Cloning - What's new and faster?

SOURCE   TARGET
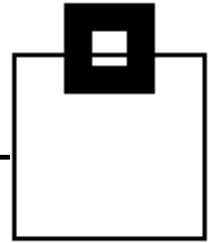
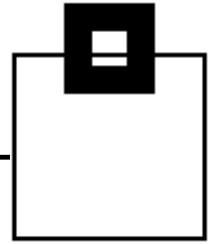DB2 z/OS Database cloning
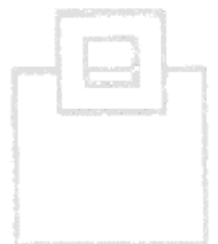
Agenda/Content to be addressed
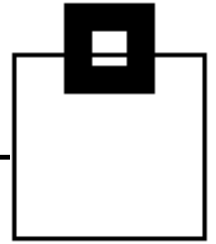
- **Cloning basics**
  - What type of cloning is the right choice for a given requirement?
  - What are the gotchas and where are the shortcuts?
  - What to take care of – beyond DB2?
- **Cloning details**
  - XML scenario definition – the sky is the limit!
  - Naming conversion – how do you want to 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
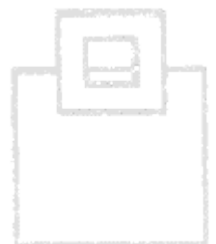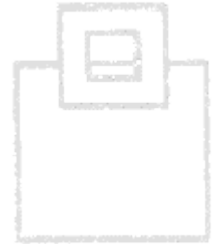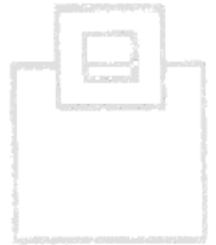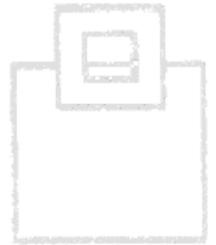
To Clone or not to Clone?

- 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)
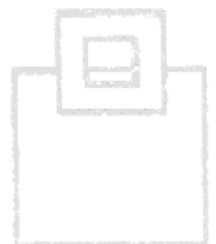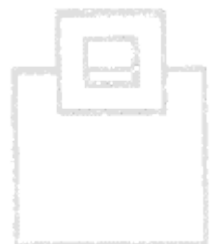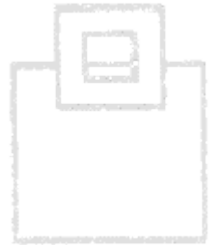
To Clone or not to Clone?

- 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
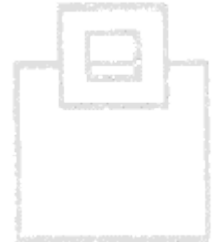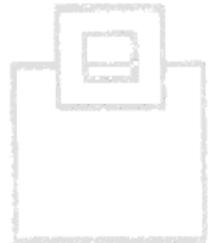
To Clone or not to Clone?

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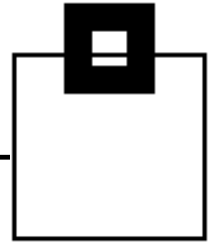 - Duplication of subsystems
    - For (DR) Test and Quality Assurance (QA)
    - For Backup
    - For new Subsystem creation
    - For Audit, Reporting and Data Mining
    - Demo and training

The various ways/flavors of Cloning

Duplication of Subsystems
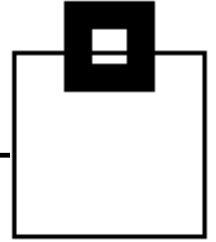
Data Sharing x members

Data Sharing y members

V10
SOURCE

V11
TARGET

Non-Data Sharing

Non-Data Sharing

Non-Data Sharing

Data Sharing

Data Sharing

Data Sharing
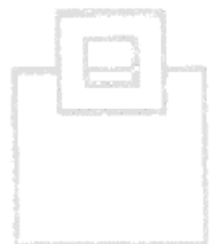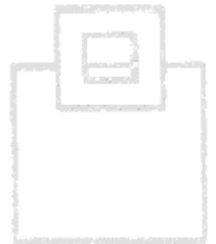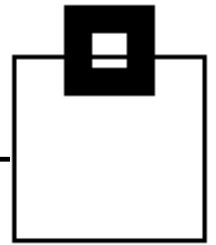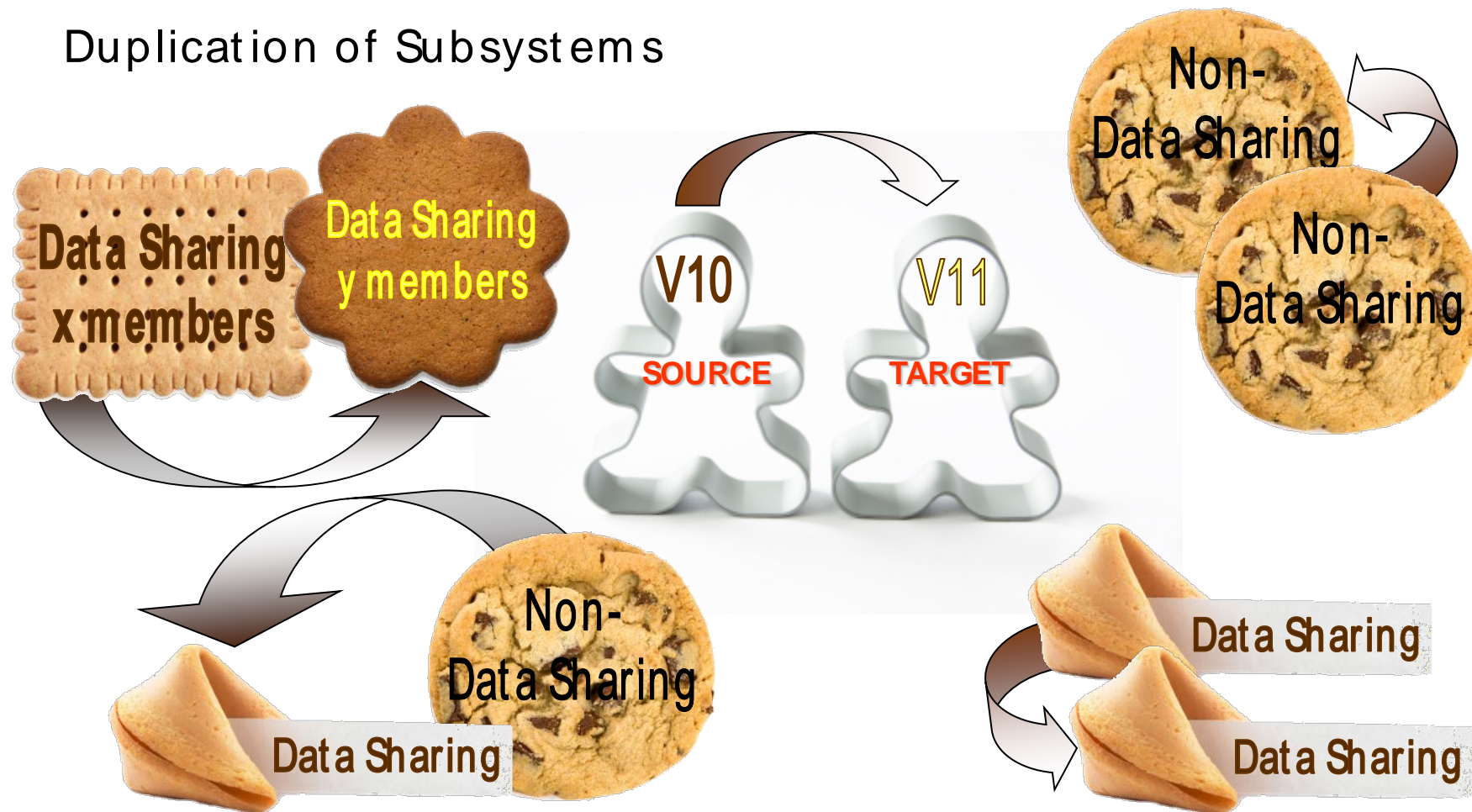
The various ways of Cloning

