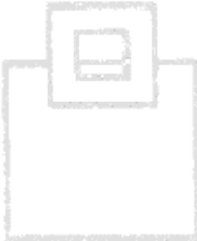
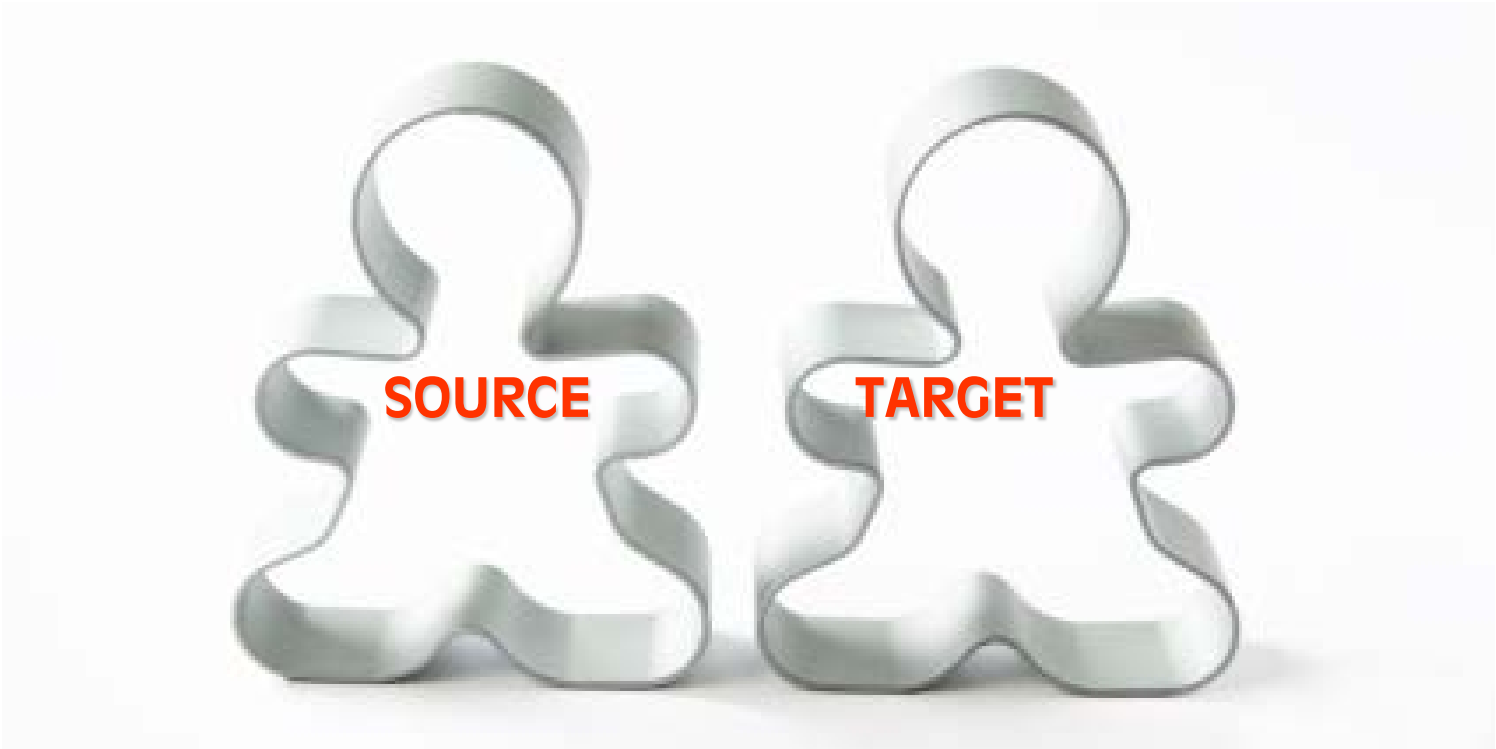
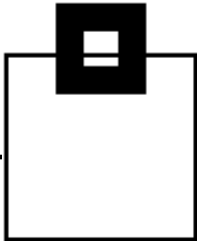


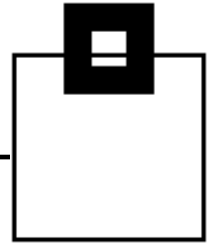
Cloning - What's new and faster?



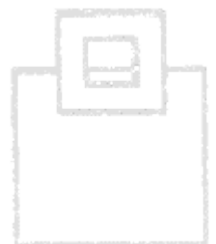
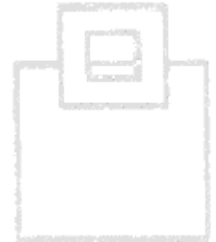
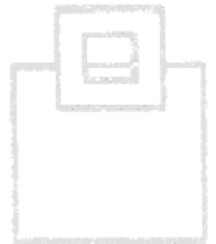
DB2 z/OS Database cloning



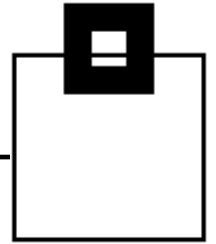
Agenda/Content to be addressed



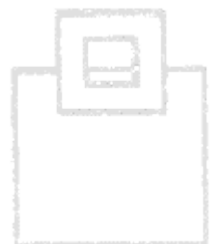
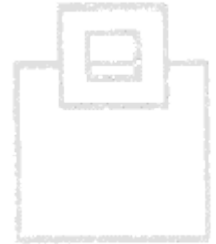
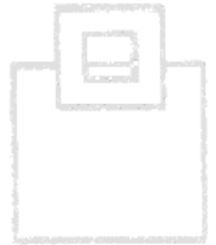
- Cloning basics
 - What type of cloning is the right choice for a given requirement?
 - What are the gotchas and where are the shortcuts?
 - What to take care of – beyond DB2?
- Cloning details
 - XML scenario definition – the sky is the limit!
 - Naming conversion – how do you want to be called today?
 - The path to DB2 Data Sharing – how many members do you need?
 - How can I exploit instant copy technology, like Flashcopy?
- Tips and Tricks
 - DB2 cross version cloning and system cloning
 - Cloning costs considerations
 - Do's and Don't's



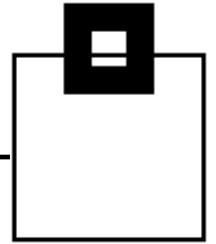
To Clone or not to Clone?



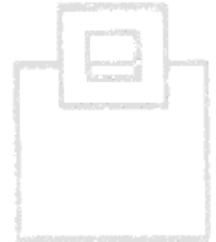
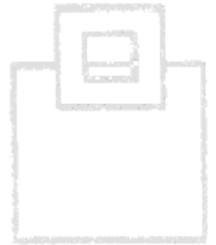
- Cloning is used for different reasons
 - Duplication of subsystems
 - For (DR) Test and Quality Assurance (QA)
 - For Backup
 - For new Subsystem creation
 - For Audit, (Compliance) Reporting and Data Mining
 - Demo and training
 - Merge/Duplication of systems/data
 - Consolidation of Systems (Mergers & Acquisitions)
 - Separation of test data, applications or business units
 - (Refresh of an entire system or parts of it)



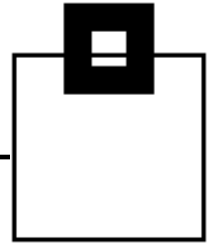
To Clone or not to Clone?



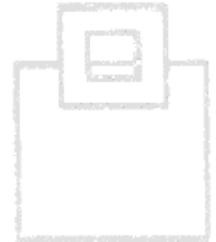
- Advantages of cloning for
 - DR tests, QA, development
 - No effects on the real production system/data
 - New subsystem creation
 - New system w/o starting from scratch reduces set up efforts
 - Audit, Reporting, Data Mining
 - Shifts workload from production to the clone
 - Allows what if and point in time access to the data
 - Merge/Duplication of systems/data
 - Reduces administration overhead and increase flexibility



To Clone or not to Clone?

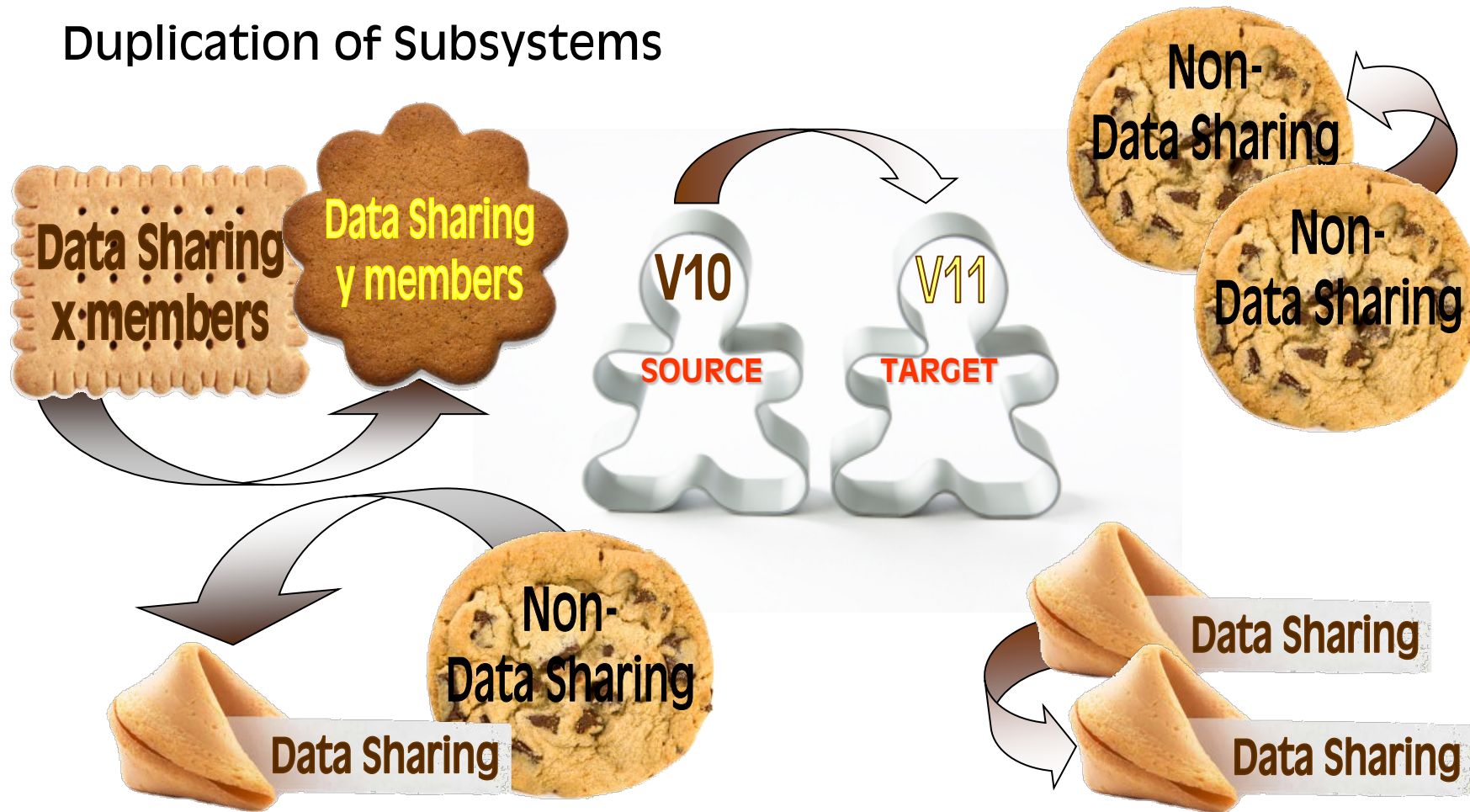


- How to achieve those benefits?
 - Duplication of subsystems
 - For (DR) Test and Quality Assurance (QA)
 - For Backup
 - For new Subsystem creation
 - For Audit, Reporting and Data Mining
 - Demo and training

