

MIGRATING DB2 DATABASES TO DB2 DAAS OFFERINGS

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WHAT IT IS ABOUT, AND WHAT IT'S NOT ABOUT

- » It's not a step-by-step instruction of DB migration to any specific Public Cloud DaaS offering.
- » It's not a comparison of different DB as a Service Db2 offerings
- » It's a sharing of personal experience of working on a large migration project where migration target was a private cloud Db2 DaaS offering.

PROJECT SCOPE

Duration	A bit more than two years
Number of migrated databases	200-300
DB sizes	5Gb - 8Tb
Full migration life cycle period (per 1 DB)	3-4 hours - up to 4-6 months per environment (Test/Dev, INT, Prod)
Migration methods	Backup/Restore, DB structure recreation + data movement (EXPORT/LOAD)
Source DBs	on-premise DB2 installations, DB2 installations in virtual environment (Linux VMs), third party managed DBs.
No cluster configurations (no DPF, no PureScale installations).	

- » Host migration (host virtualization, VM movement, etc.)
 - » DB2 stop/start before / after host virtualization.
 - » Control of external storage presence after migration.
 - » Post-migration db2nodes.cfg correction.

- » DB backup + redirected restore

Advantages:

All objects (even DB2 ATS jobs and their artifacts, defined monitors, collected statistics, packages with prepared execution plans, etc.) will be copied with a DB.

Most simple and fast method to perform migration from its start till the end.

- » Full recreation of DB structure + data copying (EXPORT or fast UNLOAD / LOAD, data replication solutions).

This is the only available method in the case of

- » Migration between different platform groups having different byte order (Big-Endian vs Little-Endian).
e.g. AIX or zLinux -> x86 Linux DB2 DBs migrations
- » There is a requirement to convert System Catalog tablespace from SMS to Automatic Storage.

- » Significant DB physical design changes.
- » Lack of direct access to the target system to perform DB restore.

- » Issues:
 - » Increased time for migration preparing
 - » Increased outage time for the data movement step.
 - » Difficulties with extracting all DB artifacts. Some of them can't be extracted with a db2look tool

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Just to note.

There could be different approaches to improve LOAD performance for different table types.

The best LOAD strategy will be different in cases where table has LOB columns or doesn't have, has XML columns or doesn't have, is small or large, is Range Partitioned or not Partitioned, is MDC or not, etc.

- » General approach was to use Backup/Restore method whenever it was possible.

MIGRATION WORKFLOW

- » An approach which became considered as the best practice was to
 - force migration requester to order target DB via standard DaaS DB ordering instruments
 - use it as a placeholder for the migration target

» Pros

- » automatically created and configured VM according to environment standards.
- » creates a database fully acceptable by Ops DBA team.
- » registers host and DB as CIs with proper ownership
- » provides standard pre-configured DB access interfaces

- » Major challenge when you have DB as a Service offering as a migration target.
- » DB & environment standardization vs source environment DB parameters configuration.

- » How target environment becomes configured
 - » DB provisioning is ordered within some interface with specified general parameters:
 - workload type (transactional, analytical, mixed)
 - size (small, medium, large, extra-large)
 - Authorization mechanism and predefined users/roles
 - » Resources extension ordering (optional) to meet sizing special requirements:
 - ordering additional CPU cores
 - ordering additional storage

- » How to resolve possible conflicts between predefined configuration and original DB configuration?
- » How to make DB acceptable by cloud operational support DBA team?

- » Understand what are differences
- » Choose those which are important to be kept
- » Conform keeping these parameters with a target environment DBA team

Make a configuration DIFF!