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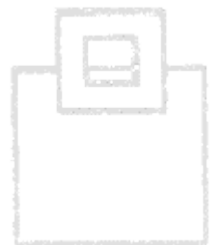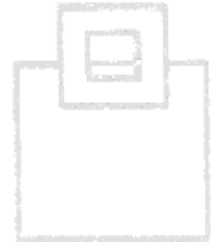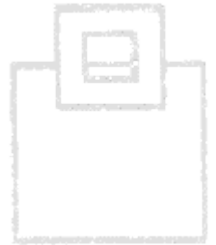
Duplication of Subsystems

- 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
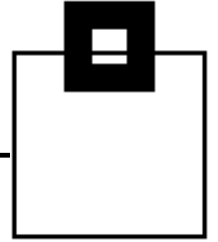
Scope of Cloning

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
- …
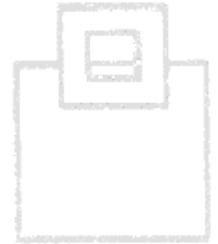
You may want to talk to your systems/operations colleagues.
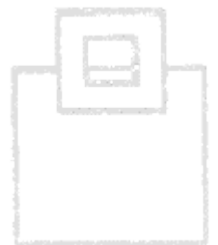
Duplication of Subsystems
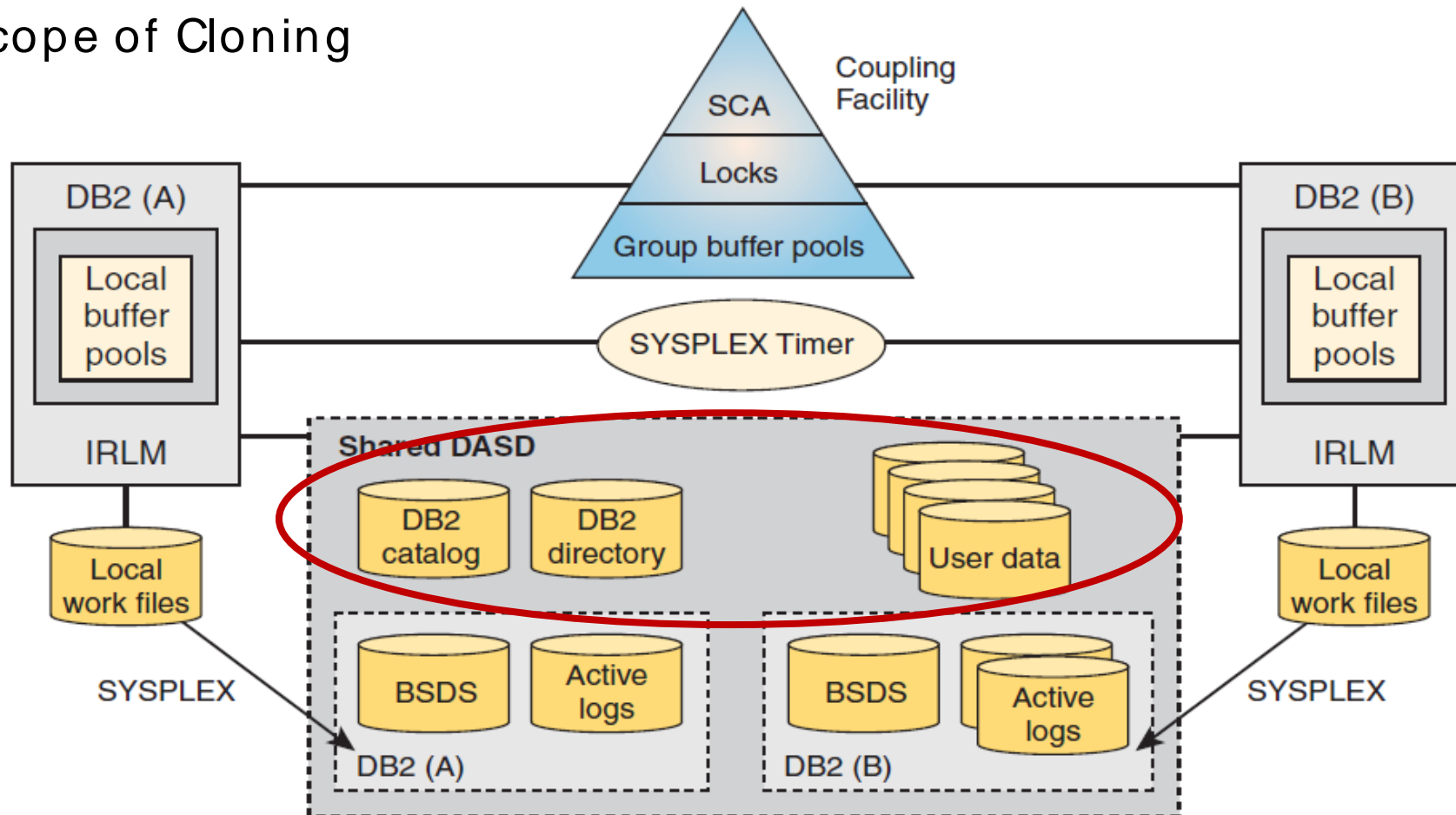
Scope of Cloning

The various ways of Cloning

Scope of Cloning

DSNDB01

Application Indexspaces

DSNDB06

Application Tablespaces

DSNDB04

ICF* Catalogs

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

Active LOGs

Archive LOGs

BSDSs
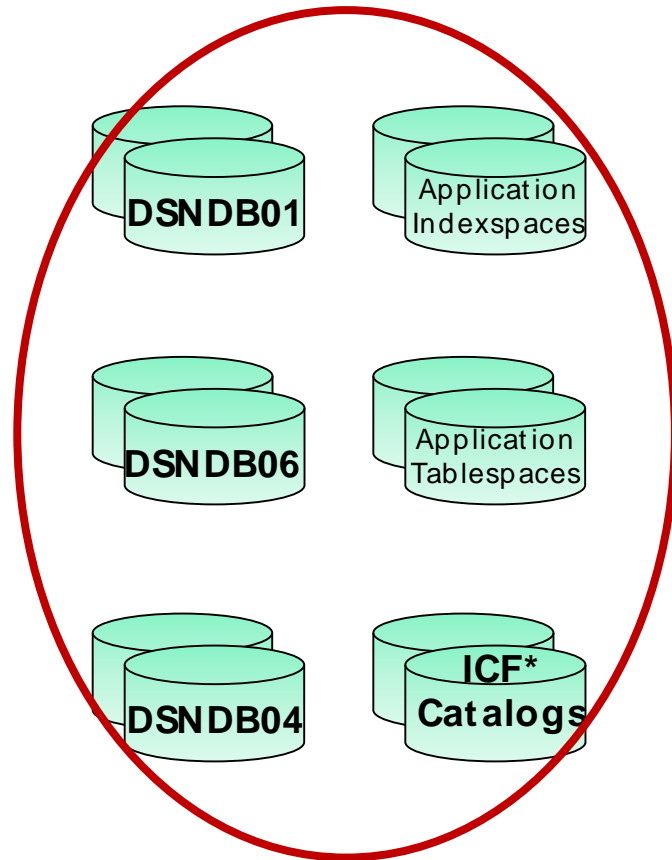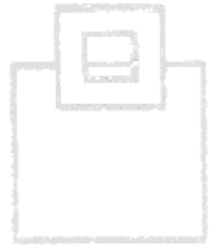
ICF* Catalogs