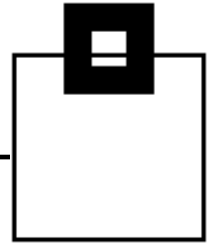


The various ways/flavors of Cloning

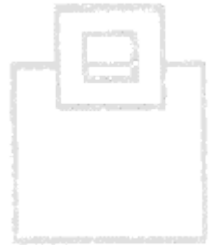
Duplication of Subsystems



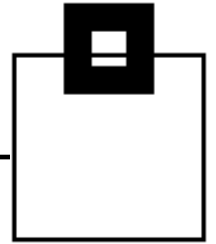
The various ways of Cloning



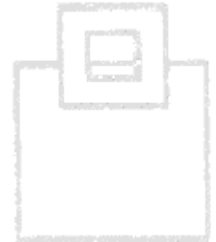
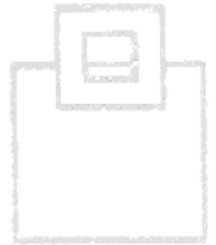
- Duplication of Subsystems
 - Details about Source and Target
 - Scope of Cloning
 - Required Steps
 - Gotchas to watch out for



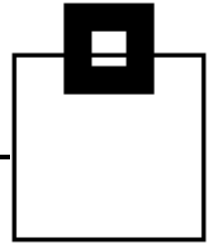
Duplication of Subsystems



- Details about Source and Target
 - All data of an entire system is duplicated
 - If both, source and target are one and the same OS and database type (e.g. DB2 z/OS → DB2 z/OS)
→ Homogeneous System Copy (aka. HSC)
- BTW
 - If the target is different (e.g. DB2 LUW → DB2 z/OS)
→ Heterogeneous System Copy (not addressed today)



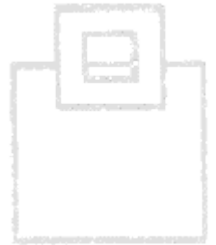
Duplication of Subsystems



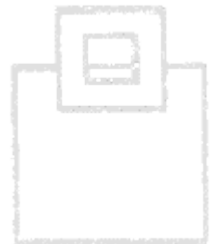
Scope of Cloning

We are talking about *database* cloning. This usually doesn't include the subsystem /data sharing group setup, like

- z/OS subsystem definition
- DB2 address spaces set up
- RACF rules
- SMS storage group/class set up
- WLM definitions
- Coupling Facility structures
- ...

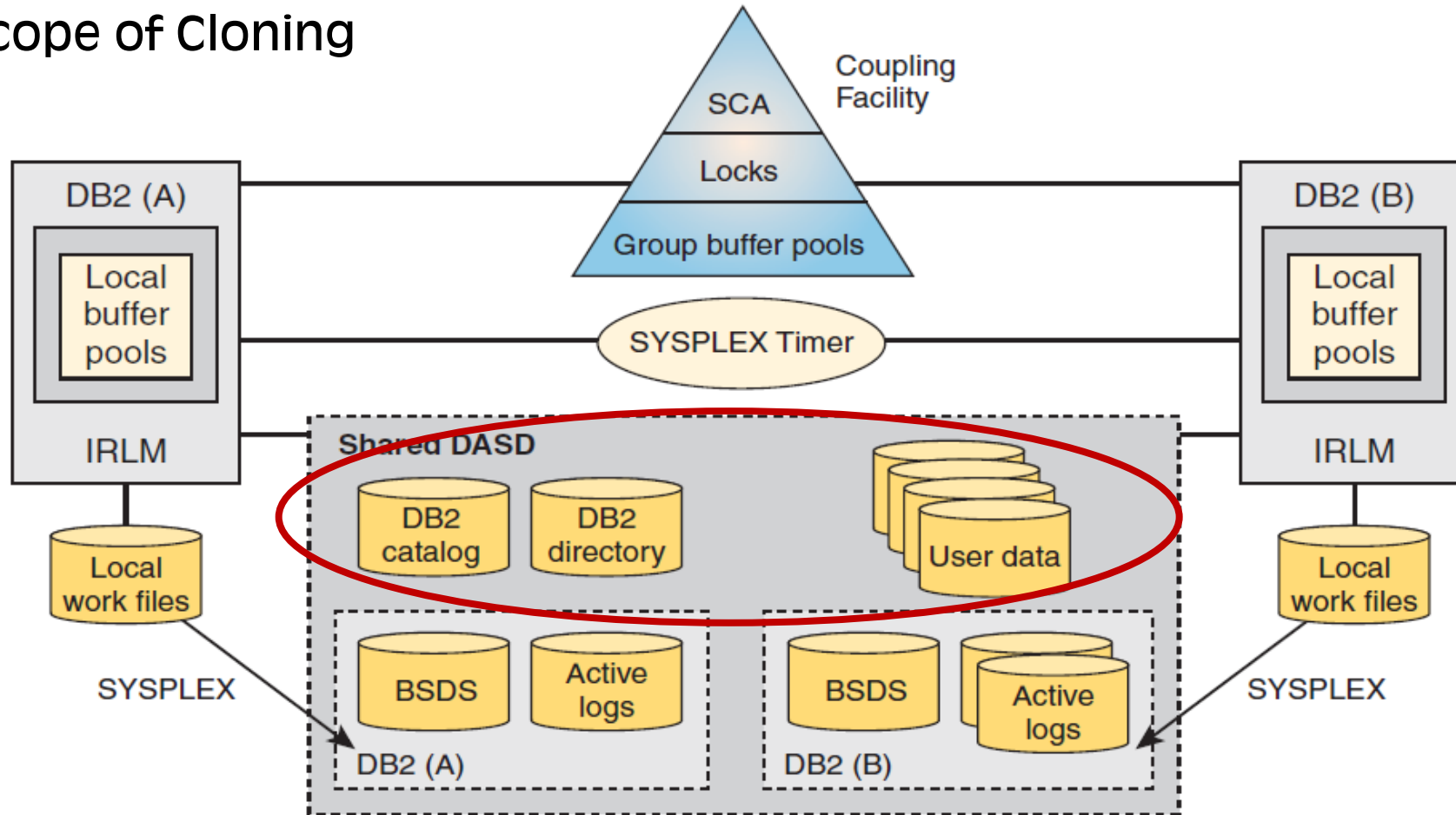


You may want to talk to your systems/operations colleagues.

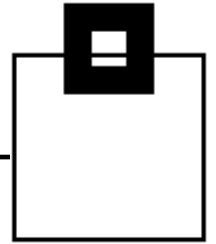


Duplication of Subsystems

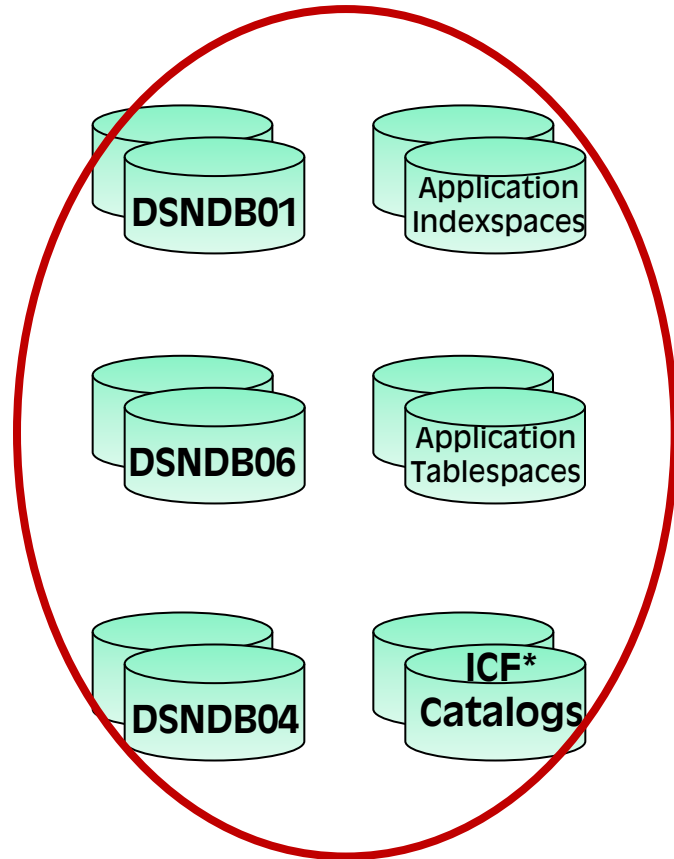
Scope of Cloning



The various ways of Cloning

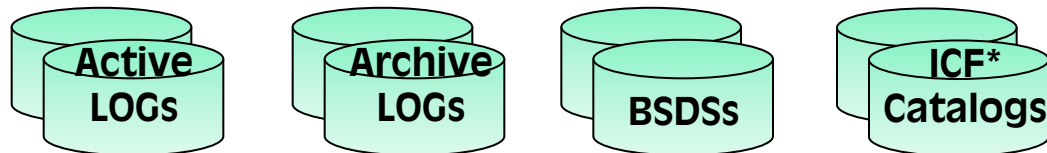


Scope of Cloning



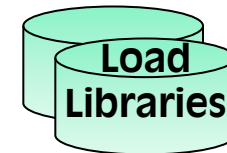
Note:

DSNZPARAM, DSNHDECP, BSDS, LOGs must be considered, but not cloned. Use them as a basis.



