DB2 Cloning Tool

Clone Your Way to a Better Business Result: Faster, Automated DB2 Cloning and Refresh Operations

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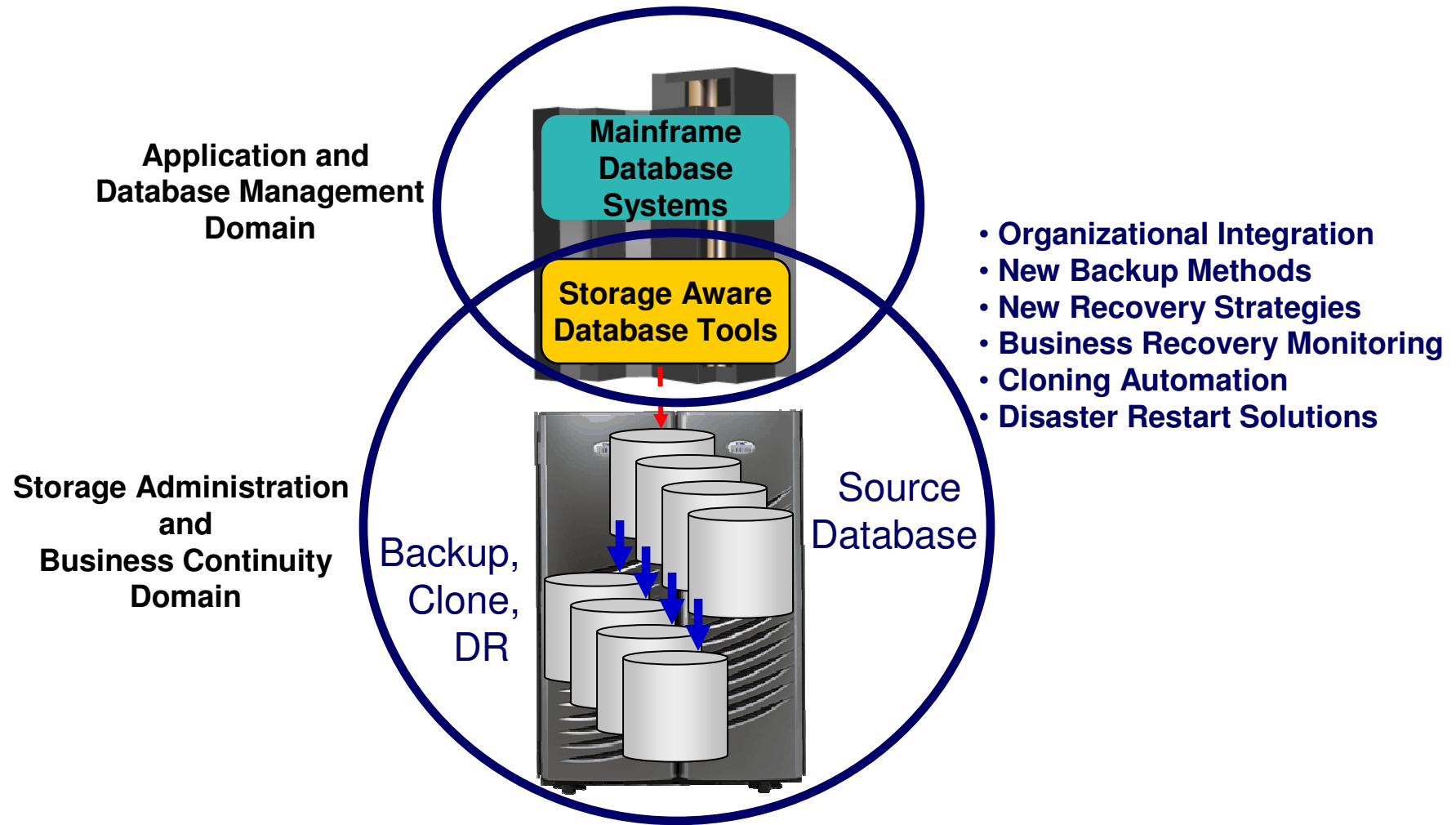# Agenda

- **Trends and directions**

- **Cloning terminology**

- **Use cases**

  – DB2 system cloning

  – Refresh table and index spaces

- **Options for copying data**

- **Clone DB2 systems**

- **Refresh DB2 table and index spaces**

Trends and Directions

- **DB2 systems require high availability as these systems and the web have evolved**