Optional:
Including DB2 Load Libraries allows cross-version cloning

Load Libraries
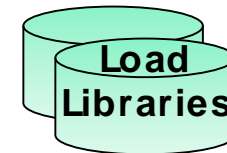
* Working on the volume level requires inclusion of ICF catalogs
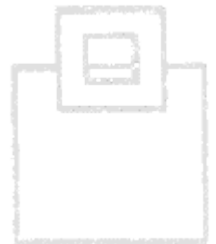
Duplication of Subsystems

- 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 introduces NEWCAT)

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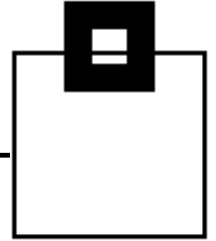
- Gotchas to watch out for
  - Don't burn time and resources
    - If you have the appropriate storage features, use them!
      - Instant copies (like Flashcopy) can clone your TB-sized source system in a fraction of time
      - Instant copies (like Flashcopy) don't burn CPU
      - Backup System assures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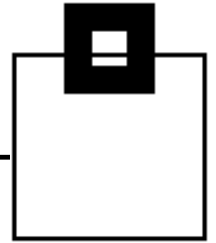
Duplication of Subsystems

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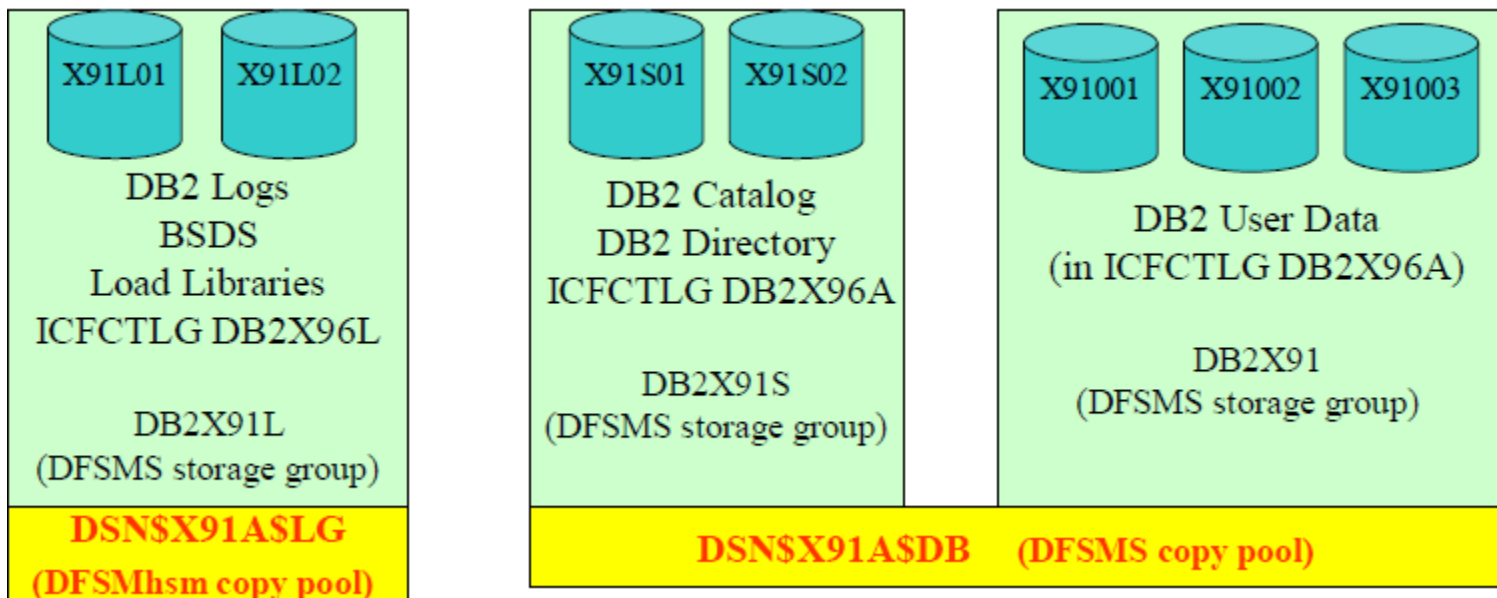
Duplication of Subsystems

- 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
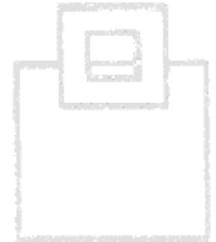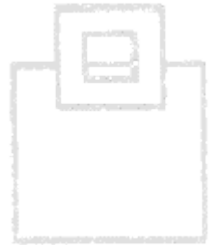
Duplication of Subsystems
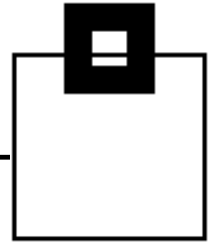
- **Bottom Line**
  - Cloning DB2 systems isn't rocket science, but a complex and error-prone process.
  - Familiarize yourself with these procedures and define an easy to use step by step guide.

- 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
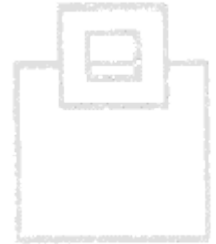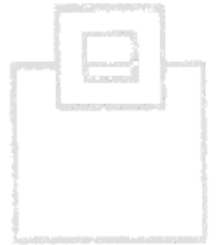
Duplication of Subsystems

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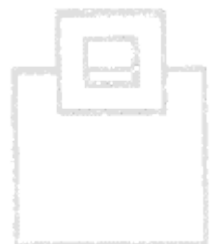
Duplication of Subsystems
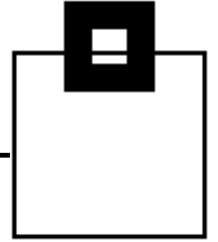
- What you should cover for sure
  - Support and exploit storage subsystem instant copies like
    - Backup systems or native
      - ESS Flashcopy
      - Timefinder
      - Snapshot
  - Assure data consistency for cloned data taken from running source systems – no source outage
  - Support rename –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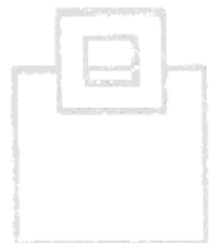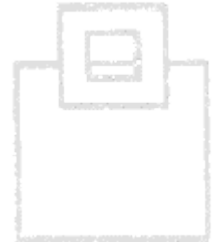
Duplication of Subsystems
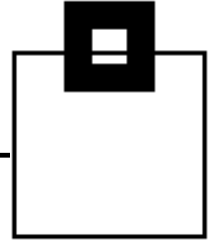
- What you should cover for sure
  - Guide and take care of the various types of cloning
    - Non data sharing to non data sharing
    - Data sharing to data sharing
    - Non data sharing to data sharing
    - Data sharing to non data sharing
    - Data sharing x members to data sharing y members

    → One standardized, central solution for your cloning needs
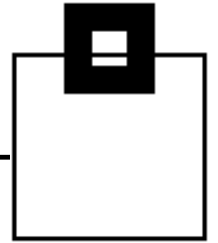
Duplication of Subsystems

And now a quick walk through the process
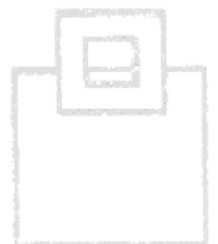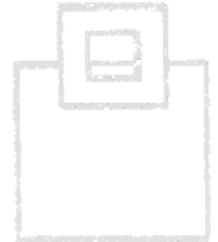
Duplication of Subsystems

