

Ducks Unlimited: Migration to Linux User Experience

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Ducks Unlimited: Migration to Linux User Experience

- **About Ducks Unlimited Canada**
- **Ducks Unlimited Migration**
- **Benefits of Linux Based Environment**
- **The Migration Process**
- **How it worked**
- **Who Helped us**



Ducks Unlimited: Migration to Linux User Experience



About Ducks Unlimited Canada



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About Ducks Unlimited Canada

Who are we?

Ducks Unlimited Canada is a private, non-profit organization that conserves, restores and manages wetlands and associated habitats for waterfowl. These habitats also benefit other wildlife and people.



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About Ducks Unlimited Canada Information Systems Department

- The I.S. department of Ducks Unlimited Canada is responsible for the development and maintenance of our internal and external web based applications as well as the infrastructure required to support this environment.
- Other areas of responsibility include GIS, Networking, PCs, file serving, email, PC backups, DNS, etc.
- In 2004, Ducks Unlimited Canada began supporting our U.S. sister organization, Ducks Unlimited, Inc., by hosting their data and providing access to our applications.
- The I.S. department consists of 2 DBA, 6 Application Development, 5 Infrastructure, and 5 GIS Staff.



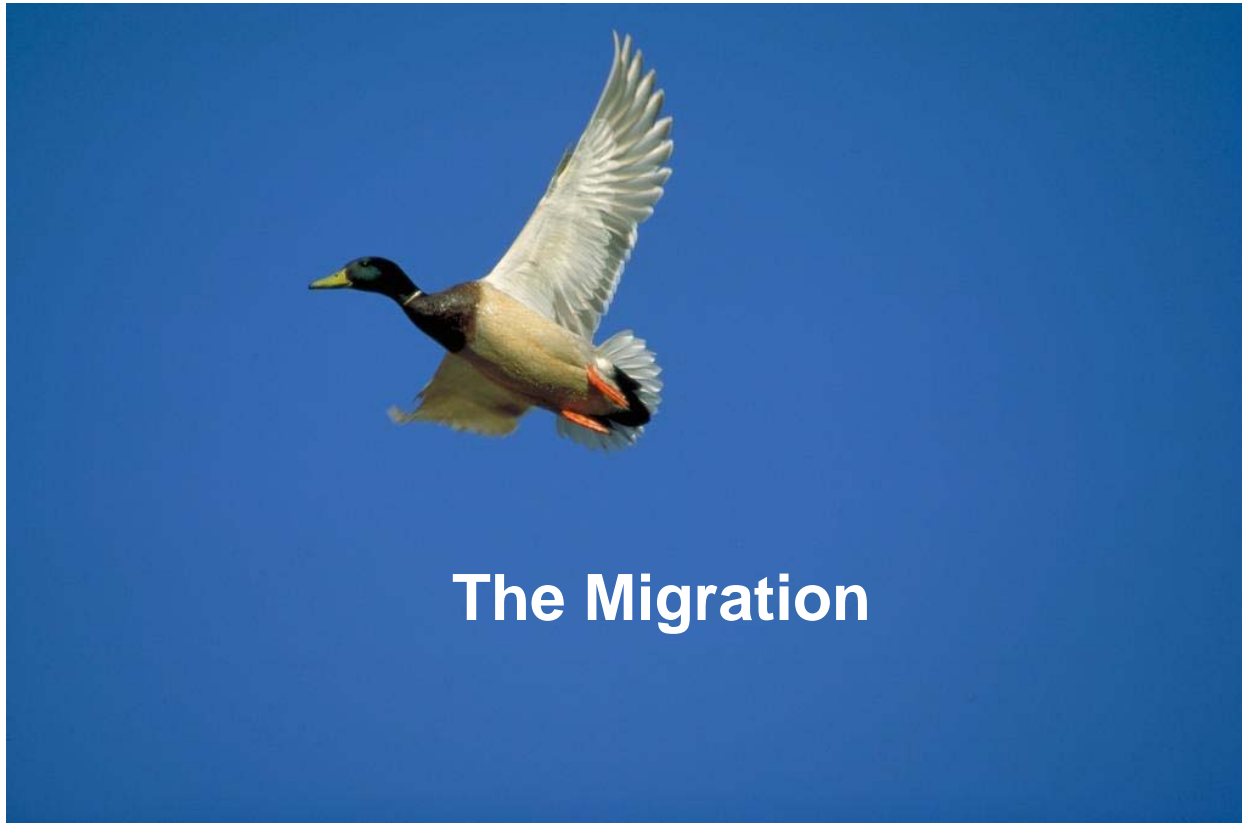
About Ducks Unlimited Canada

Database Statistics

	DUC	DUI	Total
Staff, Contractors & Volunteers in 1 day	242	183	425
# Logical Files in the Database			2,200
# Records in the Database	298,570,000	358,481,000	657,051,000
Browser Clicks in 1 day	59,000	52,000	111,000
Database Commands in 1 day	26,000,000	36,000,000	62,000,000
Database Reads in 1 day	155,000,000	261,000,000	416,000,000
Database Writes in 1 day	370,000	590,000	960,000
# Data Loads in 2007	2,194,000	11,100,000	13,294,000
# Inventory Transactions in 2007	1,284,000	13,000	1,297,000