HOW TO PREPARE DIFF

» Queries to extract configuration:

```
select REG_VAR_NAME as NAME, REG_VAR_VALUE as VALUE_FLAGS from  
SYSIBMADM.REG_VARIABLES;
```

```
select NAME, VALUE, VALUE_FLAGS from sysibmadm.dbmcfg;
```

```
select NAME, VALUE, VALUE_FLAGS from sysibmadm.dbcfg;
```

```
bash$ db2_ "select REG_VAR_NAME as NAME, REG_VAR_VALUE as VALUE, 'NONE' as VALUE_FLAGS from SYSIBMADM.REG_VARIABLES order by name"
```

NAME	VALUE	VALUE_FLAGS
DB2CODEPAGE	1208	NONE
DB2COMM	TCPIP	NONE
DB2SYSTEM	billing	NONE
DB2_4K_DEVICE_SUPPORT	ON	NONE

```
4 record(s) selected.
```

```
bash$ db2_ "select REG_VAR_NAME as NAME, REG_VAR_VALUE as VALUE, 'NONE' as VALUE_FLAGS from SYSIBMADM.REG_VARIABLES order by name"
```

NAME	VALUE	VALUE_FLAGS
DB2CODEPAGE	1208	NONE
DB2COMM	TCPIP	NONE
DB2SYSTEM	billing	NONE
DB2_4K_DEVICE_SUPPORT	ON	NONE
DB2_BACKUP_USE_DIO	ON	NONE
DB2_ENABLE_COS_SDK	OFF	NONE
DB2_OBJECT_STORAGE_SETTINGS	OFF	NONE
DB2_REDUCE_FLUSHING_DURING_BACKUP	ON	NONE
DB2_RESTORE_GRANT_ADMIN_AUTHORITIES	ON	NONE
DB2_TRUST_MDC_BLOCK_FULL_HINT	ON	NONE
DB2_USE_ALTERNATE_PAGE_CLEANSING	ON	NONE

```
11 record(s) selected.
```

```
bash$ db2 "export to src_reg_var.csv of del
select REG_VAR_NAME as NAME, REG_VAR_VALUE as VALUE, 'NONE' as VALUE_FLAGS
from SYSIBMADM.REG_VARIABLES order by name
"
SQL3104N  The Export utility is beginning to export data to file
"src_reg_var.csv".

SQL3105N  The Export utility has finished exporting "4" rows.

Number of rows exported: 4
```

```
bash$ db2 "export to tgt_reg_var.csv of del
select REG_VAR_NAME as NAME, REG_VAR_VALUE as VALUE, 'NONE' as VALUE_FLAGS
from SYSIBMADM.REG_VARIABLES order by name
"
SQL3104N  The Export utility is beginning to export data to file
"tgt_reg_var.csv".

SQL3105N  The Export utility has finished exporting "11" rows.

Number of rows exported: 11
```

```
bash$ cat src_reg_var.csv
"DB2CODEPAGE","1208","NONE"
"DB2COMM","TCPIP","NONE"
"DB2SYSTEM","billing","NONE"
"DB2_4K_DEVICE_SUPPORT","ON","NONE"
```

```
bash$ cat tgt_reg_var.csv
"DB2CODEPAGE","1208","NONE"
"DB2COMM","TCPIP","NONE"
"DB2SYSTEM","billing","NONE"
"DB2_4K_DEVICE_SUPPORT","ON","NONE"
"DB2_BACKUP_USE_DIO","ON","NONE"
"DB2_ENABLE_COS_SDK","OFF","NONE"
"DB2_OBJECT_STORAGE_SETTINGS","OFF","NONE"
"DB2_REDUCE_FLUSHING_DURING_BACKUP","ON","NONE"
"DB2_RESTORE_GRANT_ADMIN_AUTHORITIES","ON","NONE"
"DB2_TRUST_MDC_BLOCK_FULL_HINT","ON","NONE"
"DB2_USE_ALTERNATE_PAGE_CLEANSING","ON","NONE"
```

```
=====
#!/bin/bash

join -t "," -a1 -a2 -eNONE -o0,1.2,1.3,2.2,2.3 $1 $2 \
  | sed 's/"/"/g' \
  | awk -F, '{ if ($2!=$4 || $3!=$5) printf " %-40s %-24s %-15s %-24s\n", $1, $2, ($3!="NONE")?$3:"", $4, ($5!="NONE")?$5:""}' \
  > $3
=====
```