Screen Flow of the HSC process

```
Homogeneous System Copy ----- Scenario Selection ------------ Row 1 to 3 of 3
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 TYPE DESCRIPTION
  -------- ---- ------------------------------------------------------------
_ DEFRFDR  D    CLONE FROM FULL VOLUME DUMP
_ DEFRFDRA D    CLONE FROM FULL VOLUME DUMP AUTOMATED
_ DEFSOFF  D    CLONE NDS WITH SOURCE DB2 OFFLINE
  -------- ---  ------------------------------------------------------------
```
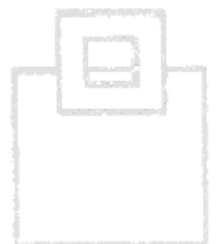
Duplication of Subsystems
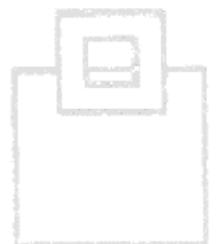
Screen Flow of the HSC process

```
Homogeneous System Copy ----- Scenario Control Menu -------------------------
Command ===> _
MENU=ON SCENARIO=DEFRFDR SOURCE=UNSELECTED TARGET=UNSELECTED

Execute options  1 through 15 in sequence.
Press ENTER to proceed with Select DB2


  ===>    1. Select DB2          - Select source
          2. Select DB2          - Select target
          3. Prepare             - Define Datasets
          4. Gather Information   - Get all needed Information
          5. Stop DB2            - Stop target DB2
          6. Restore             - Restore volumes
          7. Rename              - Rename all Datasets
          8. DSNZPARM+DSNHDECP   - Assemble and linkedit
          9. Start DB2           - START Target DB2 ACCESS(MAINT)
         10. VCAT SWITCH         - Switch VCAT for all DB2 USER DATA
```

Duplication of Subsystems

XML scenario framework of the HSC process

```
000135     <ftailor wait="02" allmemb="t"> <!-- FTOPEN -->
000136        <finclude>HSTSTOP</finclude> <!-- FTINCL -->
000137     </ftailor> <!-- FTCLOSE -->
000138  </jobsubmitlist>
000139  <force>
000140     <ftailor temp="y"> <!-- FTOPEN -->
000141        <finclude>HSCVARS</finclude> <!-- FTINCL -->
000142     </ftailor>
000143  </force>
000144  <showmenu />
000145  <jobsubmitlist prefix="CKSP">
000146     <description>Wait for STOP2 DB2</description>
000147     <ftailor> <!-- FTOPEN -->
000148        <finclude>HSTCKSP</finclude> <!-- FTINCL -->
000149     </ftailor> <!-- FTCLOSE -->
000150  </jobsubmitlist>
000151  <showmenu />
000152  <displaypanel name="HSTRSBCK" confirm="y" />
000153  <showmenu />
000154  <force>
000155     <ftailor temp="y"> <!-- FTOPEN -->
000156        <finclude>HSCVARS</finclude> <!-- FTINCL -->
000157     </ftailor>
000158  </force>
000159  <jobsubmitlist prefix="PRST">
000160     <description>Rename/Restore DB2</description>
000161     <if var="HSTENV" operator="EQ" val="D">
```
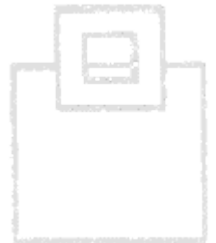
Duplication of Subsystems
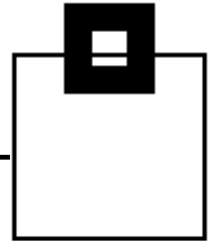
Screen Flow of the HSC process

```
Homogeneous System Copy ----- SOURCE Selection ---------------- Row 5 from 13
Command ===> _                                           Scroll ===> CSR
MENU=ON SCENARIO=DEFRFDR SOURCE=UNSELECTED TARGET=UNSELECTED

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

Select the SOURCE system for HSC:

  DB2    DESCRIPTION
  ----   -------------------------------------------------
_ DSG8   S814+S815Data Sharing
_ D81X   NDS V8
_ D91X   V9 Non Data Sharing
_ F98    F918 + F919 DTAT SHARING V9
_ S710   NDS V7
_ S810   NDS V8
_ S91A   S91A V9 NDS
_ TEST   Nur ein test,....
_ TSD    TEST GETECPF for poland
********************************* Bottom of data *********************************
```
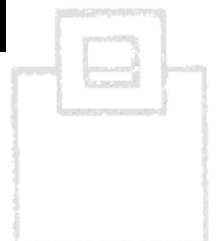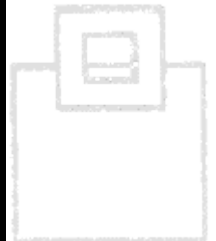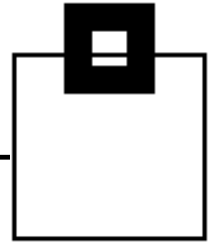
Duplication of Subsystems

Screen Flow of the HSC process

```
Homogeneous System Copy ----- Shutdown --------------------------------
Command ===>
MENU=ON SCENARIO=DEFRFDR SOURCE=D81X TARGET=D91X

Shutdown your DB2.


        Stop the DB2 subsystem D91X
        e.g.: -D91X STOP DB2



Confirm SHUTDOWN completed . . N    - Y(es)/N(o)
```
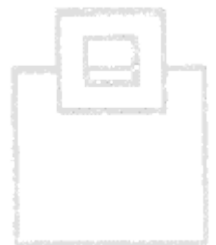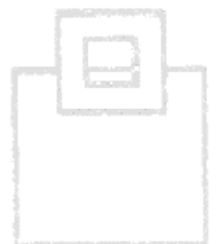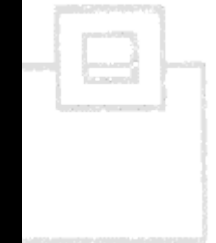
Duplication of Subsytems
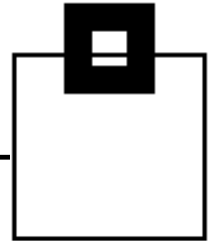
Screen Flow of the HSC process

```
Homogeneous System Copy ----- Scenario Control Menu ---------------------------
Command ===>  _
MENU=ON SCENARIO=DEFRFDR SOURCE=D81X TARGET=D91X

Execute options  1 through 15 in sequence.
Press ENTER to proceed with Cleanup


    DONE    6. Restore              - Restore volumes
    DONE    7. Rename               - Rename all Datasets
    DONE    8. DSNZPARM+DSNHDECP    - Assemble and linkedit
    DONE    9. Start DB2            - START Target DB2 ACCESS(MAINT)
    DONE   10. VCAT SWITCH          - Switch VCAT for all DB2 USER DATA
    DONE   11. Stop DB2             - STOP Target DB2
    DONE   12. Start DB2            - START Target DB2
    DONE   13. Work DB/WLM          - Create/Rename
    ===>   14. Cleanup              - Delete work files
           15. Finished             - Cloning completed
```
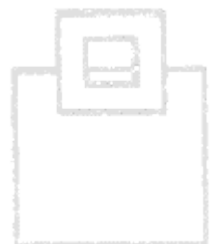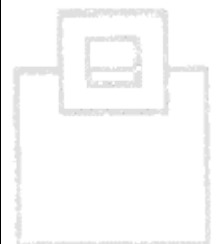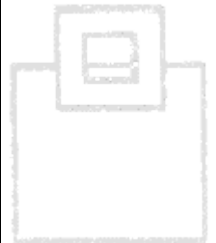
Duplication of Subsystems

Screen Flow of the HSC process

```
Homogeneous System Copy ----- Job Submit List ------------- Job 00001 of 00010
Command ===> _____ Scroll ===> CSR
MODE=TEST MENU=ON AUTO=001                                            DB2:D91X
Primary cmd: SUB(mit), AUTO, J(ob status), G(et failed job), EXIT,
Line    cmd: V(iew), E(dit), R(eset status)

          Member    Prompt      Size  Created        StatusTime           Status
_____  INIT0001               72    2010/04/22     2010/04/22 15:56:28  CC=0000
_____  INIT0002               71    2010/04/22     2010/04/22 15:56:28  SUBMIT
_____  INIT0003               106   2010/04/22     2010/04/22 15:49:41  GENERAT
_____  INIT0004               108   2010/04/22     2010/04/22 15:49:41  GENERAT
_____  INIT0005               113   2010/04/22     2010/04/22 15:49:42  GENERAT
_____  INIT0006               72    2010/04/22     2010/04/22 15:49:43  GENERAT
_____  INIT0007               70    2010/04/22     2010/04/22 15:49:44  WAIT#01
_____  INIT0008               83    2010/04/22     2010/04/22 15:49:44  WAIT#01
_____  INIT0009               83    2010/04/22     2010/04/22 15:49:45  WAIT#01
_____  INIT0010               82    2010/04/22     2010/04/22 15:49:46  WAIT#01
          **End**
```

To Clone or not to Clone?
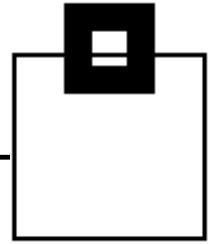
How to achieve those benefits (...continued)?