Optional:

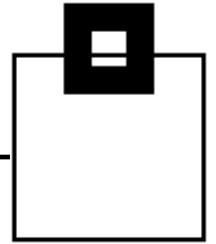
Including DB2 Load Libraries allows cross-version cloning



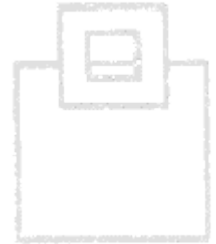
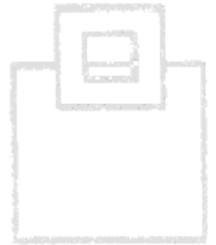
* Working on the volume level requires inclusion of ICF catalogs



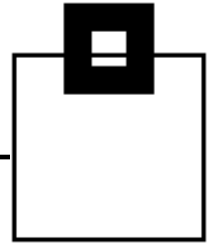
Duplication of Subsystems



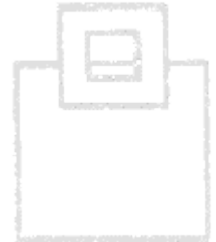
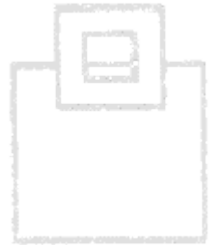
- Required Steps
 - Clone your source data
 - Dump via ADRDSSU
 - Split Mirror systems and break the mirror
 - FLASH Copy / Disk dump and then Restore
 - Any other method...
 - Stop the target system
 - Restore the source data
 - Rename (if naming should be different and/or target isn't isolated from source)
 - Adjust LOGs, BSDSs, DSNZPARM, DSNHDECP
 - Start target
 - Adjust DB2, like old naming (DB2 9 introduced NEWCAT)



Duplication of Subsystems

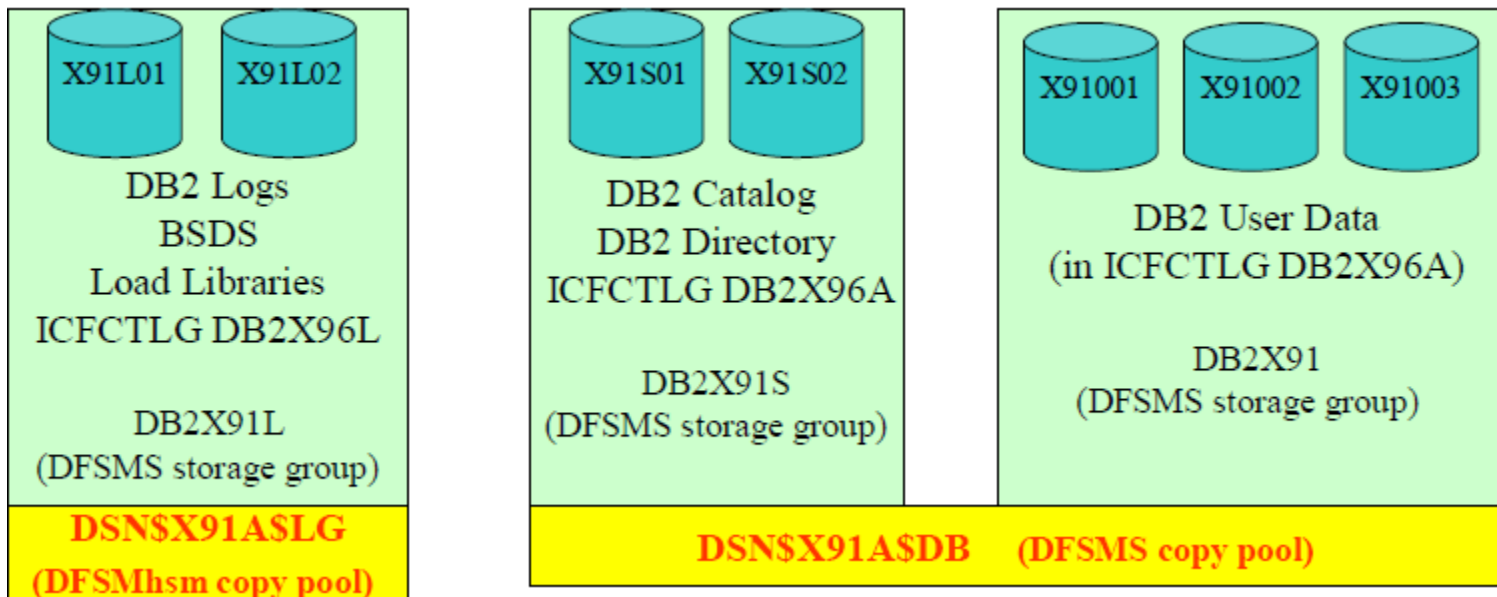


- Gotchas to watch out for
 - Don't burn time and resources
 - If you have the appropriate storage features, use them!
 - Instant copies (like Flashcopy) can clone your TB-sized source system in a fraction of time
 - Instant copies (like Flashcopy) don't burn CPU
 - Backup System assures full DB2 interaction
 - Data consistency without downtime (**QUIESCE**)

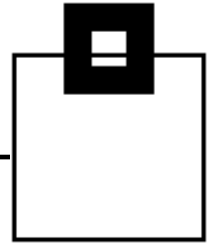


Duplication of Subsystems

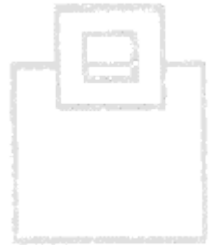
- Gotchas to watch out for
 - Assure a proper DFSMS definition if you want to exploit instant copy



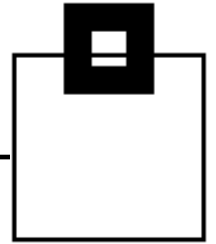
Duplication of Subsystems



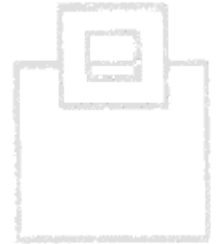
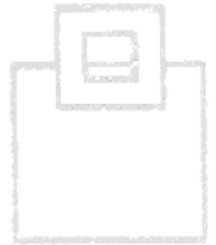
- Gotchas to watch out for
 - Be careful with the RACF definitions
 - If the target can access the source you can end up with corrupted source data!
 - Changing the DB2 subsystem type (non data sharing/data sharing) requires additional steps
 - Be very careful going to less members!
 - Cross version cloning requires to include the DB2 load libraries and changes the DB2 version of the target
 - Take special care during DB2 11 cloning when having basic and extended RBAs/LRSNs
 - DS → NDS LRSN becomes an RBA
 - DS target: be careful with your BSDSs



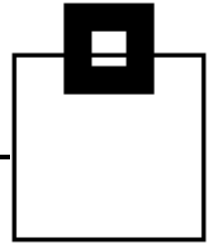
Duplication of Subsystems



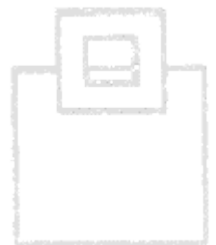
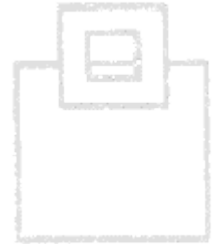
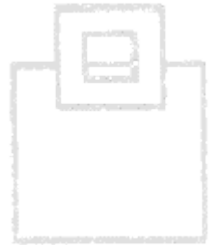
- Bottom Line
 - Cloning DB2 systems isn't rocket science, but a complex and error-prone process.
 - Familiarize yourself with these procedures and define an easy to use step by step guide.
- Tools that supervise, manage and optimize cloning lead to
 - More flexibility
 - Higher degree of automation
 - Exploitation of latest storage technology and DB2 features
 - Highest efficiency



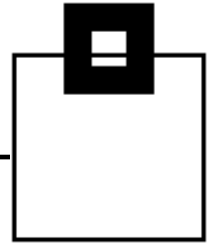
Duplication of Subsystems



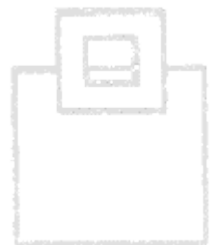
- How to manage those issues?
 - Dataset names – If on the same “system” duplicates
 - Consider storage technology features → “fast rename”
 - Subsystem parameters – In built “names” VCAT etc.
 - XML user exits for all parameters
 - Manual Intervention – Issuing shutdown messages etc.
 - XML user exits for external event triggering
 - Huge folder full of instructions – updates, errors etc. → Automated step-by-step customizable system



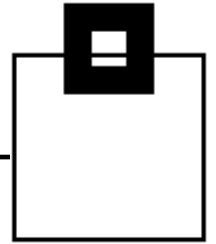
Duplication of Subsystems



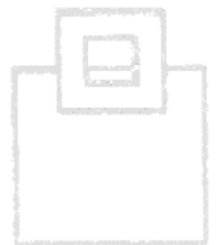
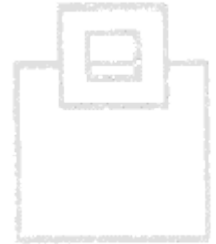
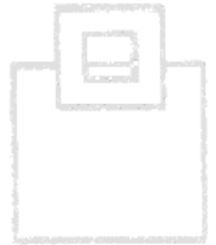
- What you should cover for sure
 - Support and exploit storage subsystem instant copies like
 - Backup systems or native
 - ESS Flashcopy
 - Timefinder
 - Snapshot
 - Assure data consistency for cloned data taken from running source systems – no source outage
 - Support rename – including changing the HLQ length
 - Guide and verify the entire process
 - Take care of special steps (e.g. V10 → V11, DS → NDS)

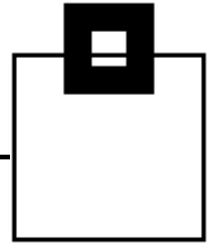


Duplication of Subsystems



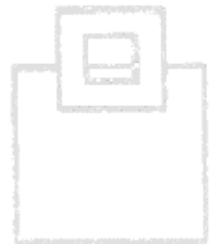
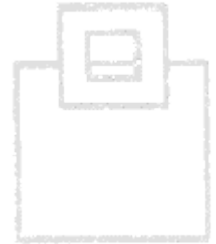
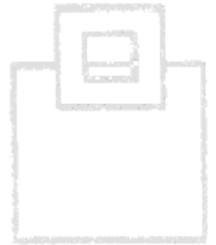
- What you should cover for sure
 - Guide and take care of the various types of cloning
 - Non data sharing to non data sharing
 - Data sharing to data sharing
 - Non data sharing to data sharing
 - Data sharing to non data sharing
 - Data sharing x members to data sharing y members
- One standardized, central solution for your cloning needs