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Ducks Unlimited Migration

The Migration

- **In February, 2008 we migrated our production databases that were running under CMS for the last 26 years to run under Linux.**
- **The seeds for this change were planted many years before the actual conversion.**
 - DU IT Staff are knowledgeable and dedicated with years of DU, Software AG, VM, and Linux experience
 - DU is a Natural & ADABAS only environment
 - 15 Years of using Construct Program Generator – consistent code
 - Browser Based User Interface - little Operating System dependency
 - Long Term relationship with IBM and Software AG
 - Excellent consulting from Software AG and IBM



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Ducks Unlimited Migration Benefits of Linux Based Environment

- **Open Source Linux**
- **Operating Linux**
- **Apache**
- **Software AG Products – ADABAS**
- **Software AG Products – Natural**
- **Software AG Products – SPOD**
- **Software AG Products - NBS**



Benefits of Linux Based Environment

Open Source Linux

(1 of 2)

- **Hardware Independence**
- **Cheaper Pricing Model**
- **Open Source Operating System**
- **Tens of Millions of Copies Worldwide**
- **Taught in the school system**
- **Most job applicants come with Linux knowledge and training**
- **Greater Availability of Linux System Programmers**
- **Greater Staff Retention using modern Open Toolset**

Working with Linux Organizations

As a community-based effort, Linux has been the beneficiary of the hard work of many community organizations. IBM actively contributes to many community and industry organizations and conferences, including:

- The Linux Foundation which promotes, protects, and standardizes Linux by providing unified resources and services needed for open source to successfully compete.
- The Linux Standard Base which works to establish interoperability between applications and the Linux operating system.
- The Free Software Foundation, whose mission is to preserve, protect, and promote the freedom to use, study, copy, modify, and redistribute computer software.
- The Open Source Initiative which provides open source education and serves as the standards body maintaining the Open Source Definition and the list of OSI-approved licenses.
- The Linux Kernel Developers Summit and Ottawa Linux Symposium, which are both annual gatherings of the top Linux kernel developers in the world.
- LinuxWorld San Francisco which is one of the premier events for Linux and open source companies and customers.



Benefits of Linux Based Environment

Open Source Linux (2 of 2)

- **Vibrant Open Source Community Developing Applications, Perl Scripts etc. and available to DU**
- **Tremendous amount of Linux Support, millions of Users**
- **Linux Support available thru Google, User Groups, Web Sites, Blogs**
- **Majority of the world in ASCII not EBCDIC, less translation issues, PCs, printers**

Why IBM Supports Linux

IBM's commitment to Linux stems from the belief that Linux is not only a world-class operating system, but that it also provides flexibility, choice, and an attractive total cost of ownership that can benefit IBM customers. As an open source development project, Linux benefits from community innovation that constantly develops and integrates leading-edge technologies and best practices into the operating system. As a result, Linux is a forward-looking long-term strategic platform that is supported by major server and middleware vendors.



Benefits of Linux Based Environment

Operating Linux

- **Great Visibility into who is running what even under Apache**
- **Backups run 4x quicker - daily Backup window down from 4.5 hours to 45 minutes**
- **Less Tapes used for Backups (3590 => 3592)**
- **BLOB Database from IBM SFS to 1 single Linux File System**
 - Long File Names, Permissions Available (Legal Docs scanned)
- **All DU Printers are defined in the CUPS Database therefore Users can print on any printer within the Network – reducing PC Support**
- **CUPS provides users with a Browser Based utility to manage their print jobs**
- **Natural can work directly with CUPS to control printers**
- **Cron replaces Wakeup**
- **Stable environment**



Benefits of Linux Based Environment Apache

- **Strength of the Apache Software Foundation – a “community of developers and users” - "the Apache Way"**

FOREST HILL MD – 15 January 2008 – The Apache Software Foundation (ASF) – stewards, incubators, and developers of leading Open Source projects, including Apache HTTP Server, the world's most popular Web server software for twelve years running – today announced the 2007 year finished as its strongest ever, reinforcing the broad-reaching success of “The Apache Way”.

As the backbone of more Websites than any other Web server software, the Apache HTTP Server remains the #1 Web server, powering more than 75 million Websites across the Internet, according to the December 2007 Web Server Survey by Netcraft. This translates to a 74% market penetration across all Web Server domains, according to the January 1 2008 Web Server Survey by Security Space. In September 2007 the Apache HTTP Server Project announced the stable release of Apache HTTP Server version 2.2.6.