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
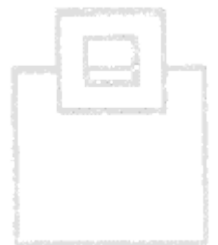
The various ways / flavors of Cloning

Merge of systems/data

DB2-A
DB2-B
DB2-C
DB2-D
DB2-N
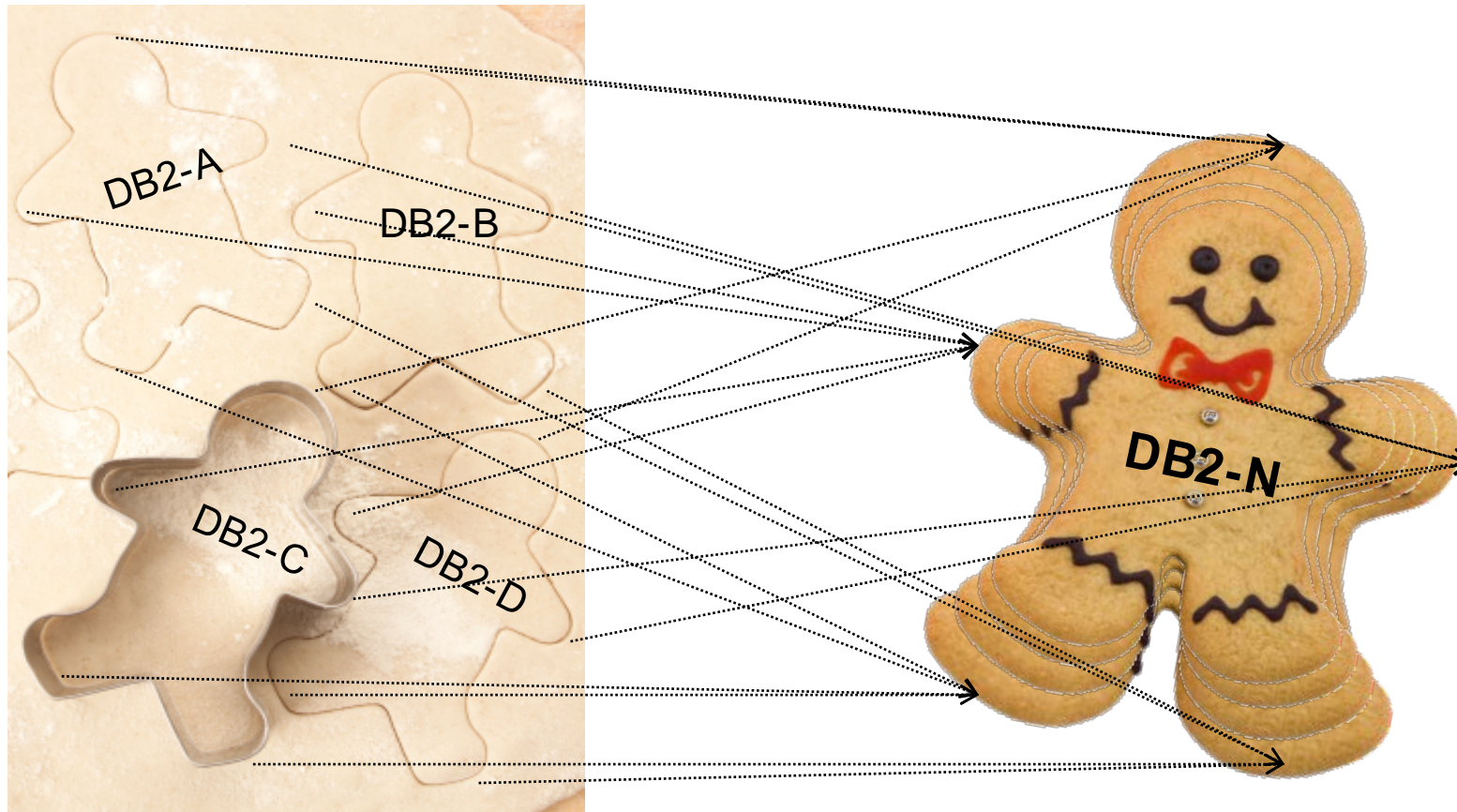
Duplication of systems/data
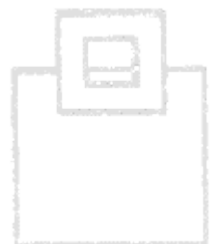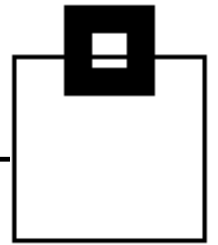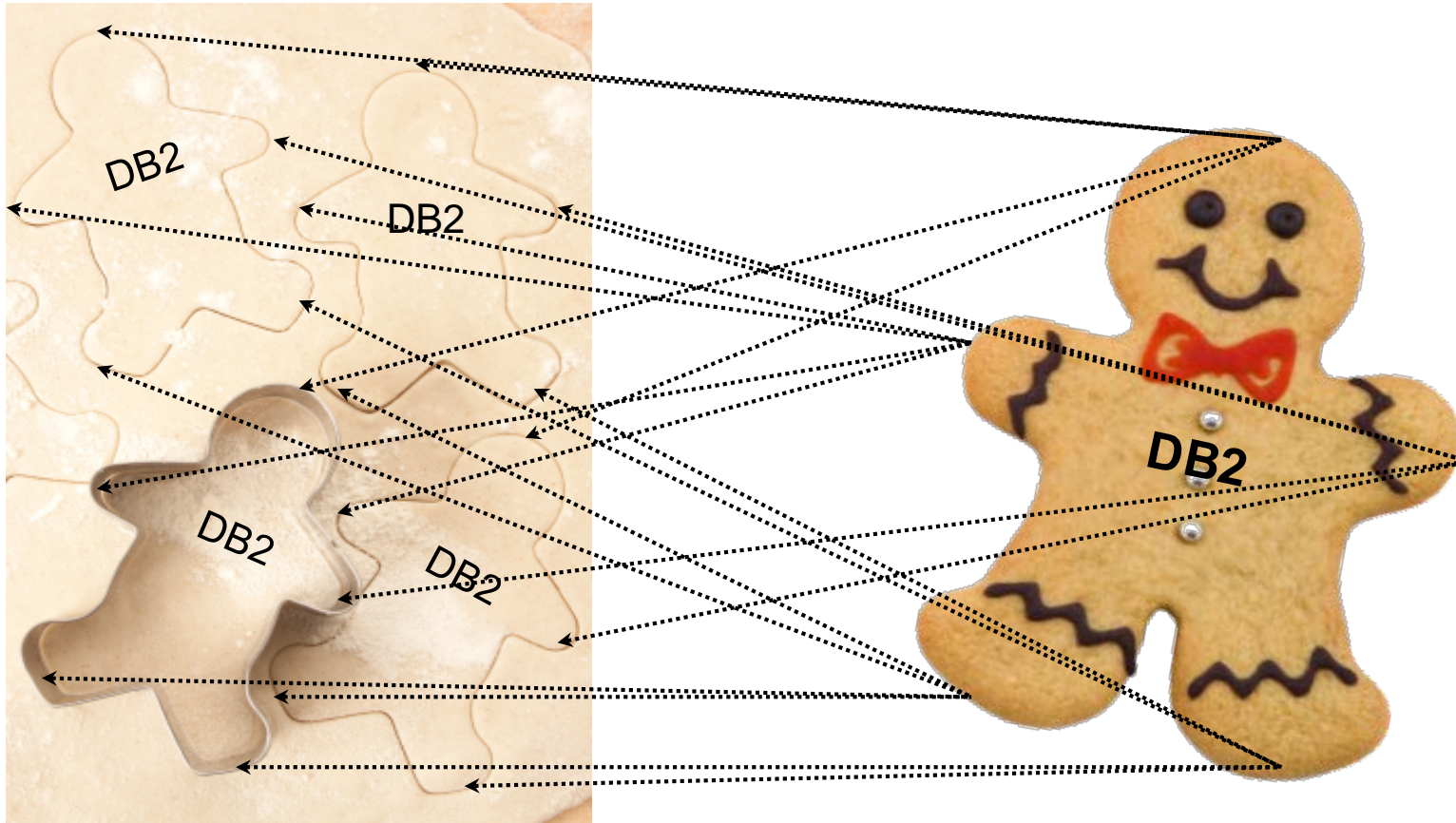
The various ways / flavors of Cloning