DIFF SCRIPT OUTPUT

=====

```
bash$ cat reg_var_diff.txt
```

DB2_BACKUP_USE_DIO	NONE	ON
DB2_ENABLE_COS_SDK	NONE	OFF
DB2_OBJECT_STORAGE_SETTINGS	NONE	OFF
DB2_REDUCE_FLUSHING_DURING_BACKUP	NONE	ON
DB2_RESTORE_GRANT_ADMIN_AUTHORITIES	NONE	ON
DB2_TRUST_MDC_BLOCK_FULL_HINT	NONE	ON
DB2_USE_ALTERNATE_PAGE_CLEANSING	NONE	ON

=====

DB CFG DIFF EXAMPLE

```
bash$ cat db_cfg_diff.txt
database_memory      3689493          AUTOMATIC      3675120          AUTOMATIC
locklist             13824           AUTOMATIC      33280            AUTOMATIC
logarchmethl         DISK:/billing_db/DB2BILLD/archive_logs/      DISK:/home/db2bill/db/ar
logsecond            12
maxlocks             98              AUTOMATIC      97              AUTOMATIC
num_log_span         0
pckcachesz           8528            AUTOMATIC      12792            AUTOMATIC
sheapthres_shr       5000            AUTOMATIC      25432            AUTOMATIC
softmax              520
sortheap             986             AUTOMATIC      5086            AUTOMATIC
util_heap_sz         19794
loghead              S0100675.LOG    S0265117.LOG
logpath              /billing_db/DB2BILLD/active_logs/NODE0000/LOGSTREAM0000/ /billin
mon_req_metrics      BASE
mon_act_metrics      BASE
mon_obj_metrics      BASE
mon_uow_data         NONE
mon_locktimeout      NONE
mon_lck_msg_lvl      1
mon_uow_pkglist      OFF
mon_uow_execlist     OFF
mon_rtn_execlist     OFF
mon_rtn_data         NONE
extbl_location       /home/db2billd  /home/db2bill
bash$
```

CONFIGURATION PARAMETERS GROUPS

- » Business logic related
 - » DECFLT_ROUNDING
 - » DEC_ARITHMETIC
 - » LARGE_AGGREGATION
 - » DFT_SQLMATHWARN
 - » STRING_UNITS
 - » NCHAR_MAPPING

- » Most probably important for application correct execution
 - » configured size of transaction logs space
 - » lock timeouts
 - » APPLHEAPSZ & APPL_MEMORY
 - » MAXAPPLS

- » Environment related
 - » Monitoring configuration
 - » IO CLEANERS, IO SERVERS
 - » LOG archiving methods/paths
 - » Automatic maintenance configuration
- » SYS groups

**PRE-DAAS MIGRATION DB
TRANSFORMATIONS.**

TWO-STEP MIGRATIONS.

- » Too much modifications to make them in one step
- » Make DB conforming pre-migration requirements you define to reduce migration risks
 - » Make DB on the same version and fixpack level as target environment
 - » Clean-up DB to reduce migration time
 - » Do a migration between platform groups

SECURITY. ACCESS PRIVILEGES TRANSFORMATION.

- » Certificates

- » Authentication & Authorization

- » Populate privileges

- db2look with -xd + grep + replace with “sed” may be good enough option.

- » Transfer ownership

IMPORTANCE OF TEST MIGRATIONS.

» DB owners

» Realists

- Test migration (one or more)
 - Application tests
 - Cutover migration
- repeat for each environment (Dev, Test, UAT, Prod)

» Optimists

- Let's do it without test

POST-MIGRATION ACTIVITIES

- » DB Hardening
- » DB Handover between Migration team and operational support team.

CONTROL POST-MIGRATION PERFORMANCE

- » Performance tests (nice to have during test migrations)
- » Collect detailed performance metrics in source environment
 - » MON_xxx table functions (mostly all and several times to have an ability to see deltas for different period of times)
 - » In the case of high statements flow in the package cache, set-up package cache event monitor to collect evicted statements characteristics

REDUCING MIGRATION OUTAGE TIME

- » Online backup + logs shipping or HADR setup
- » Replication setup
- » Optimize backup/restore
- » Use various methods to speed-up LOADs

THE END