- **Apache more versatile and very reliable**
- **Natural is now part of a Community of 75 million Apache users**



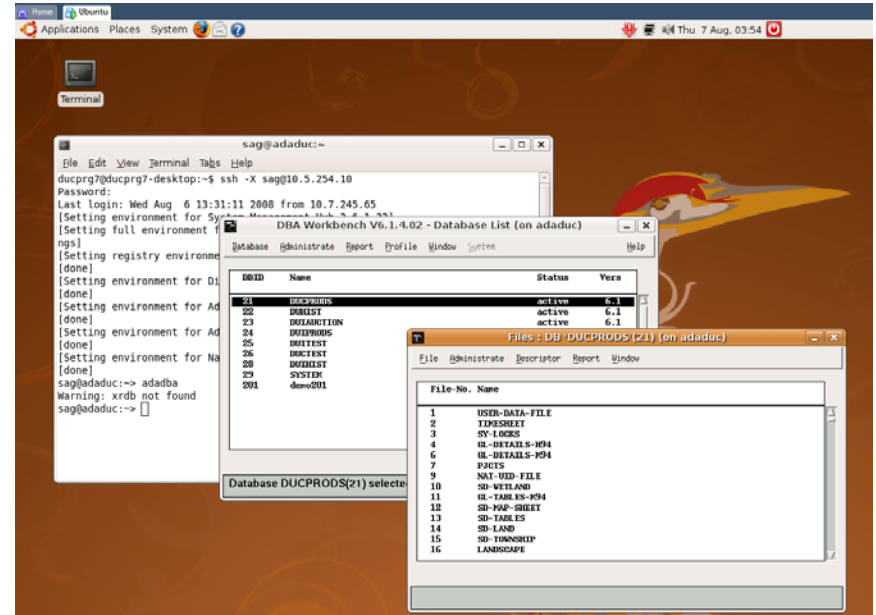
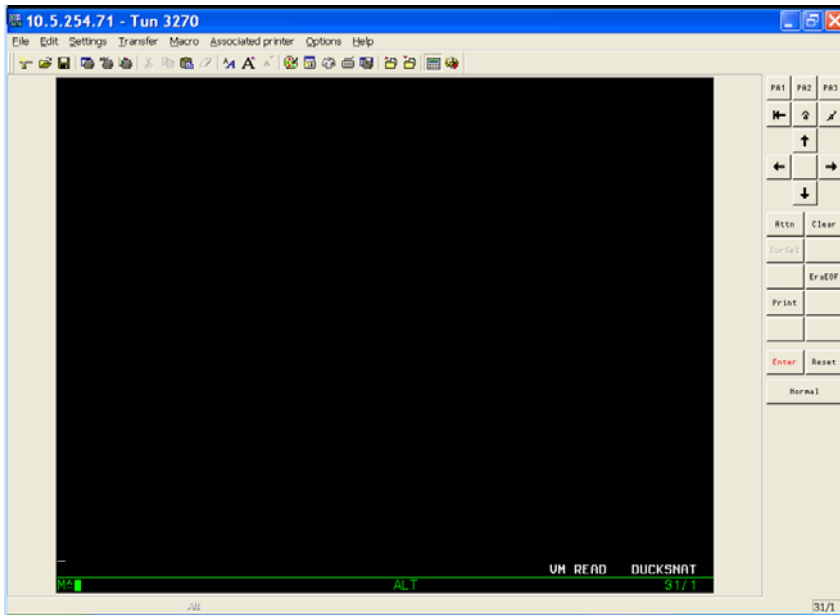
Benefits of Linux Based Environment Software AG Products - ADABAS

- **ADABAS much quicker in all aspects – 8x**
- **Database utilities are much easier to run in Linux than CMS**
- **Any Database file can have many more extents than the in CMS**
- **Files within a Database can have different Blocksizes**
- **Linux ADABAS supports BLOBS**
- **SOA Gateway to ADABAS – Open ADABAS to excel, etc.**
- **More ADABAS managing, monitoring, reporting scripts available**
- **Easier DBA Database manipulation, sizing, expanding, ...**
- **And ...**



Benefits of Linux Based Environment Software AG Products - ADABAS

- DBA Workbench GUI Based and Intuitive



Benefits of Linux Based Environment Software AG Products - Natural

- **Natural able to Zip, PDF, Email, FTP and has access to any Open Source Software**
- **Natural has greater access to Linux Environmental Variables and the operating system**
- **Natural programs are stored in a Linux File System and backed up by TSM and the user can restore an individual program**
- **Natural programs are just text files and therefore accessible via many standard editors/tools**
- **More Natural Statements/Commands available**
- **XML Toolkit**
- **Natural Engineer Documents our Applications**