Refresh Cloning
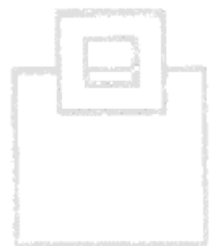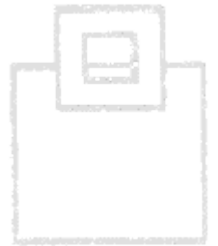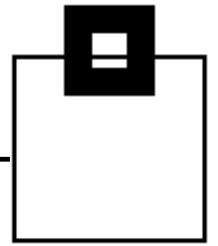
The various ways of Cloning
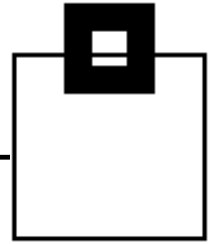
- Merge/Duplication of systems/data

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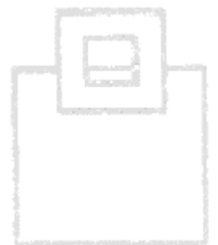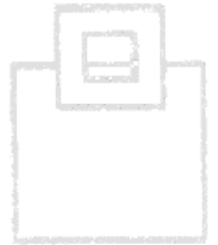
Merge/Duplication of systems/data

- 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
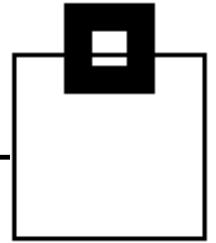
  → Homogeneous Object Cloning (aka. HOC)

Merge/Duplication of systems/data
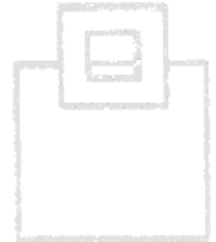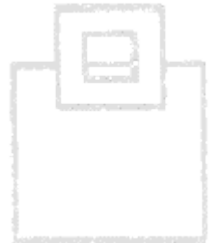
Scope of Cloning

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
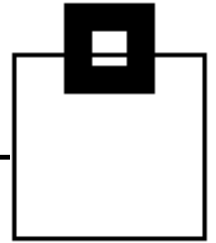
- Required steps
  - Define scope of objects
  - Determine depending objects like indexes, views, authorization, … if desired
  - Extract DDL for resulting source objects
  - Extract data from resulting source objects
  - Apply naming conversion if desired
  - Run DDL on target
  - Load data on target objects
  - Note: Refresh only requires the data
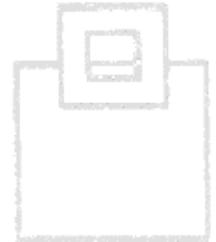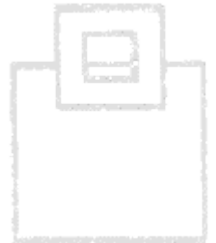
Merge/Duplication of systems/data
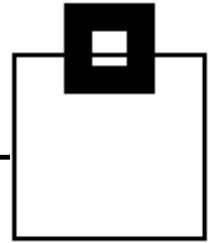
- Gotchas to watch out for
  - Don't burn time and resources
    - If you have the appropriate storage features, use them!
      - → Instant copies (like Flashcopy2) can clone your TB-sized source objects in a fraction of time
      - → Instant copies (like Flashcopy2) don't burn CPU
      - → DB2 supports Flashcopy2 for ONLINE CHECK INDEX maybe for copies one day, too ;-)
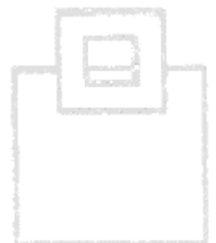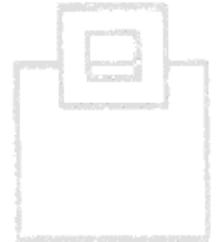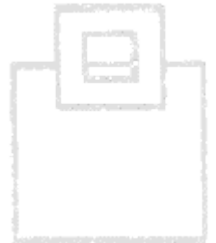
Merge/Duplication of systems/data

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

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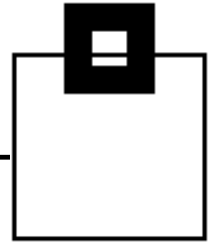
- Gotchas to watch out for
  - Be careful with user defined objects
  → DEFINE CLUSTER
  - Be careful with Multi linear datasets in both directions
    - Multi on source – single on target
    - Single on source and multi on target
    - or even multi on source and multi on target but different number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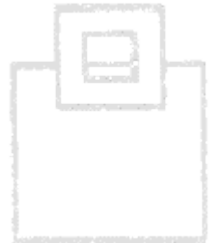
Merge/Duplication of systems/data

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
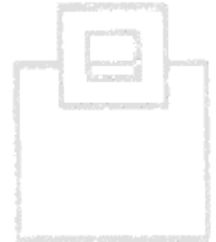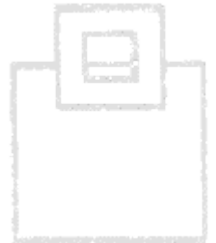
Merge/Duplication of systems/data
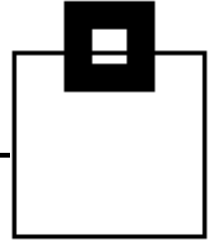
What you should cover for sure

- 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
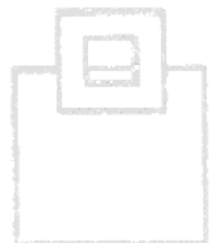
Merge/Duplication of systems/data

- 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 and data 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

- Refresh via DB2 Clone Tables for High Availability

→ One standardized, central solution for your cloning needs
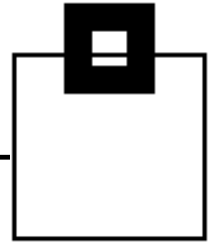
Merge/Duplication of systems/data

And now a quick walk through the process
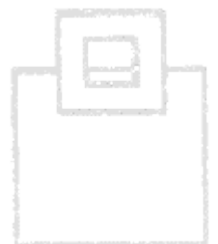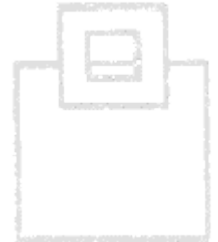
Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ------ Main Menu -------------------- VERSION 1.10
Command ===>  _                                                 DB2: Q91A