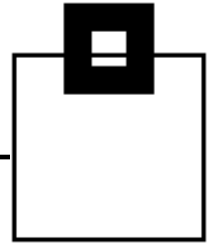


Duplication of Subsystems

And now a quick walk through the process



Duplication of Subsystems



Screen Flow of the **HSC** process

```
RecoveryCenter for DB2 z/OS ----- Main Selection ----- VM 0420
Command ==> _____ PTF_13002

Primary cmd: A(bout)

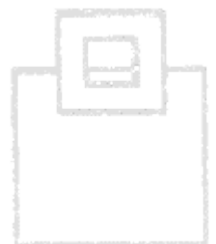
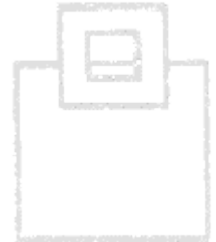
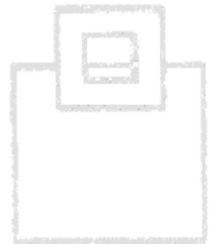
Select one of the following. Then press ENTER.

1. PARAMETERS - Define global parameters
2. DB2         - Define DB2 subsystem/group

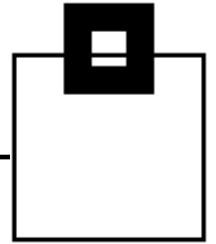
3. RAX         - Execute Recovery Assurance Expert
4. PIT RECOVERY - Execute a Point in Time Recovery
5. HSC         - Execute a Homogeneous System Copy
6. HOC         - Execute Homogeneous Object Cloning
G. GEN FDB2 JCL - Generate JCL for fast rename jobs

T. TUTORIAL   - Using RecoveryCenter for DB2 z/OS
X. EXIT       - Exit RecoveryCenter for DB2 z/OS

(c) Copyright SOFTWARE ENGINEERING GMBH 2005-2015 . All rights reserved.
```



Duplication of Subsystems



Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Scenario Selection Filter -----
Command ==> _____ Scroll ==> CSR

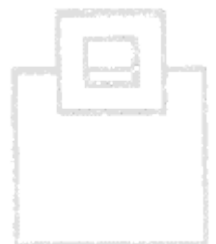
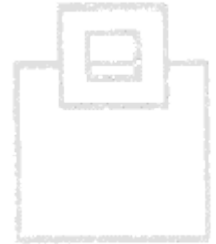
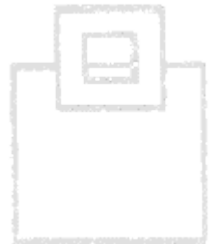
Filter settings allow the correct cloning scenarios to be selected.
Matching site and delivered scenarios will be displayed.

Confirm settings and press ENTER to continue.      CONFIRM: Y - Y(es)/N(o)
Press HELP for more information.

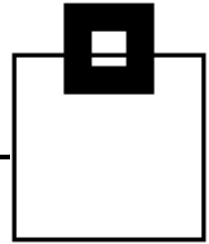
Online copy (*): Y - Y(es)/N(o)
Fast rename execution shall be isolated (*): N - Y(es)/N(o)
Target DB2 already exists (*): Y - Y(es)/N(o)
Intersystem cloning (*): T - N(o ISC)
                               S(ource based)
                               T(arget based)

Work file database of target is user managed in DB2: N - Y(es)/N(o)
DISCONNECT of UCAT from MCAT shall be done by HSC: Y - Y(es)/N(o)
DB2 stop and start shall be done automatically: Y - Y(es)/N(o)
Perform RTDX cloning: N - Y(es)/N(o)
Use scenario : Show only site specific scenarios: N - Y(es)/N(o)
Test mode (check job generation, only) (*): N - Y(es)/N(o)

(*) - These settings must be entered.
```



Duplication of Subsystems



Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Scenario Selection ----- Row 1 to 16 of 16  
Command ==> _____ Scroll ==> CSR
```

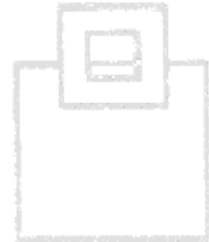
```
Primary cmd: L(ocate SCENARIO)
```

```
Line cmd: S(elect), I(nfo), E(dit), C(reate), D(elete), V(alidate)
```

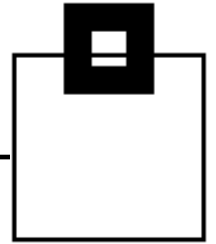
```
Select the Scenario for HSC
```

```
SCENARIO T DESCRIPTION
```

```
-----  
_ BREWLMB3 U TEST OF WLM CHANGES - SCENARIO BASED ON DEFAFDB3  
_ DEFAISA3 D ISOL FR/DISCON UCAT/AUTO DB2 STRT/SYS MAN WKDB/ONL+OFFL COPY  
_ WDACINIT U CUSTOMIZED CLONING SCENARIO FOR NON-EXISTING TARGET (INIT)  
_ WTCAFDA3 U DISCONN UCAT/AUTO DB2 START/SYS MANAGED WKDB/ONL+OFFL COPY/RTDX  
_ XEFAFDB3 V NO DISCONN UCAT/AUTO DB2 STRT/SYS MANAGED WKDB/ONL+OFFL COPY  
-----
```

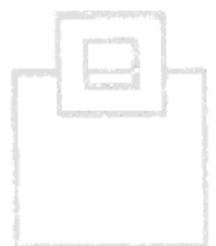
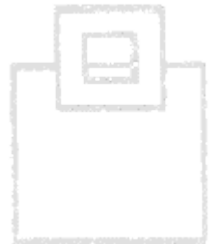


Duplication of Subsystems

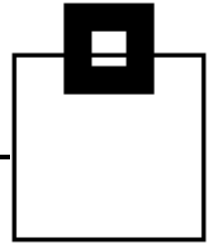


XML scenario framework of the **HSC** process

```
VIEW SE.RDB2VNEX.SCENARIO(DEFAISA3) - 01.25          Columns 00001 00072
Command ==>                                         Scroll ==> CSR
***** ***** Top of Data ***** *****
000001 <?xml version="1.0" encoding="ibm-1140" standalone="yes"?>
000002 <scenario name="DEFAISA3" prod="HSC" type="DEF" opt0="">
000003 <description short=
000004 "Isol FR/DISCON UCAT/Auto DB2 Strt/Sys man WKDB/Onl+Offl Copy ">
000017 </description>
000018 <menu>
000019 <menuitem>
000020 <name>Select DB2</name>
000021 <description>Select source</description>
000022 </menuitem>
000023 <menuitem>
000024 <name>Select DB2</name>
000025 <description>Select target</description>
000026 </menuitem>
000027 <menuitem>
000028 <name>Prepare</name>
000029 <description>Define datasets</description>
000030 </menuitem>
000035 <menuitem>
000036 <name>Build samples</name>
```

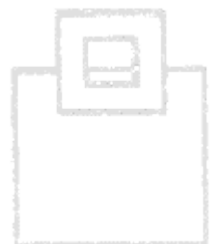


Duplication of Subsystems

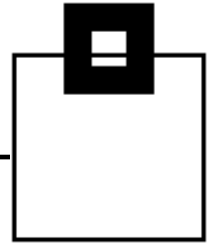


Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Scenario Control Menu -----  
Command ==> _____  
MENU=ON SCENARIO=DEFAISA3 SOURCE=N/A TARGET=N/A ONLINE COPY  
EXTERNAL FRENAME - EXISTING TARGET - INTERSYSTEM SCENARIO (TARGET BASED)  
  
Execute options 1 through 16 in sequence by pressing ENTER.  
Enter M to switch between menu display ON or OFF.  
  
Press ENTER to proceed with Select DB2  
  
==> 1. Select DB2           - Select source  
     2. Select DB2         - Select target  
     3. Prepare            - Define datasets  
     4. Build samples      - Generate sample input for new DB2s  
     5. Set environment    - General cloning options and sources  
     6. Validate variables - Check customer variables  
     7. Validate datasets  - Check installation specific datasets  
     8. Gather information - Get all needed information  
     9. Stop DB2 and XCF job - Stop target DB2, FORCE XCF connections  
    10. Customer dialog    - Site specific restore/rename dialog
```



Duplication of Subsystems



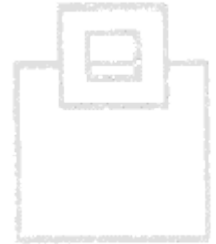
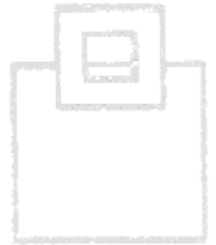
Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- SOURCE Selection ----- Row 1 from 30
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=DEFAISA3 SOURCE=UNSELECTED TARGET=UNSELECTED

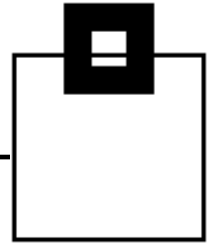
Primary cmd: L(ocate DB2)
Line      cmd: S(elect)

Select the SOURCE system for HSC:

  DB2  DESCRIPTION
  ----  -
_ CXA  HSC test system V10 NON DS
_ DB10 DB2 11 non-datasharing
_ DC10 DB2 12 non-datasharing
_ HXG  HSC test system V10 (2 way DS)
_ JXG  HSC test system V11 (3 way DS)
_ LXA  HSC test system NON DS
_ MXG  HSC test system V10 (2 way DS)
_ M9G  HSC test system (2 way DS)
_ QA1B DB2 10 non-datasharing
_ QB1A DB2 11 non-datasharing
_ QB1B DB2 11 non-datasharing
***** Bottom of data *****
```



Duplication of Subsystems



Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Renaming Parameters ----- Top of data
Command ==> _____ Scroll ==> CSR
SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A ONLINE COPY - TEST MODE
EXTERNAL FRENAME - EXISTING TARGET - SHARED DASD SCENARIO
Cloning will be done according to following settings for renaming. They can
be changed for this cloning process by typing in other or new values. Values
marked with (*) may be entered generically using '*' or '%' as wildcards.

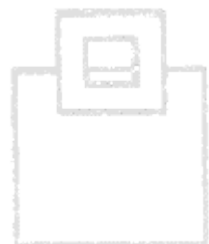
==> Scroll down to check all values! Press HELP for more information.

Confirm settings and press ENTER to continue. CONFIRM: N - Y(es)/N(o)
More: +

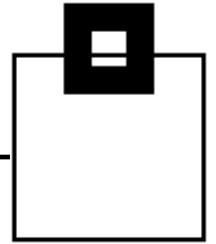
Fast rename is executed with 6 parallel tasks.

Fast rename backup feature is using:
  PO library      : _____
  PS DSN prefix: SETEST.QB1B.DEFAISA3.QA1BQB1A   Work unit: SYSALLDA

Datasets will be renamed as follows:
  From      : QA1B.** (*)
  To        : QB1A.** (*)
  From      : _____ (*)
  To        : _____ (*)
```



Duplication of Subsystems



Screen Flow of the **HSC** process

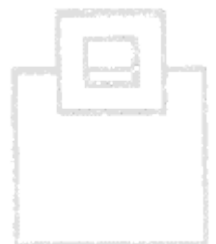
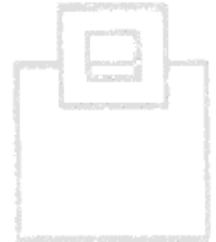
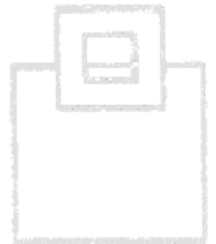
```
Homogeneous System Copy ----- Renaming Parameters ----- Top of data
Command ==> _____ Scroll ==> CSR
SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A ONLINE COPY - TEST MODE
EXTERNAL FRENAME - EXISTING TARGET - SHARED DASD SCENARIO
Cloning will be done according to following settings for renaming. They can
be changed for this cloning process by typing in other or new values. Values
marked with (*) may be entered generically using '*' or '%' as wildcards.