- **Need fast and non-intrusive cloning facilities to maintain high availability**

  - Storage processors have evolved
    - All that functionality can be moved into the storage processor
  - Most cloning does not leverage storage-based fast-replication facilities

- **Storage-based fast-replication facilities are under-utilized**

  - Tend to be used by storage organizations
  - Tend not to be used by database administrators (DBAs)
  - Not many tools integrate database management with storage to drive fast replication

Database and Storage Integration

Mainframe Database Systems

Application and Database Management Domain

Storage Aware Database Tools

- **Organizational Integration**
- **New Backup Methods**
- **New Recovery Strategies**
- **Business Recovery Monitoring**
- **Cloning Automation**
- **Disaster Restart Solutions**

Storage Administration and Business Continuity Domain

Source Database

Backup, Clone, DR

Database and Storage Integration Operational Advantages

- **Reduce administration costs through automation**

  - Fast replication executed in safe and transparent manner

- **Reduce host CPU and I/O resource utilization**

  - Copy process is done in the storage processor

- **Copy data instantaneously**

  - Data cloning in minutes

- **Promotes high availability solutions**

  - Copy of production data without sacrificing data availability

Data Cloning Terminology

- **What is a clone?**

  A clone is an exact replica

- **What is DB2 system and table space cloning?**

  The act of replicating the data, making the replica
  accessible, and then using the replica in lieu
  of the original data

DB2 Cloning Terminology

- **DB2 system cloning automation**

  – Clones a complete DB2 system including all its databases

  – Use the DB2 system clone in lieu of the original data

- **DB2 table and index space refresh automation**

  – Refreshes specific table and index spaces

  – Lowest level is by data set

Use Cases for Cloning DB2 Systems

- **To run 'read-only' production**
  - Offload business processes from production
  - Improve production performance

- **To copy SAP interrelated data**

- **To create or refresh a test, development, or quality assurance environment**

- **To apply maintenance and verify integrity before applying to production**

- **To stage data-warehouse loads**

- **To aid in problem determination**

You may be cloning your DB2 systems!

Use Cases for Refreshing DB2 Table and Index Spaces

- **To run 'read-only' production**

  - Offload business processes from production

  - Improve production performance

- **To refresh data in a test, development or quality assurance environment**

- **To stage data-warehouse loads**

- **To aid in problem determination**

- **Refresh table spaces into a previously cloned DB2 skeleton**

Fast Replication Data Copy Options

Fast copies performed by the storage processors

- **Volume based fast replication options for DB2 system cloning**

  - FlashCopy (IBM,EMC,HDS)

  - SnapShot (IBM,STK)

  - TimeFinder/Clone, Volume Snap (EMC)

  - TimeFinder/Snap (EMC)

  - Mirror processes

    - PPRC (IBM,EMC,HDS)

    - TimeFinder/Mirror, SRDF (EMC)

    - ShadowImage HUR (HDS)

- **Data set based fast replication options for table space refreshes**

  - Data Set FlashCopy (IBM,EMC,HDS)