Primary cmd:  END, ABOUT

        1. Collect Object(s) via catalog browser

        2. Run DDL-Generator for collected Object(s)
        3. Generate Utility JCL for collected Object(s)

        S. Settings

        X. Terminate DDL and Utility Generator




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```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ------ Collect Objects ---------------------------
Command ===> _                                              DB2: Q91A

Primary cmd : END, R(un), SE(up), +(ADD), S(how), RES(et)

ACTION (Run): DDL      DDL,RST,RSI,ROT,ROI,CO

OBJECT TYPE : D        D(atabase)                    X(Auxiliary table)
                       R(Tablespace)                 I(ndex)
                       T(able)                        A(lias)
                       G(lobal temporary table)      S(ynonym)
                       M(aterialized query table)    V(iew)


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

```
ADHO nd Utility Generator ----- Database Overview ------- Database 1 from 128
Command ===>  _                                           Scroll ===> PAGE
MODE: CATALOG                                                       DB2: Q91A
Primary cmd: END, CAN(cel), Z(oom) +(Add All), L(ocate) name
Line    cmd: T(ables), G(TTs), M(QTs), R(Tablespaces), Z(oom), +(Add)

     Creator      Name                    Created by    Created timestamp
     DBID         Group_member    Type    StoGroup      Altered timestamp
                  Encoding_scheme         Bufferpool    Index bufferpool
    --------------------------------------------------------------------------
+    BOXWELL      BOXWELLX                BOXWELL       2007-07-09-08.57.43.323074
        280                               SYSDEFLT      2007-07-09-08.57.43.323074
                  UNICODE                 BP0           BP0
    --------------------------------------------------------------------------
+    BOXWELL      DIRKDB2                 BOXWELL       2009-01-26-12.40.52.086554
        295                               SYSDEFLT      2009-01-26-12.40.52.086554
                  EBCDIC                  BP0           BP0
    --------------------------------------------------------------------------
_    CHRISTO      EXPHOPPE                CHRISTO       2009-08-27-14.52.51.947899
        301                               SYSDEFLT      2009-08-27-14.52.51.947899
                  EBCDIC                  BP0           BP0
    --------------------------------------------------------------------------
+    DUDEK        DUDEKDB                 DUDEK         2009-10-06-18.30.39.843413
        320                               SYSDEFLT      2009-10-06-18.30.39.843413
                  EBCDIC                  BP0           BP0
    --------------------------------------------------------------------------
+    DUDEK        DUDEKUTF                DUDEK         2010-07-05-14.49.21.377269
        375                               SYSDEFLT      2010-07-05-14.49.21.377269
                  UNICODE                 BP0           BP0
    --------------------------------------------------------------------------
+    DUDEK        DUDEKXML                DUDEK         2007-02-28-17.36.32.449190
        265                               SYSDEFLT      2007-02-28-17.36.32.449190
                  UNICODE                 BP0           BP0
    --------------------------------------------------------------------------
+    DUDEK        IDATQB                  DUDEK         2009-11-30-14.53.59.590595
        327                               SYSDEFLT      2009-11-30-14.53.59.590595
                  EBCDIC                  BP0           BP0
```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ----- DDL Generator Settings ----- Setting 1 from 10
Command ===> _                                              Scroll ===> CSR
                                                            DB2: F91D
Primary cmd: END, CAN(cel), F(ilter), T(ext on/off), G(roup on/off),
             L(ocate) setting
Line    cmd: S(elect), R(eset to DEFAULT)

Profile: HEINRIC       Creator . .: HEINRIC
                       Description: Default profile for RTDX
   Category
     Setting                              Value        Valid Input
 --------------------------------------------------------------------------------
 _     READ INTERVAL FOR OBJECTS          250          50 to 2000
 _     CURRENT SQLID                      &USERID      CHAR(08)
 _     DEPENDENCY DDL                     Y            Y/N
 _     GRANTS                             Y            Y/N
 _     DEFINE                             Y            Y/N
 _     GEN USER IDCAMS                    Y            Y/N/A
 _     LITERAL APOST                      '            '/"
 _     DECIMAL POINT                      .            ./,
 _     TRIGGER DELIMITER                  $            CHAR(01)
 _     TRACE                              OFF          ON/OFF
 --------------------------------------------------------------------------------
```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ------ Collect Objects ----------------------------
C                                                                    DB2: Q91A
P   _ADHO -------------------- Status --------------------------
A            SCANNING OBJECTS
             *********
O            0% --------- 50% ------- 100%




                    M(aterialized query table)    V(iew)


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