==> Scroll down to check all values! Press HELP for more information.

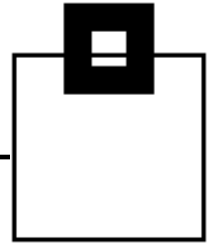
Confirm settings and press ENTER to continue. CONFIRM: N - Y(es)/N(o)
More: - +

WLM environment of routines will be renamed as follows:
From : WLMQA1B (*)
To : WLMQB1A (*)

Renaming is executed on following volumes or storage groups:
Volume lists: SE* (*) Storage groups : _____
              _____ (*) Storage groups : _____
              _____ (*) Storage groups : _____
              _____ (*) Storage groups : _____
              _____ (*) Storage groups : _____
```



Duplication of Subsystems



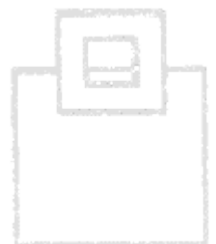
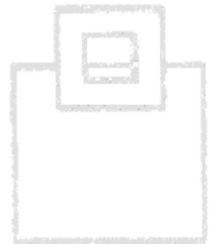
Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Renaming Parameters ----- Top of data
Command ==> _____ Scroll ==> CSR
SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A ONLINE COPY - TEST MODE
EXTERNAL FRENAME - EXISTING TARGET - SHARED DASD SCENARIO
Cloning will be done according to following settings for renaming. They can
be changed for this cloning process by typing in other or new values. Values
marked with (*) may be entered generically using '*' or '%' as wildcards.

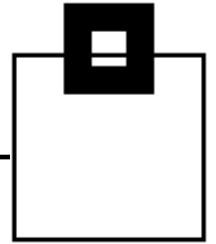
==> Scroll down to check all values! Press HELP for more information.

Confirm settings and press ENTER to continue. CONFIRM: N - Y(es)/N(o)
More: - +

ICF user catalogs for DB2 and their aliases will be renamed as follows:
  1. From      : USERCAT.DB2.QA1B
     To        : USERCAT.DB2.QB1A
     Aliases for 1. user catalog (DS qualifiers):
         From : QA1B           From : _____
         To   : QB1A           To   : _____
  2. From      : _____
     To        : _____
     Aliases for 2. user catalog (DS qualifiers):
         From : _____       From : _____
         To   : _____       To   : _____
  3. From      : _____
     To        : _____
     Aliases for 3. user catalog (DS qualifiers):
         From : _____       From : _____
         To   : _____       To   : _____
```



Duplication of Subsystems



Screen Flow of the **HSC** process

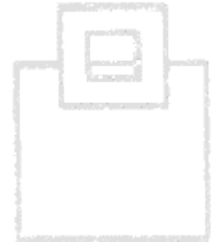
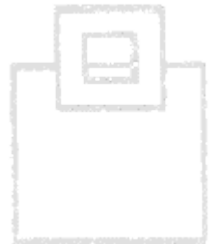
```
Homogeneous System Copy ----- Renaming Parameters ----- Top of data
Command ==> _____ Scroll ==> CSR
SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A ONLINE COPY - TEST MODE
EXTERNAL FRENAME - EXISTING TARGET - SHARED DASD SCENARIO
Cloning will be done according to following settings for renaming. They can
be changed for this cloning process by typing in other or new values. Values
marked with (*) may be entered generically using '*' or '%' as wildcards.

==> Scroll down to check all values! Press HELP for more information.

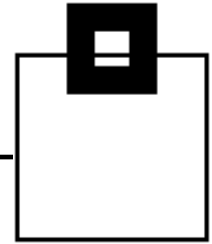
Confirm settings and press ENTER to continue. CONFIRM: N - Y(es)/N(o)
More: - +

Volume ids will be renamed in VVDS and catalog as follows:
From : QA1B* (*) To : QB1A* (*)
From : _____ (*) To : _____ (*)
From : _____ (*) To : _____ (*)
From : _____ (*) To : _____ (*)
From : _____ (*) To : _____ (*)

SMS data classes will be renamed in VVDS and catalog as follows:
From : _____ (*) To : _____ (*)
From : _____ (*) To : _____ (*)
From : _____ (*) To : _____ (*)
```



Duplication of Subsystems



Screen Flow of the **HSC** process

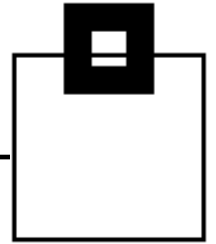
```
Homogeneous System Copy ----- Job Submit List ----- Job 00001 of 00023
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A AUTO=002

Primary cmd: SUB(mit), AUTO, J(ob status), G(et failed job), EXIT
Line      cmd: V(iew), E(dit), R(eset status), F(inished)

Member  Prompt      Size  Created      StatusTime      Status
-----  -
INIT0001 123  2015/09/07  2015/09/07 14:07:34  CC=0004
INIT0002 120  2015/09/07  2015/09/07 14:07:34  CC=0004
INIT0003  87  2015/09/07  2015/09/07 14:07:41  CC=0000
INIT0004 153  2015/09/07  2015/09/07 14:07:57  CC=0000
INIT0005  85  2015/09/07  2015/09/07 14:07:42  CC=0000
INIT0006 204  2015/09/07  2015/09/07 14:04:55  WAIT#01
INIT0007 117  2015/09/07  2015/09/07 14:08:12  CC=0000
INIT0008  58  2015/09/07  2015/09/07 14:07:59  CC=0000
INIT0009 101  2015/09/07  2015/09/07 14:08:03  CC=0000
INIT0010  73  2015/09/07  2015/09/07 14:04:58  WAIT#01
INIT0011  89  2015/09/07  2015/09/07 14:04:58  WAIT#01
INIT0012 102  2015/09/07  2015/09/07 14:04:59  WAIT#01
INIT0013  85  2015/09/07  2015/09/07 14:05:00  WAIT#02
INIT0014  84  2015/09/07  2015/09/07 14:08:05  CC=0000
INIT0015  80  2015/09/07  2015/09/07 14:08:07  CC=0000
```

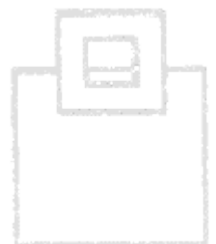
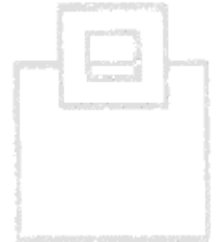
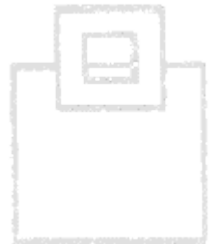


Duplication of Subsystems

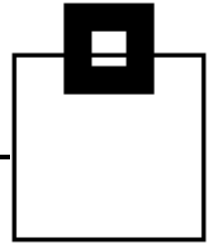


Screen Flow of the **HSC** process

```
Homogeneous System Copy ----- Scenario Control Menu -----  
Command ==> _____  
MENU=ON SCENARIO=DEFAISA3 SOURCE=QA1B TARGET=QB1A ONLINE COPY - TEST MODE  
EXTERNAL FRENAME - EXISTING TARGET - SHARED DASD SCENARIO  
  
Execute options 1 through 16 in sequence by pressing ENTER.  
Enter M to switch between menu display ON or OFF.  
  
Press ENTER to proceed with Customer dialog  
  
DONE    7. Validate datasets      - Check installation specific datasets  
DONE    8. Gather information      - Get all needed information  
DONE    9. Stop DB2 and XCF job    - Stop target DB2, FORCE XCF connections  
==>   10. Customer dialog         - Site specific restore/rename dialog  
        11. Rename adjustments     - Additional renaming tasks  
        12. DSNZPARM+DSNHDECP      - Assemble and linkedit  
        13. Start DB2/ACC MAINT     - Start DB2 AM/VCAT SWITCH/Work DB  
        14. Final processing        - Start DB2/Bufferpools/WLM settings  
        15. Cleanup                 - Delete work files  
        16. Finished                - Cloning completed
```



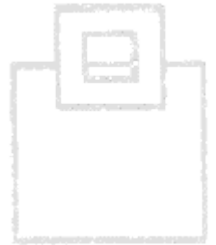
To Clone or not to Clone?



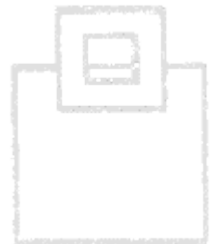
How to achieve those benefits (...continued)?

Merge/Duplication of systems/data

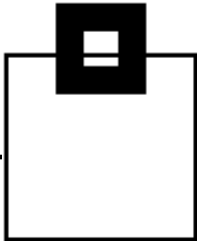
- Consolidation of Systems (Mergers & Acquisitions)
- Separation of test data, applications or business units