  - Data set SnapShot (IBM,STK)
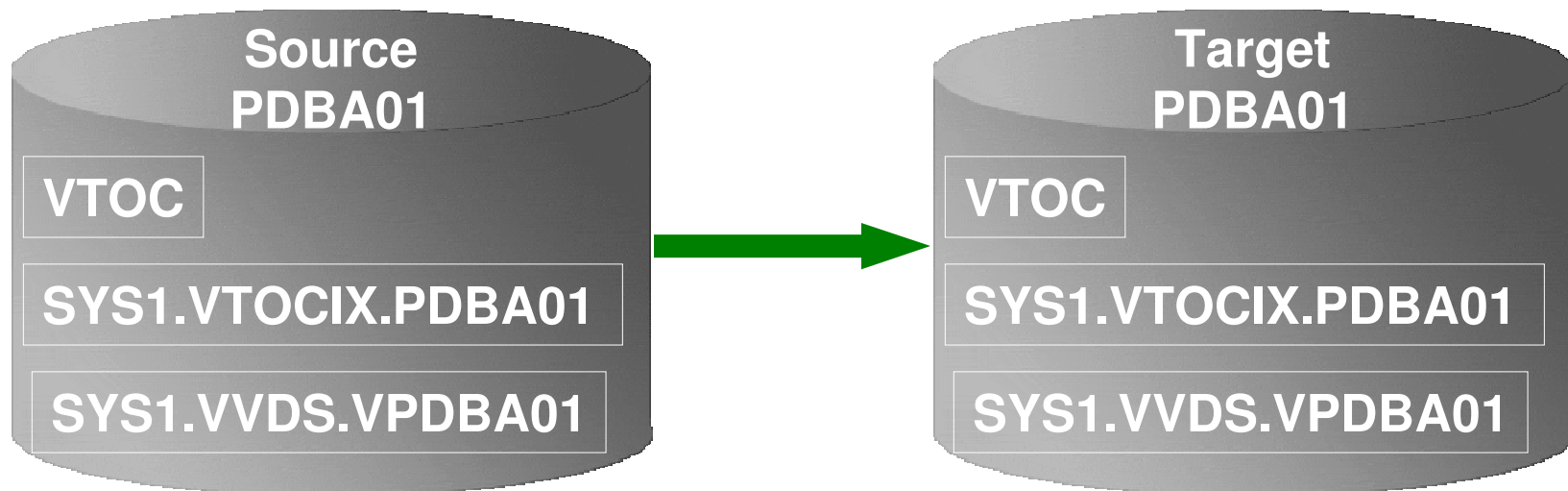
  - TimeFinder/Clone Data set Snap (EMC)

Host Based Data Copy Options

- Data copy processes use host based CPU and I/O facilities
- Much slower than storage-based fast replication

- **Volume copy options for DB2 system cloning**

  – TDMF (IBM)

  – FDRPAS (Innovation Data Processing)

  – DFSMSdss (IBM)

  – FDR (Innovation Data Processing)

- **Data set copy options for table space refreshes**

  – Any traditional data set copy processes

Challenges to Data Access
On the Same or Shared LPAR

- **DB2 system cloning is best done using volume replication**

- **Volume data is replicated fast and easy but…**

  - How do you access the cloned data?

- **Inherent Problems:**

  - VOLSERs may have the same volume names as the source

  - Data set names are the same on source and target volumes

  - If you want to access the data from

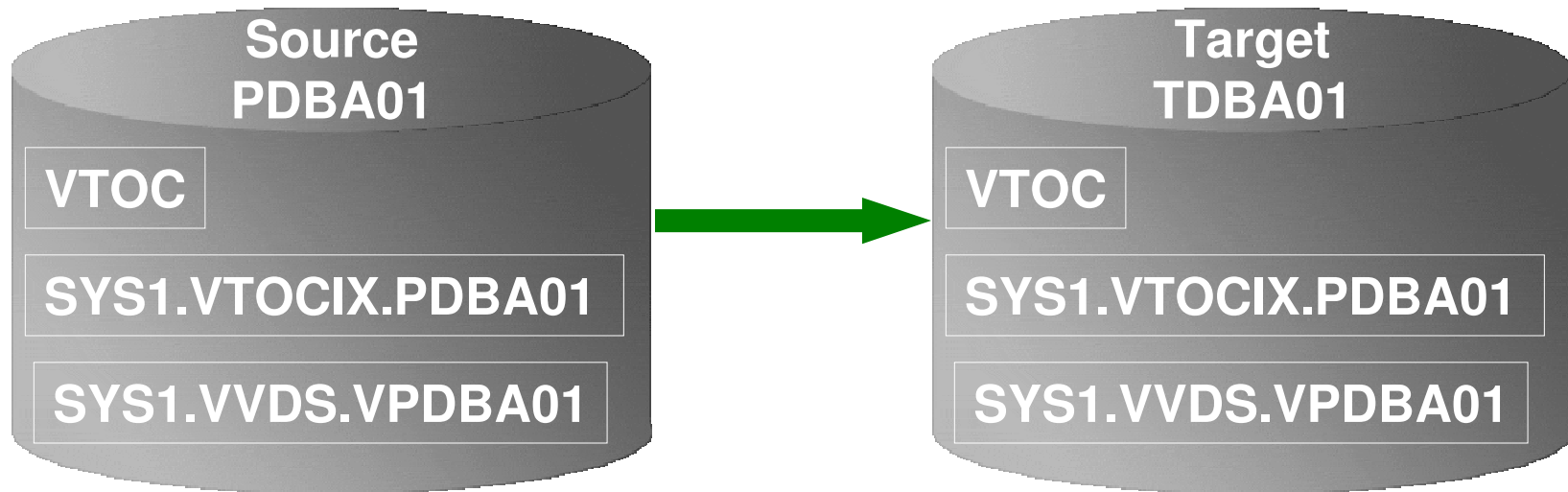   a common LPAR, how do you access

    the data?