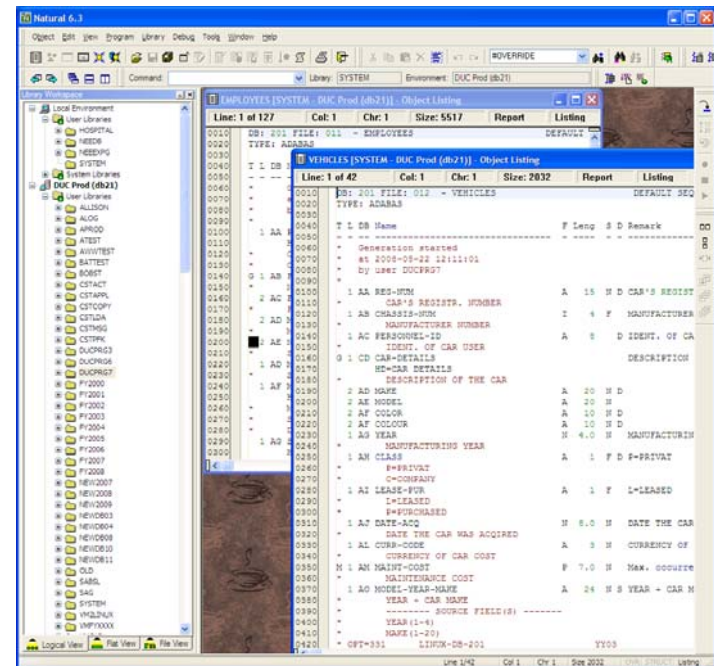
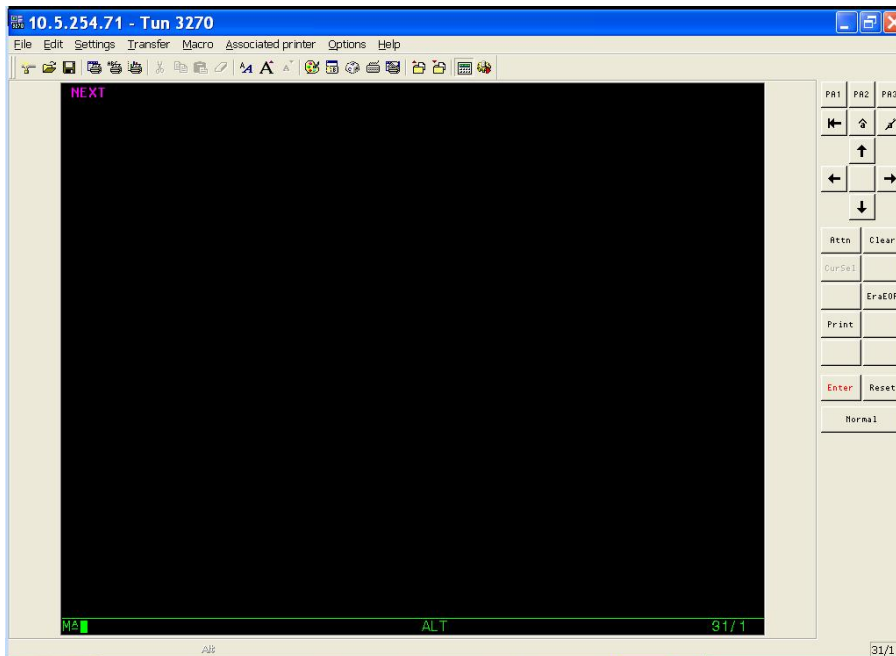
Benefits of Linux Based Environment Software AG Products - SPOD

- **Documentation embedded within the Natural Environment**
- **Scan utility very clear and concise**
- **Visibility of multiple Databases from within one SPOD session**
- **Can print an application listing on any printer**
- **Program Locking**
- **Staff recruiting and training will be easier**
- **And ...**



Benefits of Linux Based Environment Software AG Products - SPOD

- GUI Natural is 75% more Developer Efficient



Benefits of Linux Based Environment Software AG Products - NBS

- **GUI based panels**
- **Can see protected Natural Code**
- **Syntax checking on entry**
- **Check will put error in a separate window, correct and go**
- **Needs some enhancements**



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The Migration Process

Software AG Consultants

- **Contract with Software AG to provide Consultants to assist with the migration.**
- **Provide the consultants with database reports (ADAREPS & DDMs). These were used to check for irregularities in our database structure:**
 - Duplicate keys
 - Fields not used
 - Database and DDM inconsistencies
- **The consultants checked for syntax issues by scanning all (17,000) programs for:**
 - Binary fields with an odd number of bytes
 - Assignment of numeric data to an alpha field
 - Moving of a substring to a redefined field



The Migration Process

DU Development Staff

- **DU Development Staff scanned all programs for:**
 - All calls that were previously directed to CMS:
 - Filedef commands were changed to 'Define Work file'
 - Operating systems calls were changed to 'shcmd' commands
 - CMS commands were changed to the equivalent Linux version
 - Collating sequence issues since CMS is EBCDIC based and Linux is ASCII based. This required changing all application programs that deal with range selections. We chose to change the range:
 - From: ' ' to '99'
 - To: ' ' to 'zz'.
 - Any hard coded hex values
 - Various programming syntax changes based on the newer Natural
 - Natural keywords that were now reserved
- **This process was iterative as we monitored user problems and corrected them as they were found**
- **Could no longer redefine large fields into shorter field lengths in the DDM**