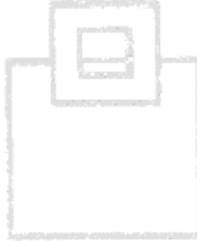
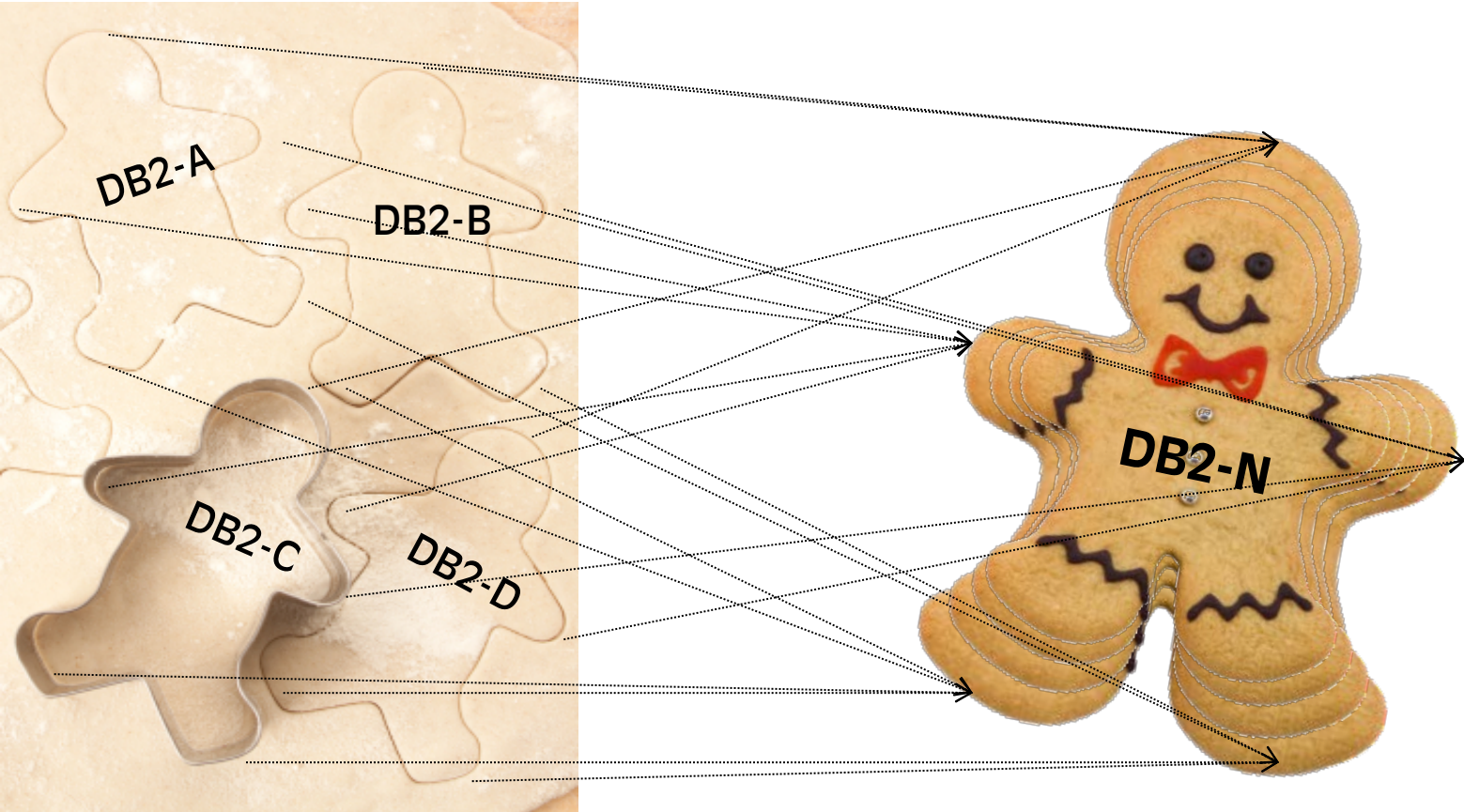
Refresh of an entire system or parts of it



The various ways / flavors of Cloning

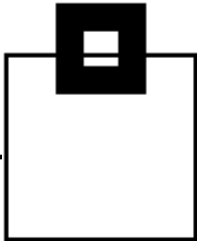
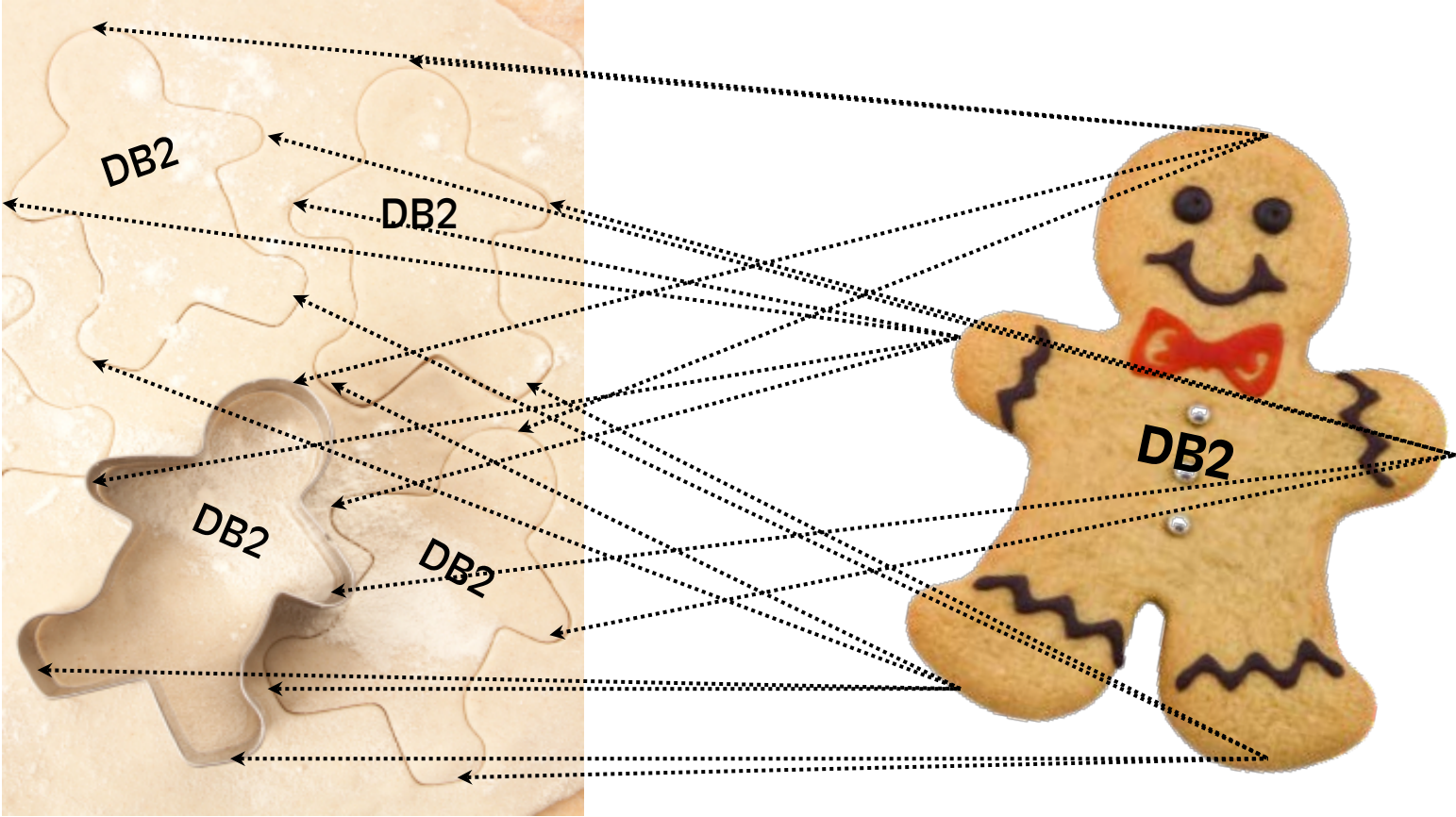


Merge of systems/data

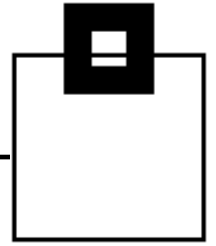


The various ways/flavors of Cloning

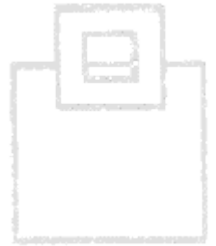
Duplication of systems/data



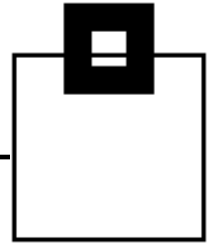
The various ways / flavors of Cloning



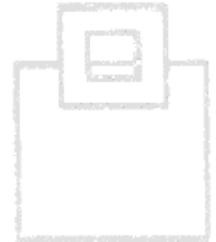
Refresh Cloning



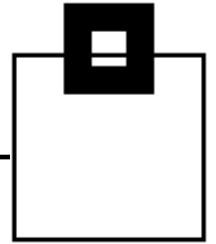
The various ways of Cloning



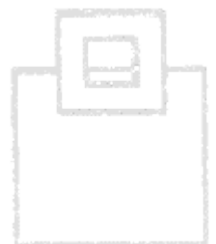
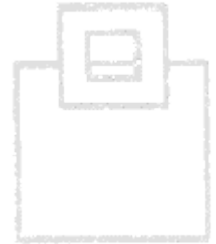
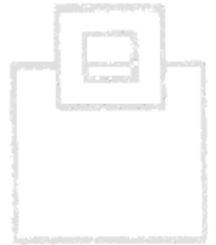
- Merge/Duplication of systems/data
- Refresh of an entire system or parts of it
 - Details about Source and Target
 - Scope of Cloning
 - Required Steps
 - Gotchas to watch out for



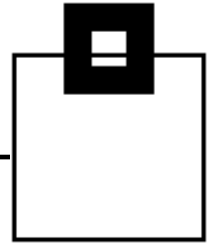
Merge/Duplication of systems/data



- Details about Source and Target
 - All or parts of data from a system is duplicated
 - Including/Excluding objects
 - Source and target can be different or the same
 - Applying conversion allows to clone objects (e.g. DB) in one and the same DB2 subsystem
 - Existing objects may only want to be refreshed
 - Catalog statistics may want to be considered to have the optimizer pick the same access path
- Homogeneous Object Cloning (aka. HOC)



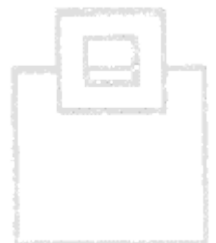
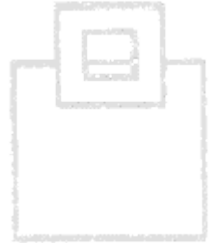
Merge/Duplication of systems/data



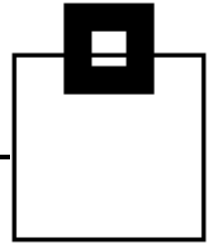
Scope of Cloning

We are talking about *database* object cloning. This usually doesn't include the DB2 subsystem /data sharing groups

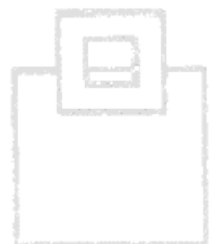
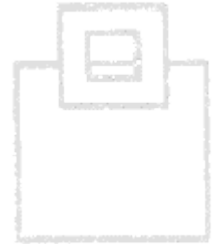
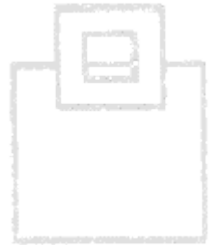
- Catalog and Directory
- Any other DB2 subsystem specific parts



Merge/Duplication of systems/data

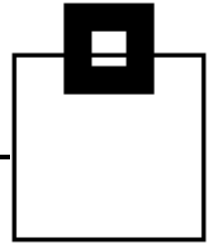


- Required steps
 - Define scope of objects
 - Determine depending objects like indexes, views, authorization, ... if desired
 - Extract DDL for resulting source objects
 - Extract data from resulting source objects
 - Extract statistics of selected objects
 - Apply naming conversion if desired
 - Run DDL on target
 - Load data on target objects