Cloned Volume Data Access Challenges
Volume ID Issues

Source PDBA01	Target PDBA01
VTOC	VTOC
SYS1.VTOCIX.PDBA01	SYS1.VTOCIX.PDBA01
SYS1.VVDS.VPDBA01	SYS1.VVDS.VPDBA01

Result:

1. **Source PDBA01 keeps its original VOLSER on the target volume**
2. **VTOC, VTOCIX, and VVDS *reflect* PDBA01**
3. **The target volume is offline because it has the same VOLSER as the source. It could be brought online on another non-sharing system to use the clone**
4. **Target volume can't be used on the same or shared disk LPAR without re-labeling the volume.**

Cloned Volume Data Access Challenges
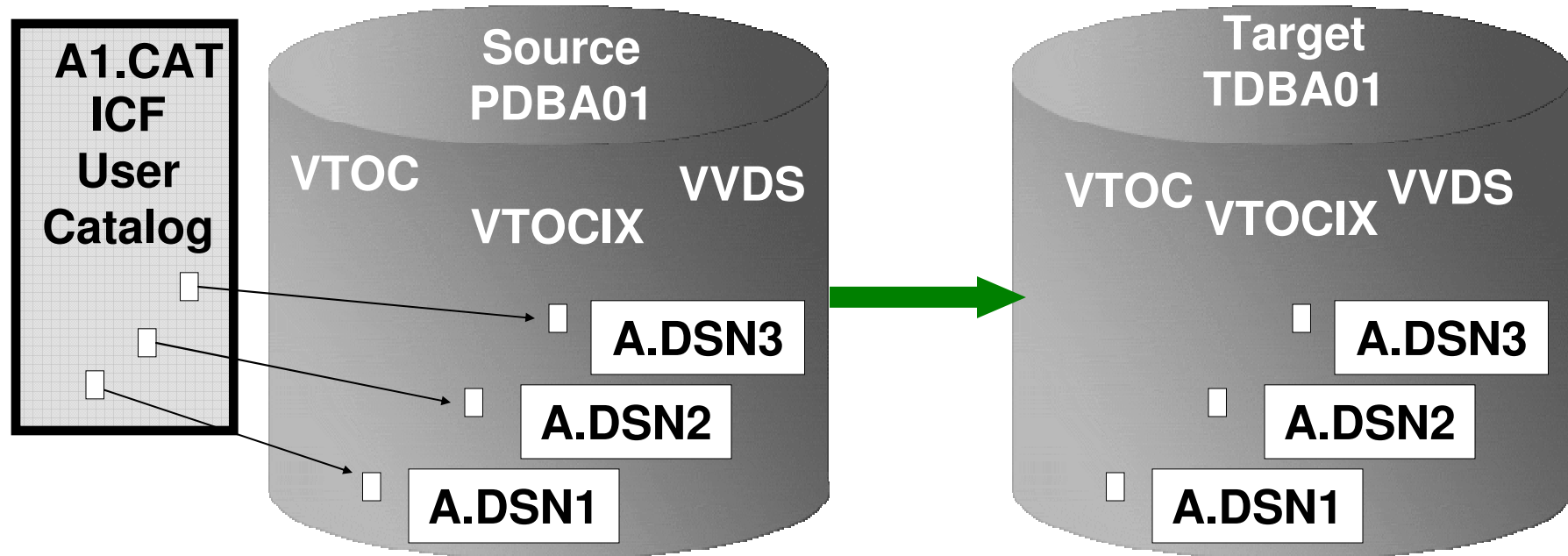## Volume ID Issues (2)

Source
PDBA01

VTOC

SYS1.VTOCIX.PDBA01

SYS1.VVDS.VPDBA01

Target
TDBA01

VTOC

SYS1.VTOCIX.PDBA01

SYS1.VVDS.VPDBA01

Result:
1. **Source PDBA01 becomes new VOLSER TDBA01 on the target volume**
2. **VTOC, VTOCIX, and VVDS *reflect* PDBA01**