The Migration Process

DU Technology Staff

- **Purchase and setup our new IFL only processor**
- **Increase the capacity of our disk drive to support both database versions and provide for database growth**
- **Install a new z/VM (5.3) operating system**
 - Start by building it second level on our existing processor
 - Duplicate the z/VM system for the second LPAR environment
 - 'Database' LPAR
 - 'Linux' LPAR
- **Build the initial Linux image to house the databases in the 'Database' LPAR**



The Migration Process

Linux Database Image Hardware Configuration

(Thank you IBM and Velocity Software)

- 11.5 Gig Memory
- 2 v-disk Swap areas
 - 150 Meg Primary
 - 1.5 Gig Secondary
- 1 Gig Ramdisk for temporary work files
- 1 Meg Apache mem_cache
- Direct attach DASD to the Linux image (not minidisks)
- LVM Striping
- Hypersocket network connections for communication between Linux images
- 3592 tape support



The Migration Process

Linux Database Image Software Configuration

(Thank you IBM, Software AG, and Velocity Software)

- Use Dynamic IP address (both Internal and External) and Cron file based on the User Id (used for backup procedure)
- 'Worker' Apache configuration
- REXX CGI scripts converted to perl
- Mod_perl
- Backticks
- Read Only Natural buffer pools
- 2 Gig Adabas buffer pools
- Existing Fortran applications converted to Linux Fortran (thank you very much Jim Elliott)
- Realm authentication
- Use CUPS for printing (we used ISO 8859-1 Symbol Set)



The Migration Process

Software AG Database Setup

- **Build database repositories for the 6 production and 2 test databases**
- **Consultants Installed Adabas, Natural, Predict, and Construct (NBS)**
- **Also Installed Entire Net-Work software**
 - Used to provided a communication link between databases housed in CMS and those that were transferred to Linux.
 - Used only for testing prior to final migration.
 - We were running a slightly older version of Adabas on CMS and therefore we could not install the latest version of Entire Net-Work. This could be the reason that this software did not work well – it required a lot of TLC.



The Migration Process

ADAMAGIC Software

- ADAMAGIC software reduces the amount of time required to convert the database from CMS to Linux format.
- Setup a Windows based computer to run ADAMAGIC conversion software from Treehouse Software.
- Create a SFS repository to hold the backup and batch files for each database or individual file to be converted
- Built a REXX exec to assist with the file migration
 - Perform the backup of the database files to the SFS repository
 - Create a batch file to be used by the ADAMAGIC to convert the Backup file into files ready to upload into the Linux database repository
 - Create a parm file based on which database files are to be converted
- Remote Desktop connect to the ADAMAGIC PC and FTP GET from the SFS the backup, batch, and parm files.
- Execute the ADAMAGIC batch file to convert the database backup file.
- FTP from the ADAMAGIC PC to the Linux database image to upload the converted data and then store the data into the Linux database
- Create a checklist to make sure all data are moved.



