what they need	5	See Partition	3	
Control	4	Weight & priority	4	Weight only	2	
Flexibility (ad-hoc demand)	4	A virtual machine can use unused cycles from other virtual machines	4	N/A		
Utilisation reporting	3	Performance ToolKit	3	In-house tool	2	
Deployment (speed)	**50**		44		21	23
New environment creation	4	Define a new virtual machine & use the cloner	5	Define a partition & install the operating system	3	
Network	3	New definitions VLAN (VM) & firewalls	4	Network cards, cables, ports in router if new server and firewall	1	
I/O	3	Shared FICON/ESCON ports	4	HBA + ports in director, cables if new server	2	
Easiness to manage software keys	10		8		4	4
	2	Calculated with the number of IFLs per partition	4	Add all processors on which the software is running, must consider virtual vs physical	2	
Disaster recovery	**130**		117		35	82
Exercises	4	Remote installation	5	Staff on site (New Jersey)	2	
Operating system recovery	5	Disk recovery (from backup)	5	Installation of the operating system	1	
Testing results	4	Complete & successful (the process is identical as z/OS)	4	Not enough time to complete the tests	1	
Hardware isolation	4	z/VM is independent of the hardware	4	Must have compatible hardware (might need the same identical hardware)	1	
Backups	5	Well known & integrated process (from mainframe expertise)	4	Limited trust in the process	2	
Inventory	4	One unique inventory	5	Multiple inventories	1	
Security	**25**		23		16	7
Certification	3	LPAR EAL5A	5	Partition EAL 4+	4	
Cryptography	2	CPACF + Crypto cards	4	Software	2	
RAS	**55**		48		22	26
Redundancy	4	Backup processors always available	5	Backup processors only available if on demand package available ($)	2	
Operating system	4	100% of planned time	4	AIX, Windows, SAN	2	
Disks	3	Partitions 9980 & FICON	4	HDS 9585 & FCP and disk towers	2	
Total	460		407		170	237
			88.48%		36.96%	

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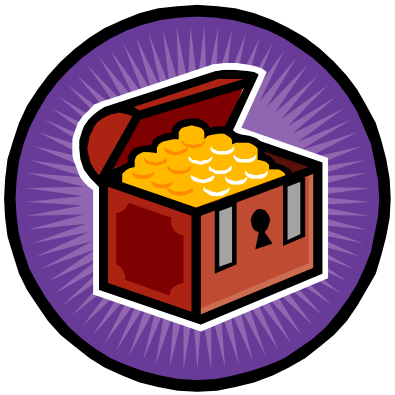
Business Case



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Business Case
Start of the project

- Identifying the potential for the client :
  - Databases
  - WebSphere Application Server (WAS)
  - WAS/Portal + LWWCM
  - Firewalls
  - TAM & LDAP
  - EDGE servers
- Identifying the most cost efficient project – Oracle/DB
  - Reduction of the number of licenses
  - Success stories
  - Easy conversion (data transfer; unload/reload)

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Business Case Summary

- Oracle/DB
  - Hardware cost is about the same
  - Software cost has a big gain by a huge reduction of the number of licenses (result : z9-EC paid within 2-3 years)
- WebSphere Application server (WAS) including WBI, MQ
  - Hardware cost is little more expensive for the System z
  - Software cost has a big gain by reducing the number of licenses (we are saving money)
- TAM & LDAP
  - Hardware cost is more expensive on the System z
  - Redundancy, Backup/Restore and DR are easier
  - Installing secondary servers on the mainframe for redundancy purposes (reducing the cost and having the mainframe gains)

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Business Case Summary

- Firewalls
  - Uncertain about the business case
  - Migration is a major impact on the organization
  - Investigation needed for the licensing (/CPU, /instance, /site)
- EDGE servers
  - Hardware cost is a little more expensive for the System z
  - Need to introduce the mainframe in the access zone (complexity and security concerns)
  - The benefits are at the intangibles level
- WAS/Portal + LWWCM
  - Potential for a big financial gain
  - Performance on the mainframe must be confirmed
  - Need a proof of concept

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Business Case
And THE winner is…

- The business case is a comparison between the server environment (Intel, SUN, …) and the System z environment
- The business case is based on
  - The cost of the software and hardware
  - The effort of installation and deployment
  - Training needed
  - Expertise needed (consultants)

- All efforts needed for migration were transferred to future projects. All new projects must be approved by the board of directors. (NOT included in the business case)
- The DGTIC's theory is "a migration is mandatory" :
  - If applicable and economical sound
  - Migrating from SUN to pSeries ~ Migrating from Sun to System z

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Business Case
And THE winner is…