Cloned Volume Data Access Challenges
Data Set Name and Cataloging Issues

A1.CAT ICF User Catalog

Source PDBA01

VTOC

VVDS

VTOCIX

A.DSN3

A.DSN2

A.DSN1

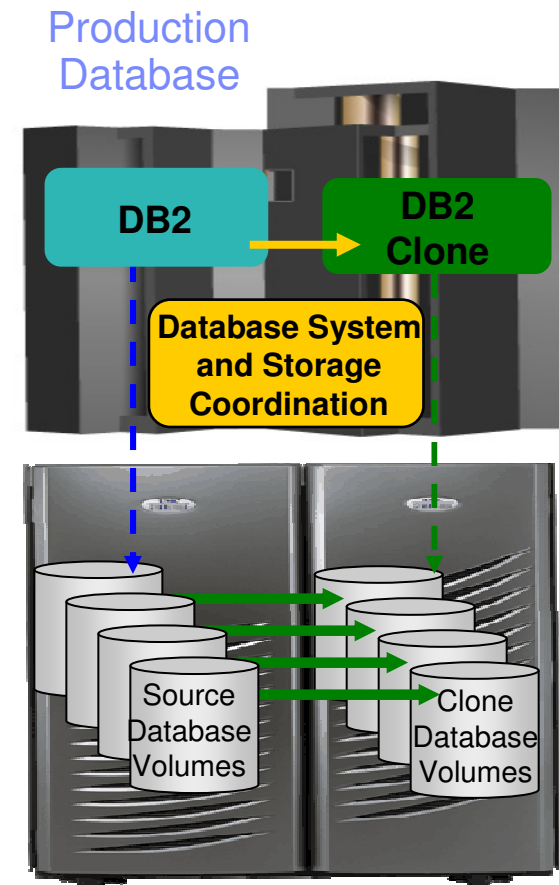**Target TDBA01**

VTOC

VTOCIX

VVDS

A.DSN3

A.DSN2

A.DSN1

Result:

1. Data sets on the volume are copied, but keep their original name
2. Only the source data sets are cataloged; even if the catalog is on the cloned volumes, it isn't connected to the system's master catalog

DB2 Cloning Tool - DB2 System Cloning Automation

- **Performs automated cloning of DB2 systems**

- **Leverages volume-based fast replication facilities to copy the data**

  – Data can be cloned while online or offline

- **Performs rapid volume reconditioning and data set renaming on cloned volumes to solve the data access challenges**