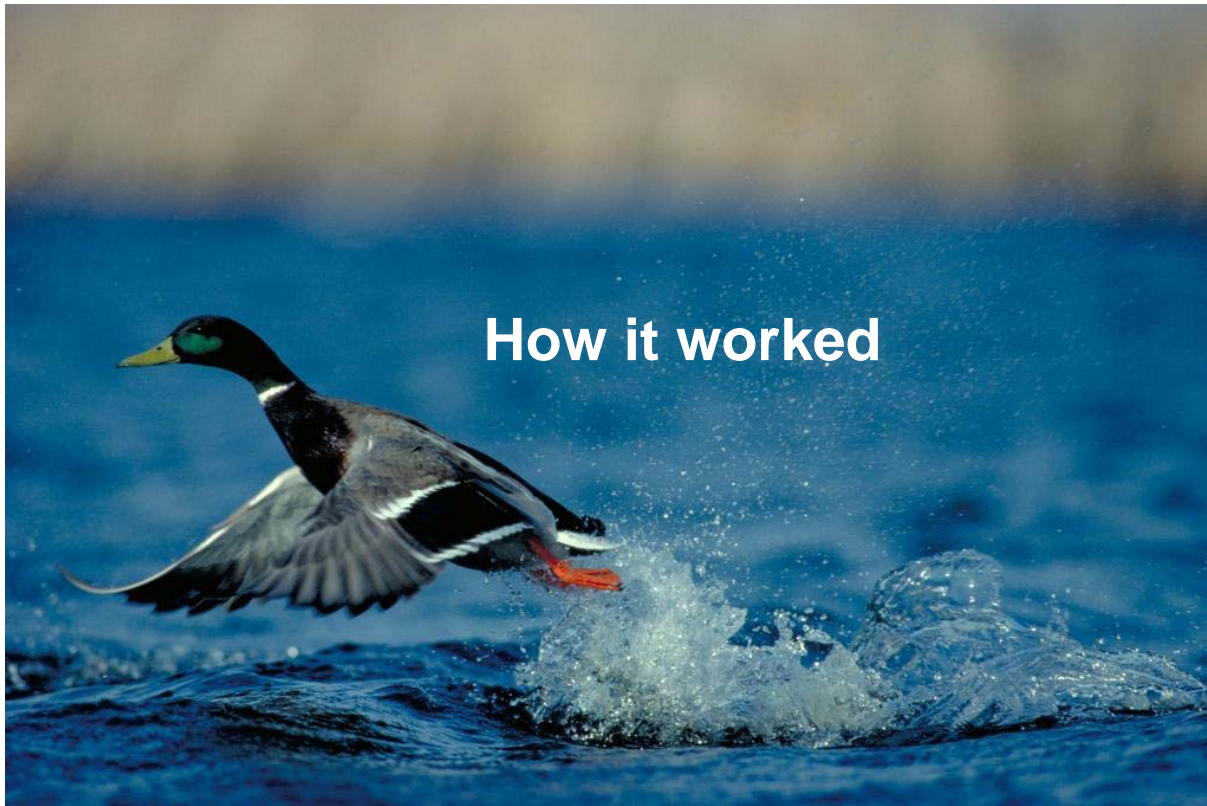
The Migration Process

The Database Conversion

- **We took the system down on the evening of Friday, February 8 and all data was converted and available for testing by noon on Sunday, February 10.**
- **Testing went well with positive reviews by our testers.**



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How it worked

ADABAS Performance

- **Fast relative to VM ADABAS**
- **Stripped LVMs for multiple IO Handlers**
 - Format and file load times about 8 times quicker
- **Super Descriptor Builds quicker**
- **Backup times quicker**
- **Natural reads records quicker**



How it worked

Natural Performance

- **Much poorer than expected**
- **Nearly disastrous for the Project**
- **IBM Loans DU an IFL which enables Apps to run**
- **IBM engages IBM Germany to Tune DU System**
- **Software AG working on the problem**



How it worked

Natural Performance

- 51 Natural Statements were tested to compare CMS Natural and Linux Natural performance.