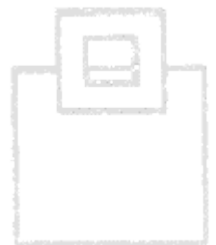
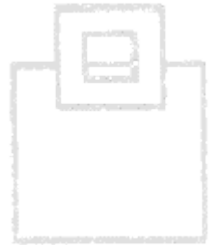


Note: Refresh only requires the data

Merge/Duplication of systems/data

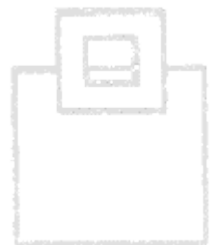
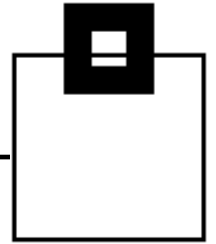


- Gotchas to watch out for
 - Don't burn time and resources
 - If you have the appropriate storage features, use them!
 - Instant copies (like Flashcopy2) can clone your TB-sized source objects in a fraction of time
 - Instant copies (like Flashcopy2) don't burn CPU
 - DB2 supports Flashcopy2 for ONLINE CHECK INDEX maybe for copies one day, too ;-)

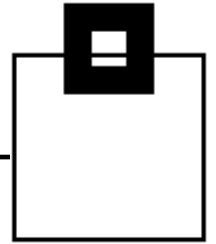


Merge/Duplication of systems/data

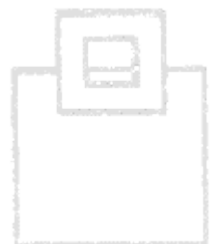
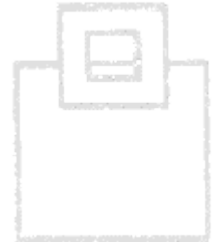
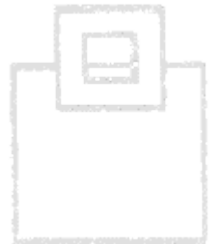
- Gotchas to watch out for
 - Be careful with Sequences
 - Manage them correctly
 - Be careful with XML (This is not supported by DSN1COPY)
 - Use the cross loader for XML (supported since DB2 11)
 - Be careful with availability
 - Use DB2 Clone Tables



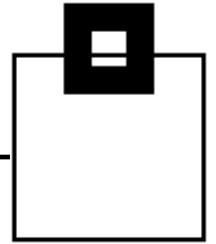
Merge/Duplication of systems/data



- Gotchas to watch out for
 - Be careful with user defined objects
 - DEFINE CLUSTER
 - Be careful with Multi linear datasets in both directions
 - Multi on source – single on target
 - Single on source and multi on target
 - or even multi on source and multi on target but different number of used datasets
 - Delete all non-used data sets to avoid later problems
 - Make sure to extract statistics consistently

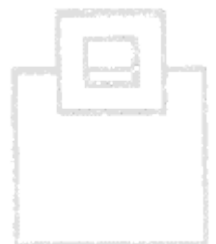
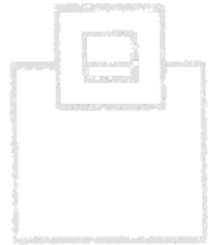


Merge/Duplication of systems/data

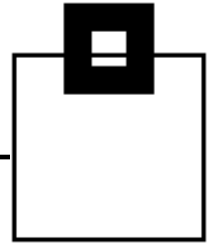


Bottom Line

- Cloning DB2 objects isn't rocket science, but there are some specialities to take care of
- Familiarize yourself with these procedures and define an easy to use step by step guide.
- Tools that supervise, manage and optimize cloning lead to
 - More flexibility
 - Higher degree of automation
 - Exploitation of latest storage technology and DB2 features
 - Highest efficiency

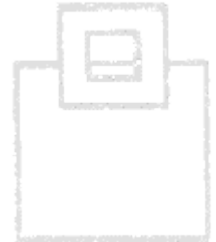
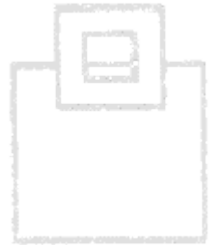


Merge/Duplication of systems/data

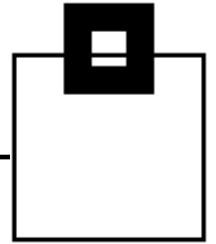


What you should cover for sure

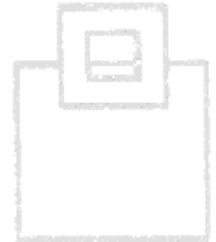
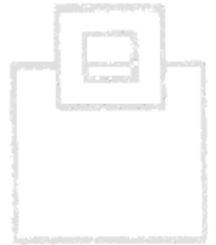
- DDL processing
 - Pimp up DSNTIAD
- Object/Dataset names – If on the same “system” duplicates
 - allow flexible renaming and wildcard support
- Complex dependencies and structures
 - e.g. optionally support dependencies
- User defined objects and multi linear datasets
 - Take care of dataset level management



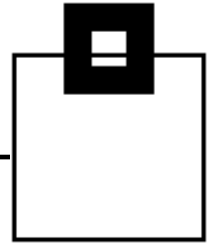
Merge/Duplication of systems/data



- What you should cover for sure
 - Support and exploit storage subsystem instant copies like
 - Flashcopy2
 - Support DB2 copies and DSN1COPY
 - DSN1COPY job generation with the appropriate OBIDXLAT option to translate the object IDs.
 - Take care of
 - “normal” DDL
 - Stogroups
 - Sequences
- Basically anything valid up to DB2 11



Merge/Duplication of systems/data



Split object, data and statistics cloning

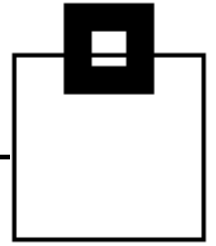
Copy DDL and/or data only using one of the methods below

- Extract object data from source and generate DDL to run on target DB2
- Data Copy using DSN1COPY based on Copies or VSAM DB2 Cluster
- Extract and apply catalog statistics
- Refresh via DB2 Clone Tables for High Availability



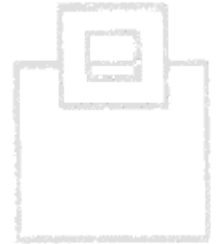
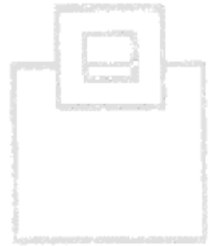
→ One standardized, central solution for your cloning needs



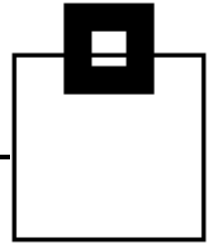


Merge/Duplication of systems/data

And now a quick walk through the process



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

```
RecoveryCenter for DB2 z/OS ----- Main Selection ----- VM 0420  
Command ==> _____ PTF_13002
```

```
Primary cmd: A(bout)
```

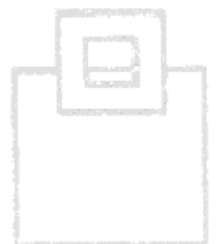
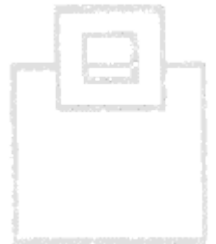
```
Select one of the following. Then press ENTER.
```

- 1. PARAMETERS - Define global parameters
- 2. DB2 - Define DB2 subsystem/group

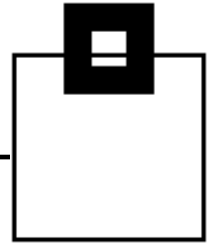
- 3. RAX - Execute Recovery Assurance Expert
- 4. PIT RECOVERY - Execute a Point in Time Recovery
- 5. HSC - Execute a Homogeneous System Copy
- 6. HOC - Execute Homogeneous Object Cloning
- G. GEN FDB2 JCL - Generate JCL for fast rename jobs

- T. TUTORIAL - Using RecoveryCenter for DB2 z/OS
- X. EXIT - Exit RecoveryCenter for DB2 z/OS

```
(c) Copyright SOFTWARE ENGINEERING GMBH 2005-2015 . All rights reserved.
```



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Homogeneous Object Cloning Settings -----
Command ==> _____ Scroll ==> CSR

The following settings determine, which job steps will be included
during HOC scenario execution.

Confirm settings and press ENTER to continue.      CONFIRM: N - Y(es)/N(o)
Press HELP for more information.

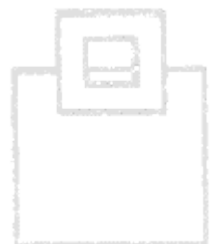
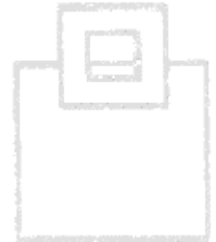
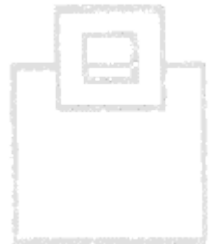
Test mode (check job generation, only)             : N - Y(es)/N(o)

Copy method (VSAM/FC2/COPY/NONE)                   : FC2

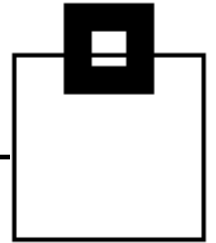
Intersystem cloning                                : T - N(o ISC)
                                                    S(ource based)
                                                    T(arget based)

Execute DROP DATABASE statements on target          : Y - Y(es)/N(o)
Execute DROP ALIAS statements on target             : Y - Y(es)/N(o)
Execute CREATE STOGROUP statements on target        : N - Y(es)/N(o)
Execute CREATE SEQUENCE statements on target        : N - Y(es)/N(o)
Generate ALTER TABLE ADD PART and TRUNCATE
statements for PBGs with source/target differences : Y - Y(es)/N(o)

Transfer source statistics to target                : N - Y(es)/N(o)
```



Merge/Duplication of systems/data



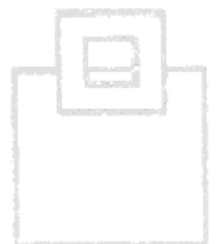
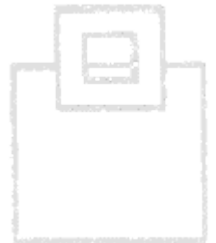
Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Scenario Selection ----- Row 1 to 1 of 1
Command ==> _____ Scroll ==> CSR

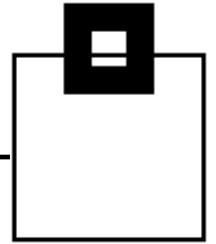
Primary cmd: L(ocate SCENARIO)
Line      cmd: S(elect), I(nfo), E(dit), C(reate), D(elete), V(alidate)

Select the Scenario for HOC

SCENARIO T DESCRIPTION
-----
_ HOCSCFC2 O HOC COMPLETE CLONE USING FLASHCOPY2 AND STATISTICS TRANSFER
-----
```