  – Target volumes retain their target volume label

  – Renames the VTOC, VTOCIX, and VVDS to match the target volume

  – Renames and catalogs all data sets to a new HLQ

- **Adjusts target DB2 system to accommodate and accept the cloned data**

  – DB2 catalog, directory, BSDS, active / archive Log

  – Makes data accessible on the same or shared LPAR

Production
Database

DB2

DB2
Clone

Database System
and Storage
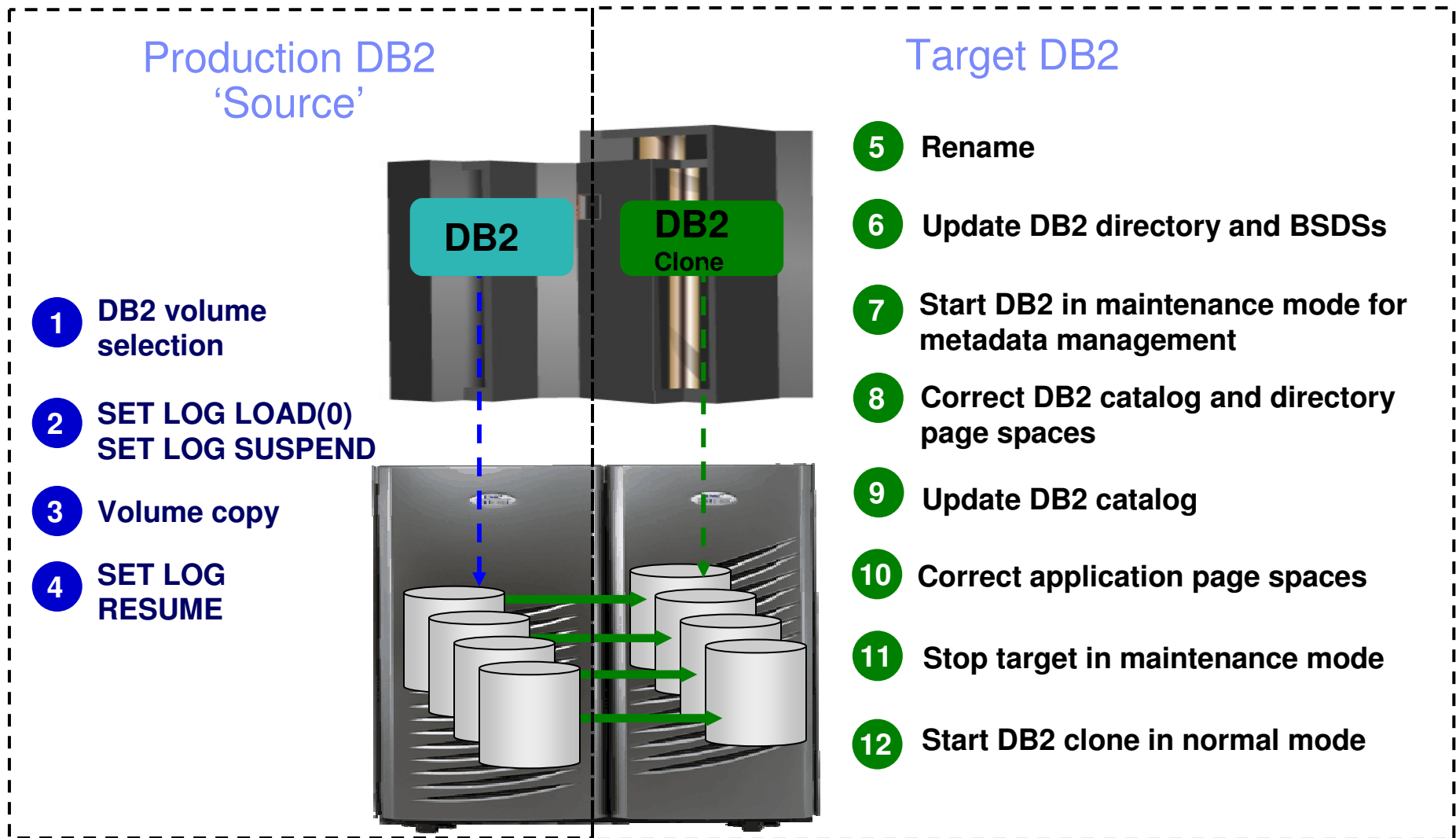Coordination

Source
Database
Volumes

Clone
Database
Volumes

Pre-DB2 System Cloning Steps

- **Set up the target DB2 system definition before performing DB2 cloning automation**

- **Set up the special DB2 system maintenance mode ZPARM before performing DB2 cloning automation**

  - Allows the DB2 catalog to be updated
  - Starts the target DB2 in DEFER mode to prevent back out processing

DB2 System Cloning Steps

Production DB2 'Source'

Target DB2

DB2

DB2
Clone

1 DB2 volume selection

2 SET LOG LOAD(0)
SET LOG SUSPEND

3 Volume copy

4 SET LOG RESUME

5 Rename

6 Update DB2 directory and BSDSs

7 Start DB2 in maintenance mode for metadata management

8 Correct DB2 catalog and directory page spaces

9 Update DB2 catalog

10 Correct application page spaces

11 Stop target in maintenance mode

12 Start DB2 clone in normal mode

Target DB2 System (Clone) Updates

- **DB2 directory updates**

  - The VCATNAME

  - Optionally, the DB2 storage group names

- **BSDSs updates**

  - The DB2 catalog name

  - The 'active' log data set names

  - Optionally, the ARCHIVE data set names and volume serial numbers

  - Optionally updates the target DB2 BSDS's DDF parameters

- **DB2 Catalog updates by SQL**

  - The DB2 VCATNAME name

DB2 Support

- **DB2 Support**
  - DB2 offline
  - DB2 online
  - DB2 data sharing
  - DB2 data sharing with many to less members
  - DB2 data sharing to non-DB2 data sharing