- Overall, the cost of the software and hardware is reduced by 30%. Every extra instance will help to reduce the cost.
- The Oracle/DB migration project will break even within two years.
- Within the first two phases of the project (Oracle/DB and WAS), the mainframe will be repaid within three years. It was very important to build the business case around a worst case scenario. It can only be better, not worse.
- The business case doesn't consider the following :
  - Electricity
  - Floor space
  - Air conditioning
  - UPS

… All of which are favorable with System z …

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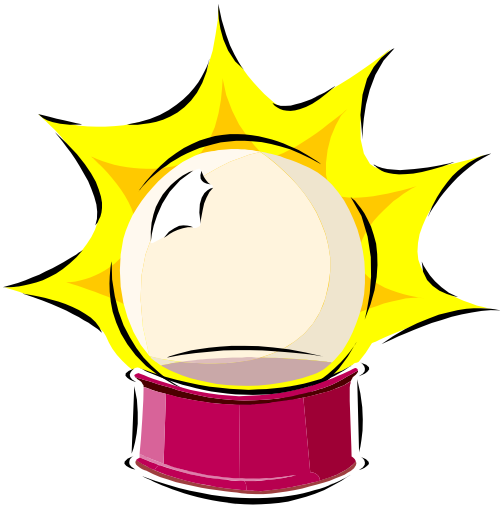
The Future



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The Future
Restructuring of the project

- The project has grown so fast that changes were mandatory :
  - Breakdown in several sub-projects with different project managers
  - One major project was created to integrate all sub-projects for controlling and monitoring purposes
    - Project status
    - Planning
    - Staffing
- Mentoring is still a major activity inside each sub-project and managing dependencies
- Project highly political with high visibility inside and outside the Québec government

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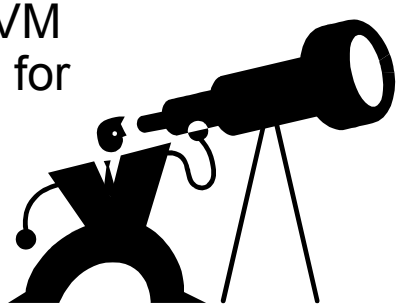
The Future
Next steps, targets, clients benefits

- Each new Oracle database is created under Linux on z/VM environment. There will be no new hardware purchases for intermediate platforms for Oracle.
- Starting new projects
  - WAS migration
  - TAM & LDAP migration
  - Proof of concept for WebSphere/Portal & LWWCM
- Potential projects
  - Domino migration
  - Open Source
  - Service Oriented Architecture (SOA)



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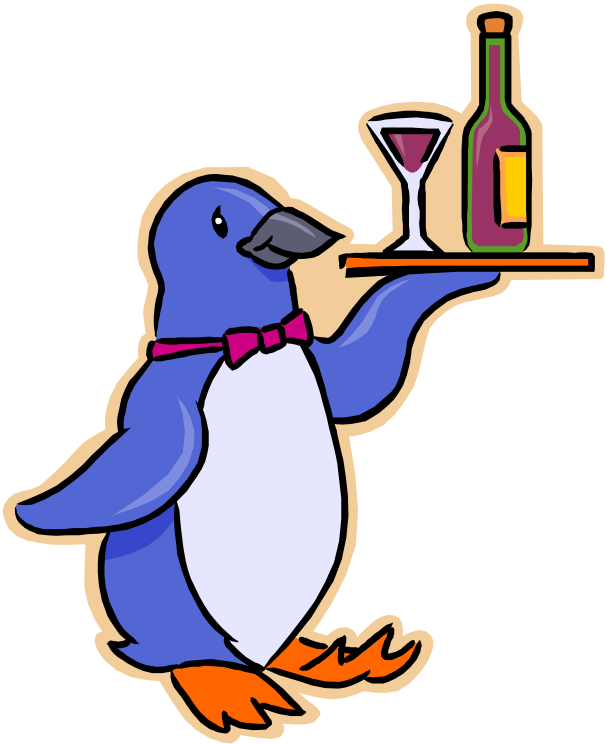
Conclusion



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Conclusion

- z/VM and Linux on the mainframe: a powerful combination for the DGTIC
- Supported open source software on the mainframe provides the stability of z/VM with the ability to run modern applications.
- Service being offered to many government offices and agencies.
- The word is out that z/VM and Linux on the mainframe is a good place to host your applications:
  - Internal government emails and announcements from the project office promoting z/VM and Linux on the mainframe solution.
- Rapid growth is forecasted:
  - *and the DGTIC is ready to keep up with the demand.*

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Conclusion

- DGTIC providing infrastructure to many offices and agencies.
- Building and nurturing business case critical to success of the project.
- The training was a vital part of the client acceptance of the concept.
- Architecture was developed and polished for over one year.
- z/VM and Linux on the mainframe natural fit for the vertical and horizontal.
- Project success will continue into the future!

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Questions ?

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