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Scenario Control Menu -----
```

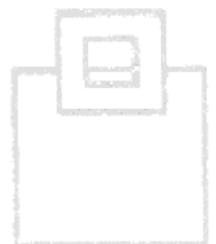
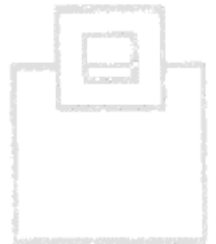
```
Command ==>
```

```
MENU=ON SCENARIO=HOCSCFC2 SOURCE=N/A TARGET=N/A  
- INTERSYSTEM SCENARIO (TARGET BASED)
```

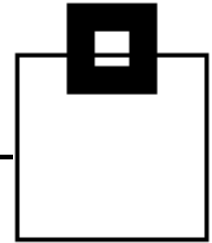
```
Execute options 1 through 18 in sequence by pressing ENTER.  
Enter M to switch between menu display ON or OFF.
```

```
Press ENTER to proceed with Select DB2
```

- | | | |
|-----|---------------------------|--|
| ==> | 1. Select DB2 | - Select source |
| | 2. Select DB2 | - Select target |
| | 3. Prepare | - Define datasets |
| | 4. User settings | - Define control and selection parms |
| | 5. Set version | - Determine DB2 version for SRC and TGT |
| | 6. Generate DDL and stats | - Run DDL and stats generation on source |
| | 7. Create DDL and stats | - Run DDL on target and insert stats |
| | 8. Prepare PBG adaptation | - Run job HOCPARMA |
| | 9. Process PBGs | - Adapt partition count for PBGs |
| | 10. Create DSN1COPY jobs | - Generate DSN1COPY jobs on target |



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

```
Homogeneous System Copy ----- SOURCE Selection ----- Row 1 from 30
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=HOCSCFC2 SOURCE=UNSELECTED TARGET=UNSELECTED
- INTERSYSTEM SCENARIO (TARGET BASED)

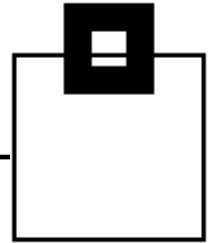
Primary cmd: L(ocate DB2)
Line      cmd: S(elect)

Select the SOURCE system for HSC:

  DB2  DESCRIPTION
  ----  -
_ CXA  HSC test system V10 NON DS
_ DB10 DB2 11 non-datasharing
_ DC10 DB2 12 non-datasharing
_ HXG  HSC test system V10 (2 way DS)
_ JXG  HSC test system V11 (3 way DS)
_ LXA  HSC test system NON DS
_ MXG  HSC test system V10 (2 way DS)
_ M9G  HSC test system (2 way DS)
_ QA1B DB2 10 non-datasharing
_ QB1A DB2 11 non-datasharing
_ QB1B DB2 11 non-datasharing
***** Bottom of data *****
```

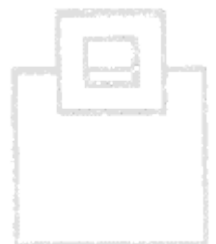
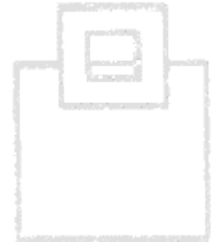


Merge/Duplication of systems/data

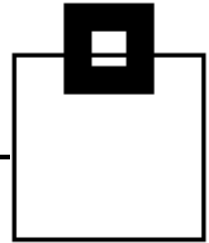


Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Collect Objects -----  
Command ==> _____  
MENU=ON SCENARIO=HOCSCFC2 SOURCE=QA1B TARGET=QB1A  
- INTERSYSTEM SCENARIO (TARGET BASED)  
  
Primary cmd : END, +(ADD), S(how), RES(et), Z(oom)  
  
OBJECT TYPE : T      A(lias)           R(Tablespace)  
              D(atabase)       S(ynonym)  
              G(lobal temporary table) T(able)  
              I(ndex)           V(iew)  
              M(aterialized query table) X(Auxiliary table)  
  
CREATOR      : * _____  
  
NAME         : * _____  
  
Notes: Wildcards '*' and '?' are allowed.  
Enter qualifier or creator in creator field.  
For database leave the creator field blank.
```



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

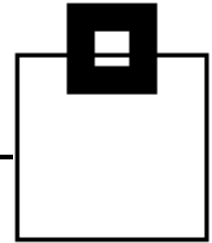
```
Homogeneous Object Clone ----- Table Overview ----- Table 200 from 250
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=HOCSCFC2 SOURCE=QA1B TARGET=QB1A
- INTERSYSTEM SCENARIO (TARGET BASED)

Primary cmd: END, CAN(cel), Z(oom), +(Add All), L(ocate) creator
Line cmd: C(olumns), A(liases), D(atabase), T(ablespace), I(ndexes),
          L(CoLdist), P(artitions), S(ynonyms), Z(oom), +(Add)

  Creator +   Name +           Database Tablespace Statstime +
  -----
_ DSNACC     EXCEPT_TBL      DSN00238 EXCEPTRT  2015-07-14-08.49.41
_ DSNRGCOL   DSN_REGISTER_APPL DSNRGFDB DSNRGFTS    2015-07-14-08.52.20
_ DSNRGCOL   DSN_REGISTER_OBJT DSNRGFDB DSNRGFTS    2015-07-14-08.52.20
_ DSN8A10    TRACE_DESCRIPTIONS DSN00233 TRACERDE   2015-07-14-08.49.40
_ DSN8A10    TRACE_TYPES       DSN00234 TRACERTY   2015-03-25-09.26.57
_ DSN8BQRY   DSN_USERQUERY_TABL DSNADMDB DSNQRYTS    2015-07-14-08.50.09
_ DSN8BQRY   PLAN_TABLE        DSNADMDB DSNPLNTS    2015-07-14-08.50.08
+ DSN81010   ACT               DSN8D10A DSN8S10P    2015-07-14-13.20.49
+ DSN81010   CATALOG           DSN8D10X DSN8S10X    2015-07-14-08.50.02
+ DSN81010   CUSTOMER          DSN8D10X DSN8S10X    2015-07-14-08.50.02
+ DSN81010   DEPT              DSN8D10A DSN8S10D    2015-07-14-13.20.48
+ DSN81010   DSN_STATEMENT_CACH DSN8D10A DSN8S10X    2015-07-14-08.49.57
```



Merge/Duplication of systems/data



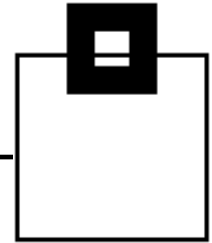
Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Object Table ----- Row 1 to 5 of 21
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=HOCSCFC2 SOURCE=QA1B TARGET=QB1A
- INTERSYSTEM SCENARIO (TARGET BASED)

Primary cmd: END, CAN(cel), R(eset)
Line      cmd: D(etele)
  SSID Creator / Database          Name
  Type Ix / Co Creator            Ix / Co Name
  Created by
-----
- QA1B DSN81010                   ACT
  T   BOXWELL
-----
- QA1B DSN81010                   CATALOG
  T   BOXWELL
-----
- QA1B DSN81010                   CUSTOMER
  T   BOXWELL
-----
- QA1B DSN81010                   DEPT
  T   BOXWELL
-----
- QA1B DSN81010                   DSN_STATEMENT_CACHE_TABLE
```



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

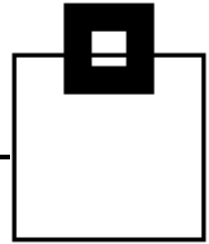
```
Homogeneous Object Clone ----- Job Submit List ----- Job 00001 of 00004
Command ==> _____ Scroll ==> CSR
MENU=ON SCENARIO=HOCSCFC2 SOURCE=QA1B TARGET=QA1B AUTO=OFF
- INTERSYSTEM SCENARIO (TARGET BASED)

Primary cmd: SUB(mit), AUTO, J(ob status), G(et failed job), EXIT
Line cmd: V(iew), E(dit), R(eset status), F(inished)

Member Prompt Size Created StatusTime Status
-----
HOCE0001 72 2015/09/07 2015/09/07 11:12:52 GENERAT
HOCE0002 59 2015/09/07 2015/09/07 11:12:53 WAIT#01
HOCE0003 71 2015/09/07 2015/09/07 11:12:54 WAIT#02
HOCE0004 69 2015/09/07 2015/09/07 11:12:54 WAIT#03
**End**
```



Merge/Duplication of systems/data



Screen Flow of the **HOC** process

```
Homogeneous Object Clone ----- Scenario Control Menu -----
```

```
Command ==>
```

```
MENU=ON SCENARIO=HOCSCFC2 SOURCE=QA1B TARGET=QA1B  
- INTERSYSTEM SCENARIO (TARGET BASED)
```

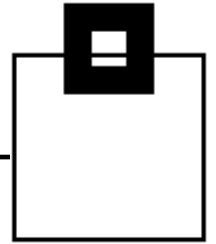
```
Execute options 1 through 18 in sequence by pressing ENTER.  
Enter M to switch between menu display ON or OFF.
```

```
Press ENTER to proceed with Prepare Copy on Source
```

```
DONE 8. Prepare PBG adaptation - Run job HOCPARMA  
DONE 9. Process PBGs - Adapt partition count for PBGs  
DONE 10. Create DSN1COPY jobs - Generate DSN1COPY jobs on target  
==> 11. Prepare Copy on Source - Execute Flashcopy2 jobs  
12. Execute Copy on target - Execute DSN1COPY jobs on target  
13. Zombie - Execute zombie detection  
14. Repair - Execute REPAIR jobs  
15. Rebuild - Execute REBUILD INDEX jobs  
16. Prepare ALTER SEQUENCES - Edit ALTER SEQUENCES SQL file  
17. Cleanup - Delete work files
```

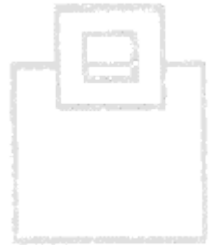


Conclusion



How to serve different needs of cloning?

- **Split DB2 z/OS homogeneous cloning into two areas:**



- **1st HSC**

- Duplication of subsystem (Homogenous System Copy)

- **2nd HOC**

- Merge/Duplication of systems/data

- Refresh of an entire system or parts of it
(Homogenous Object Copy)



Summary

- Cloning is a powerful way to duplicate data, or entire subsystems for multiple purposes
- It's important to understand what's required and choose the right scenario
- Exploiting instant copy technology can speed up cloning significantly
- Setting up standard procedures increases the degree of automation and makes the complex scenarios less error-prone