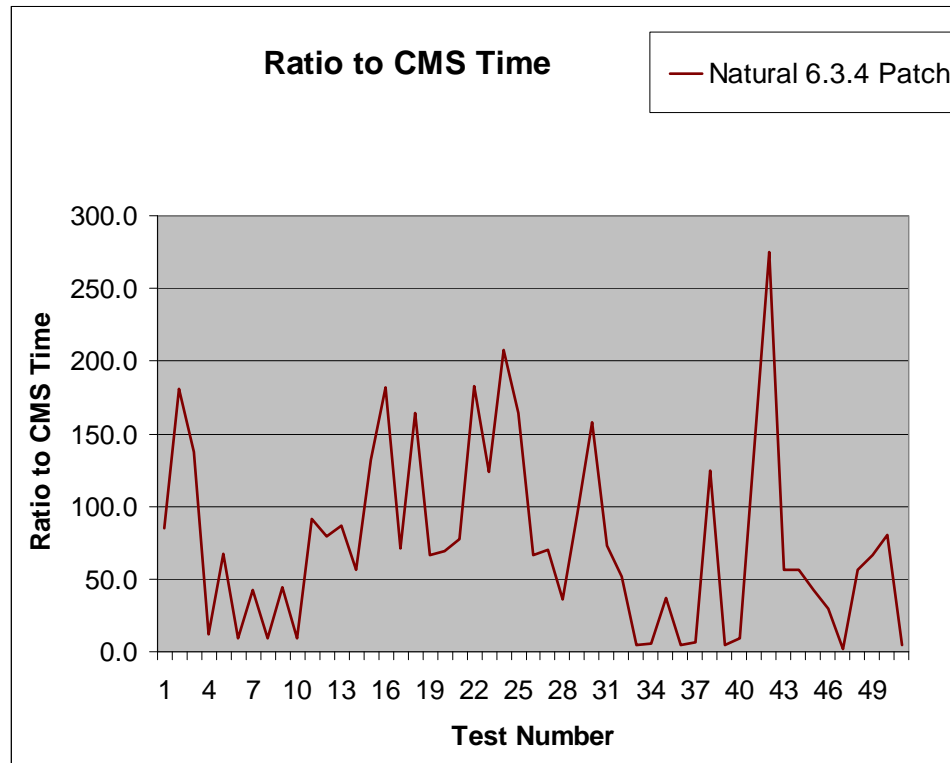
Ducks Unlimited Canada				
Test Number	Description	Time is Elapsed		
		in Seconds to the Micro-second		
		Ducks z9 CMS	Ducks z9 Linux	
		Time	Natural 6.3.4 Patch Time	Ratio to CMS
1.	For with numeric (Ignore)	0.000580	0.049297	85.0
2.	For with pack ed (Ignore)	0.000201	0.036277	180.5
3.	For with interger (Ignore)	0.000081	0.011158	137.8
4.	Decide - .20 elements - hit on 1 (numeric)	0.005315	0.063886	12.0
5.	Decide - .20 elements - hit on 20 (numeric)	0.008233	0.554904	67.4
6.	Decide - .20 elements - hit on 1 (alpha)	0.005094	0.048904	9.2
7.	Decide - .20 elements - hit on 20 (alpha)	0.005679	0.241079	42.5
8.	Decide - .20 elements - hit on 1 (integer)	0.005089	0.046401	9.2
9.	Decide - .20 elements - hit on 20 (integer)	0.005363	0.238263	44.4
10.	Decide - .20 elements - hit on 1 (packed)	0.005149	0.046645	9.1
11.	Decide - .20 elements - hit on 20 (packed)	0.006222	0.567944	91.3
12.	ADD - (numeric - no decimal)	0.000579	0.045879	79.2
13.	ADD - (numeric - 2 decimal)	0.000572	0.049896	87.2
14.	ADD - (numeric - add no decimal to 2 decimal)	0.001029	0.08387	56.7
15.	ADD - (packed - no decimal)	0.000331	0.048606	131.7
16.	ADD - (packed - 2 decimal)	0.000266	0.046468	181.5
17.	ADD - (packed - add no decimal to 2 decimal)	0.000789	0.056830	70.8
18.	ADD - (integer)	0.000137	0.022492	164.2
19.	Multiply - (numeric - no decimal)	0.001163	0.076167	66.1
20.	Multiply - (numeric - 2 decimal)	0.001994	0.136257	69.4
21.	Multiply - (numeric - no decimal by 2 decimal)	0.001280	0.099741	77.9
22.	Multiply - (packed - no decimal)	0.000401	0.073217	182.6
23.	Multiply - (packed - 2 decimal)	0.001070	0.131940	123.3
24.	Multiply - (packed - no decimal by 2 decimal)	0.000470	0.097890	207.6
25.	Multiply - (integer)	0.000146	0.023781	164.0
26.	Divide - (numeric - no decimal)	0.000797	0.052702	66.1
27.	Divide - (numeric - 2 decimal)	0.001342	0.093901	69.9
28.	Divide - (numeric - no decimal by 2 decimal)	0.002424	0.087004	35.7
29.	Divide - (packed - no decimal)	0.000523	0.049651	94.7
30.	Divide - (packed - 2 decimal)	0.000523	0.062514	157.8
31.	Divide - (packed - no decimal by 2 decimal)	0.001066	0.080209	73.2
32.	Divide - (integer)	0.000446	0.022875	51.3
33.	Examine - . - 1000 elements hit on 5	0.013626	0.088825	4.3
34.	Examine Full - 1000 elements hit on 5	0.010332	0.066241	5.2
35.	For Loop - . - 1000 elements hit on 5	0.004735	0.174877	36.9
36.	Examine - . - 1000 elements hit on 500	0.551509	2.739206	5.0
37.	Examine Full - 1000 elements hit on 500	0.359366	2.448967	8.8
38.	For Loop - . - 1000 elements hit on 500	0.126404	15.763972	124.7
39.	Examine - . - 1000 elements hit on 1001	0.984632	4.707263	4.8
40.	Examine Full - 1000 elements hit on 1001	0.708166	6.426790	9.1
41.	For Loop - . - 1000 elements hit on 1001	0.247748	35.246408	142.3
42.	IF Array(*) eq. 1000 elements hit on 1	0.000131	0.036085	275.5
43.	IF Array(*) eq. 1000 elements hit on 500	0.036561	2.007270	66.5
44.	IF Array(*) eq. 1000 elements hit on 1001	0.071088	4.020022	66.5
45.	Assign #array(*) eq #array2(*) - numeric	0.189338	8.035617	42.4
46.	Assign #array(*) eq #array2(*) - packed	0.088667	2.594864	29.2
47.	Assign #array(*) eq #array2(*) - integer	0.023294	0.044108	1.9
48.	#array(*) := #array2(*) - numeric	0.447191	25.083806	56.1
49.	#array(*) := #array2(*) - packed	0.335062	22.283018	66.5
50.	#array(*) := #array2(*) - integer	0.258667	20.800201	80.4
51.	Callnat	0.047200	0.228865	4.8
Total Elapsed time		4.542187	156.073260	34.4