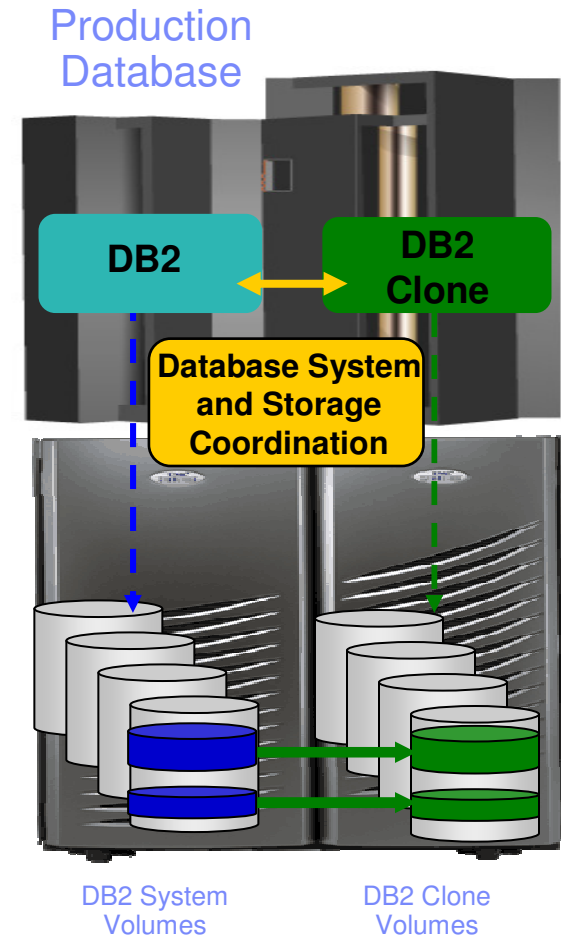# DB2 Cloning Tool Subsystem Enhancements – V2.2

- Support for extended address space (EAV) volumes

- IBM fast replication support:

  - Incremental FlashCopy

  - Space Efficient FlashCopy

  - FlashCopy consistency group

- EMC fast replication support:

  - TimeFinder/Clone Mainframe *Volume* Snap support

  - EMC consistency group

  - Differential Volume Snap

- Functionality was added to allow a slow copy when FASTPREP(PREF) is specified and no fast replication is available