```
ADHO nd Utility Generator ----- Change Data --------------------------------
EDIT        SYS10256.T013117.RA000.HEINRIC.R0103647        Columns 00001 00072
Command ===> _                                              Scroll ===> CSR
****** *********************************** Top of Data **************************************
000001 -- GRANTS BP        "BP0       "
000002    SET CURRENT SQLID = 'HENN'      ;
000003      GRANT USE OF BUFFERPOOL BP0
000004    TO PUBLIC
000005    ;
000006 -- DATABASE       "ADB01"
000007    SET CURRENT SQLID = 'VOELKEN'   ;
000008      CREATE DATABASE "ADB01"
000009              BUFFERPOOL BP0
000010              INDEXBP    BP0
000011              STOGROUP   SYSDEFLT
000012              CCSID EBCDIC
000013    ;
- - -  -  -  -  -  -  -  -  -  -  -  -  -  -   121 Line(s) not Displayed
000135 -- GRANTS DB       "DSNDB04"
000136    SET CURRENT SQLID = 'HENN'      ;
000137      GRANT  CREATETAB
000138            ,CREATETS
000139    ON DATABASE "DSNDB04"
000140    TO PUBLIC
000141    ;
000142    COMMIT ;
- - -  -  -  -  -  -  -  -  -  -  -  -  -  -   105 Line(s) not Displayed
000248 -- TABLESPACE     "ADB01"."AS13"
000249    SET CURRENT SQLID = 'VOELKEN'   ;
000250     CREATE        TABLESPACE "AS13"
000251            IN "ADB01"
000252            USING STOGROUP SYSDEFLT
000253            PRIQTY        12 SECQTY         4
000254            ERASE NO
000255            FREEPAGE    0
000256            PCTFREE     0
000257            GBPCACHE CHANGED
000258            TRACKMOD YES
000259            LOG       YES
```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ----- Change Data ---------------------------------
EDIT        SYS10256.T013117.RA000.HEINRIC.R0103647          Columns 00001 00072
Command ===> _____  Scroll ===> CSR
000264          CLOSE YES
000265          COMPRESS YES
000266          CCSID EBCDIC
000267          MAXROWS   255
000268          SEGSIZE     4
000269   ;
- - -    -   -   -   -   -   -   -   -   -   -   -  -  -   5580 Line(s) not Displayed
005850 -- TABLE          "VOELKEN"."AT131"
005851   SET CURRENT SQLID = 'HEINRIC'   ;
005852     CREATE TABLE "VOELKEN"."AT131"
005853     ("XCOUNT"                      INTEGER                NOT NULL
005854     WITH DEFAULT
005855     ,"X01"                         TIMESTAMP              NOT NULL
005856     WITH DEFAULT
005857     ,"X02"                         CHAR(   254)
005858                                        FOR SBCS DATA   NOT NULL
005859     WITH DEFAULT
005860     ,"X03"                         CHAR(   254)
005861                                        FOR SBCS DATA   NOT NULL
005862     WITH DEFAULT
005863     ,"X04"                         CHAR(   254)
005864                                        FOR SBCS DATA   NOT NULL
005865     WITH DEFAULT
005866     ,"X05"                         CHAR(   254)
005867                                        FOR SBCS DATA   NOT NULL
005868     WITH DEFAULT
005869     ,"X06"                         CHAR(   254)
005870                                        FOR SBCS DATA   NOT NULL
005871     WITH DEFAULT
005872     ,"X07"                         CHAR(   254)
005873                                        FOR SBCS DATA   NOT NULL
005874     WITH DEFAULT
005875     ,"X08"                         CHAR(   254)
005876                                        FOR SBCS DATA   NOT NULL
005877     WITH DEFAULT
005878     ,"X09"                         CHAR(   254)
005879                                        FOR SBCS DATA   NOT NULL
005880     WITH DEFAULT
```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ----- Change Data -------------------------------
EDIT         SYS10256.T013117.RA000.HEINRIC.R0103647        Columns 00001 00072
Command ===>  _                                            Scroll ===>  CSR
005883        WITH DEFAULT
005884        ,"X11"                                CHAR(   254)
005885                                                     FOR SBCS DATA   NOT NULL
005886        WITH DEFAULT
005887        ,"X12"                                CHAR(   254)
005888                                                     FOR SBCS DATA   NOT NULL
005889        WITH DEFAULT
005890        ,"X13"                                CHAR(   254)
005891                                                     FOR SBCS DATA   NOT NULL
005892        WITH DEFAULT
005893        ,"X14"                                CHAR(   254)
005894                                                     FOR SBCS DATA   NOT NULL
005895        WITH DEFAULT
005896        ,"X15"                                CHAR(   254)
005897                                                     FOR SBCS DATA   NOT NULL
005898        WITH DEFAULT
005899        ,"X16"                                CHAR(   254)
005900                                                     FOR SBCS DATA   NOT NULL
005901        WITH DEFAULT
005902        ,"X17"                                CHAR(   190)
005903                                                     FOR SBCS DATA   NOT NULL
005904        WITH DEFAULT
005905        )
005906        IN   "ADB01"."AS13"
005907        AUDIT NONE
005908        DATA CAPTURE NONE
005909        CCSID EBCDIC
005910        NOT VOLATILE CARDINALITY
005911        APPEND NO
005912     ;
005913  -- INDEX          "VOELKEN"."AX131"
005914        CREATE UNIQUE INDEX              "VOELKEN"."AX131"
005915             ON "VOELKEN"."AT131"
005916             ("XCOUNT"                          ASC
005917             )
005918             CLUSTER
005919             USING STOGROUP SYSDEFLT
005920             PRIQTY        12 SECQTY        4
```

Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ----- Change Data ----------------------------------
EDIT        SYS10256.T013117.RA000.HEINRIC.R0103647          Columns 00001 00072
Command ===> _                                                Scroll ===> CSR
005923          PCTFREE        0
005924          GBPCACHE CHANGED
005925          DEFINE YES
005926          COMPRESS NO
005927          BUFFERPOOL BP0
005928          CLOSE YES
005929          PIECESIZE     2 G
005930          COPY NO
005931     ;
- - - - - - - - - - - - - - - - - - - - - -  7544 Line(s) not Displayed
013476 -- GTT            "IDUG610"."ADB2_TODO_TABLE"
013477    CREATE GLOBAL TEMPORARY TABLE "IDUG610"."ADB2_TODO_TABLE"
013478    ("RTYPE"                           CHAR(     1)
013479                                        FOR SBCS DATA  NOT NULL
013480    ,"QUALIFIER"                        VARCHAR(  128)
013481                                        FOR SBCS DATA  NOT NULL
013482    ,"NAME1"                            VARCHAR(  128)
013483                                        FOR SBCS DATA  NOT NULL
013484    ,"NAME2"                            VARCHAR(  128)
013485                                        FOR SBCS DATA  NOT NULL
013486    ,"VERSION"                          VARCHAR(  122)
013487                                        FOR SBCS DATA  NOT NULL
013488    ,"OWNER"                            VARCHAR(  128)
013489                                        FOR SBCS DATA  NOT NULL
013490    ,"PLAN"                             VARCHAR(   24)
013491                                        FOR SBCS DATA  NOT NULL
013492    ,"STMTNO"                           INTEGER        NOT NULL
013493    ,"QUERYNO"                          INTEGER        NOT NULL
013494    ,"CONTOKEN"                         CHAR(     8)
013495                                        FOR SBCS DATA  NOT NULL
013496    ,"VTYPE"                            CHAR(     1)
013497                                        FOR SBCS DATA  NOT NULL
013498    ,"DATASET"                          CHAR(    44)
013499                                        FOR SBCS DATA  NOT NULL
013500    ,"MEMBER"                           CHAR(     8)
013501                                        FOR SBCS DATA  NOT NULL
013502    ,"DDNAME"                           CHAR(     8)
013503                                        FOR SBCS DATA  NOT NULL
```
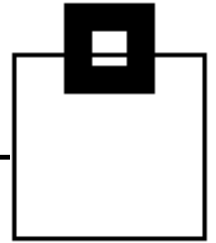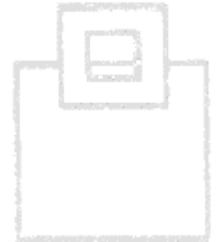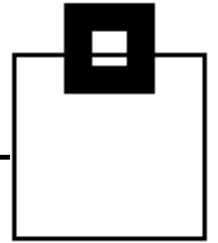
Merge/Duplication of systems/data

Screen Flow of the HOC process

```
ADHO nd Utility Generator ----- Change Data --------------------------------
EDIT          SYS10256.T013117.RA000.HEINRIC.R0103647        Columns 00001 00072
Command ===>                                                 Scroll ===> CSR
013607 --  GRANTS ON      "IDUG610"."IDUGHGT0"
013608     SET CURRENT SQLID = 'IDUGIQA'   ;
013609      GRANT ALTER,DELETE,INSERT,SELECT
013610     ON TABLE     "IDUG610"."IDUGHGT0"
013611     TO PUBLIC
013612     ;
013613 --  ALIAS          "IDUG610"."IQHGTTPACK"
013614     SET CURRENT SQLID = 'HEINRIC'  ;
013615      CREATE ALIAS "IDUG610"."IQHGTTPACK"
013616      FOR         "IDUG610"."IDUGHGT0"
013617     ;
- - - -   -  -  -  -  -  -  -  -  -  -  -  -  - - 31837 Line(s) not Displayed
045455 --  RI FOR TABLE  "IDUG610"."IDUGH005"
045456     ALTER TABLE   "IDUG610"."IDUGH005"
045457     ADD CONSTRAINT IDUGHXX51
045458     FOREIGN KEY
045459              ("BOUNDTS"
045460              ,"PLNAME"
045461              ,"NAME"
045462              )
045463     REFERENCES    "IDUG610"."IDUGH004"
045464              ("BOUNDTS"
045465              ,"PLNAME"
045466              ,"NAME"
045467              )
045468     ON DELETE CASCADE   ENFORCED      ENABLE QUERY OPTIMIZATION
045469     ;
- - -  -  -  -  -  -  -  -  -  -  -  -  -  -  - 886 Line(s) not Displayed
046356 --  TRIGGER      "IQA_IDUGCOLL_610"."IDUGAR11"
046357 --#SET TERMINATOR $
046358 CREATE TRIGGER IQA_IDUGCOLL_610.IDUGAR11
046359     AFTER
046360     UPDATE OF X_RULESETNR ON  IDUG610.IDUGA001
046361     REFERENCING NEW AS RSNEW
046362                 OLD AS RSOLD
046363     FOR EACH ROW
046364     MODE DB2SQL
046365     BEGIN ATOMIC
```
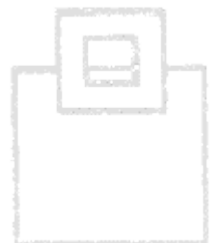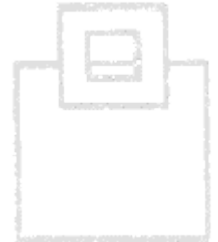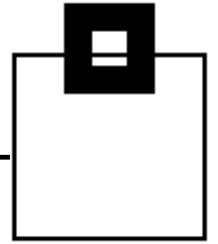
Conclusion

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