How it worked

Natural Performance

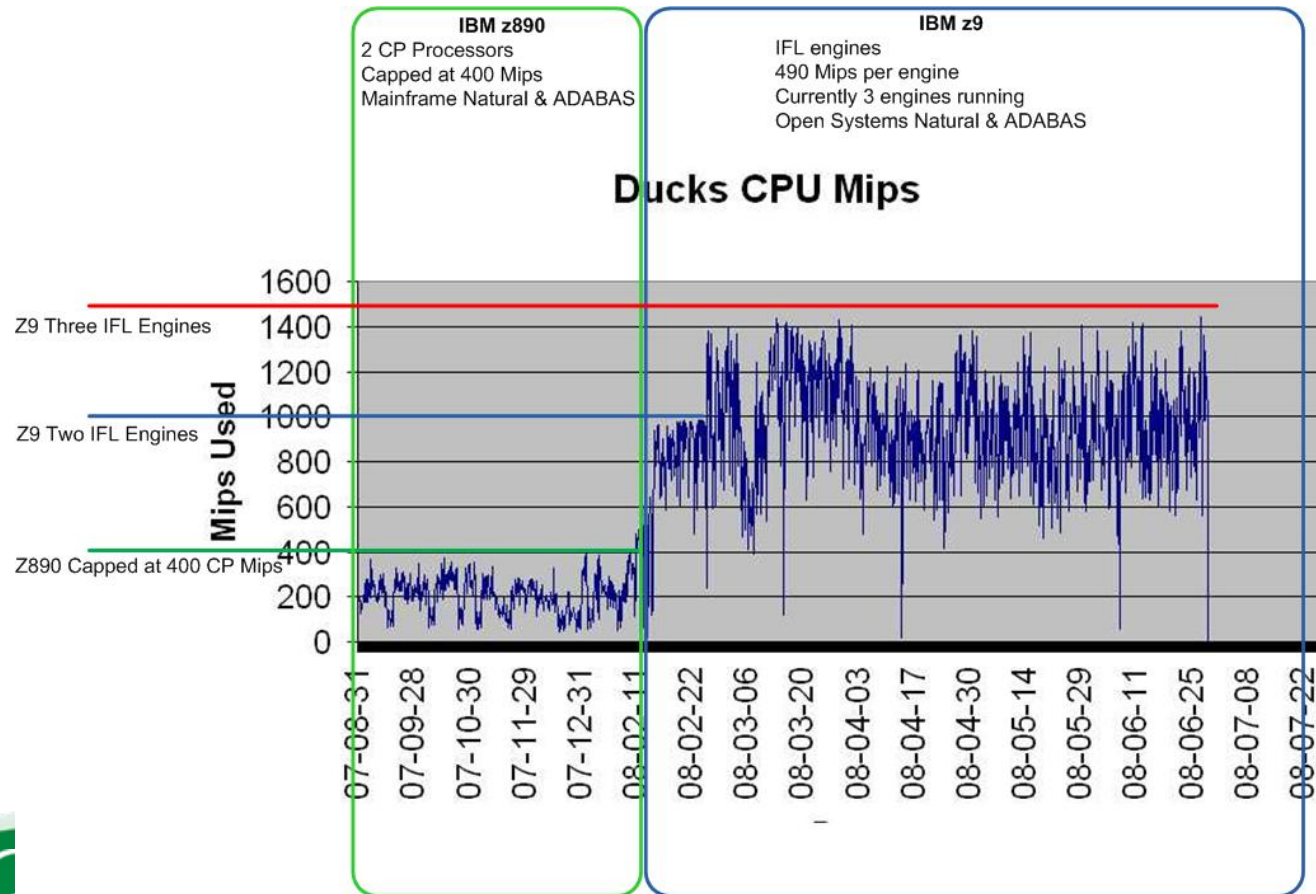
- 4 – 275 times slower than CMS Natural



How it worked

Natural Performance

- 1400 Mips just enough for 400 VM Mips



How it worked

DU Performance monitoring Applications

- **DU wrote a monitor script to check long running jobs and sets nice value to modify the job priority to prevent individual jobs from taking all processor resources. Linux process scheduler seems not as robust as the VM scheduler.**
- **We also wrote a Natural application which would look for processes that had been abandoned by the user and if so these processes would be terminated to free resources.**



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Who Helped us



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Who Helped us Ducks Migration Staff

- **Systems Programming**
 - 2 staff - 32 Years DU experience
- **DBA**
 - 2 staff – 50 Years DU Software AG experience
- **Software Development**
 - 6 staff – 54 Years DU Software AG experience



Who Helped us

Software AG Consultants

- **Mike Waldron and Bob St. Leger**
- **Critical to the Success of the Project**
- **Mike guided DU through the Conversion Phase**
- **Bob and Mike invaluable through the Implementation Phase**
- **Worked 24/7 for weeks through the Performance Phase**
- **Great knowledge and Toolbox of Scripts**
- **Tremendous Support day and night**
- **Provided a Lifeline - Never Blinked**



Who Helped us IBM Consultants

- **Canada - Brian Neudorf, Jim Elliott**
- **Germany – Holger Wolf, Martin Kammerer**
- **Brian and Jim guided DU throughout the entire project**
- **Martin and Holger engaged in the Performance Phase**
- **Loaner IFL implemented**
- **Tuning expertise was critical and given on a daily basis**
- **Success not possible without their help**



Who Helped us Other Helpful People – THANK YOU

- **IBM**
 - Romney White, Bill Bitner, Alan Altmark
- **Velocity Software**
 - Barton Robinson, Tony Noto, Dennis Andrews
- **Software AG**
 - Dick Waite, Peter Harris, Pieter Strydom, Darren Fidyk, Bob Standage
- **Novell**
 - Mark Post
- **Glasshouse Systems**
 - Donna Worthingham



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