  - Previously, FASTREP(PREF) only supported fast copy processes and FASTREP(NONE) had to be specifically specified to invoke slow copy method
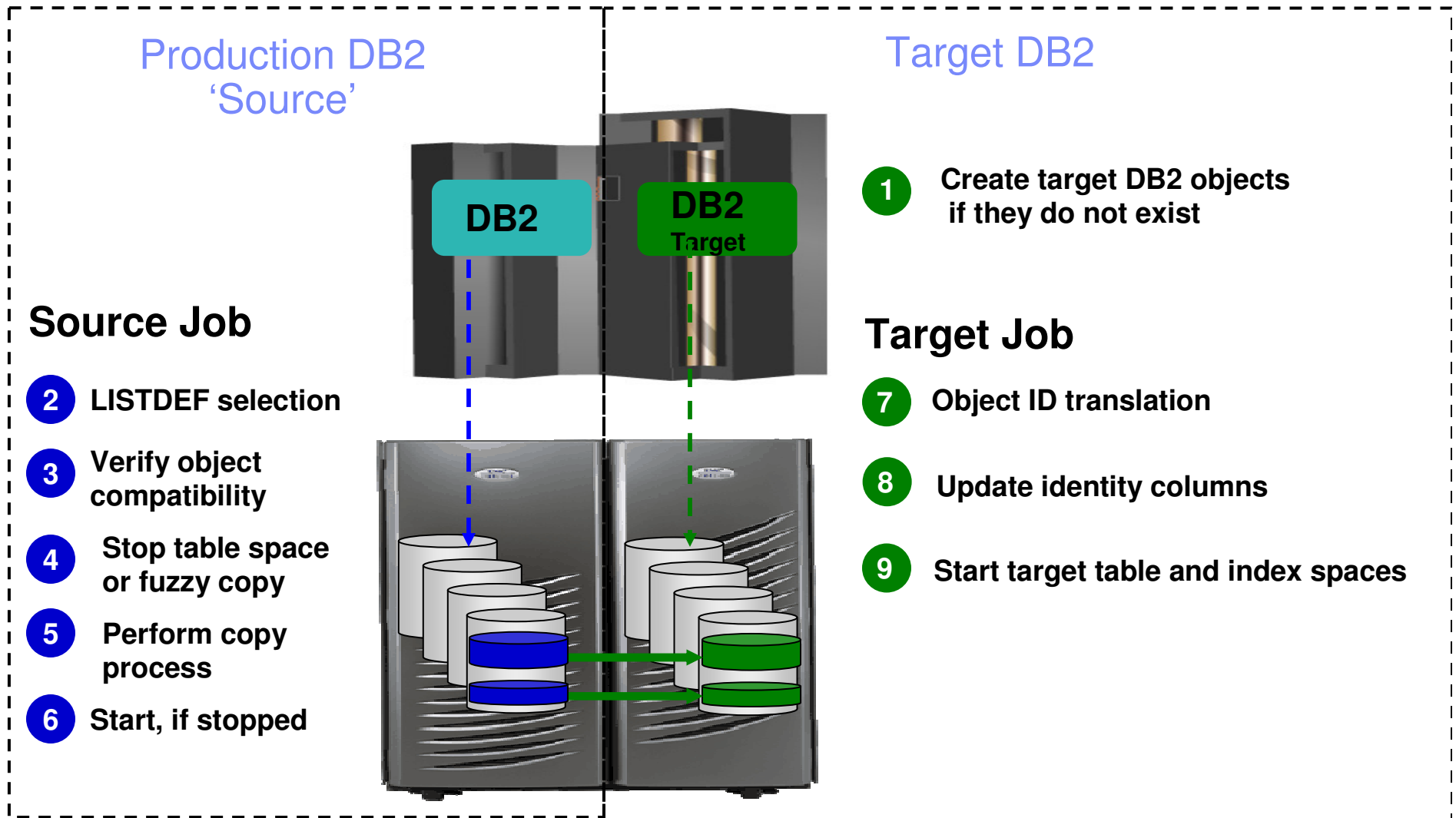
Customer Testimonials

- Provides data access and promotes high availability

- Customer Quotes:

  - **Customer 1:** It took us 48 hours to clone a DB2 subsystem. Now it takes 30 minutes.

  - **Customer 2:** Before it took a total of 96 days per year to clone our DB2 subsystems. We save 84 days per year.

  - **Customer 3:** The end users had access to the warehouse data 1 day a week. Now, the users have unlimited access to the data.

Refreshing Table and Index Spaces

- **Performs automated DB2 table and index space refresh operations**

  - DB2 RI relationships, LOBS, and Identity columns

- **Verifies source target database compatibility**

- **Leverages data set based fast replication facilities to clone data**

  - Data can be cloned while online or offline

  - Slow copy mechanism can be used

- **Performs object ID translations and target system meta-data**

Production Database

DB2

DB2 Clone

Database System and Storage Coordination

DB2 System Volumes

DB2 Clone Volumes

DB2 Table and Index Space Refresh Steps

Production DB2 'Source'

Target DB2

DB2

DB2
Target

① Create target DB2 objects if they do not exist

Source Job

② LISTDEF selection

③ Verify object compatibility

④ Stop table space or fuzzy copy

⑤ Perform copy process

⑥ Start, if stopped

Target Job

⑦ Object ID translation

⑧ Update identity columns

⑨ Start target table and index spaces

Target locations that DB2 Cloning Tool supports

- **Within the same DB2 system or to another DB2 system**

- **To the same database name or to another database**

- **To the same table space name, or to another table space name**

- **To the same Creator ID or to another Creator ID**

DB2 Cloning Tool does the Catalog Research for you

- **Determines the source and target data sets**

- **Determines the source and target object IDs**

- **Determines compatibility**

- **Creates the XLATE parameters**

- **Tracks source DB2 extents**

Compatibility

- **Determines compatibility between the source and target DB2 objects:**

  - Qualifiers

  - Object names

  - Object attributes

  - Column attributes

  - Object IDs

  - DSSIZE

  - Buffer pools

  - CCSID

  - And others

DB2 Cloning Tool Table Space Cloning Enhancements – V2.2

- EMC fast replication support:

  – EMC TimeFinder/Clone Mainframe *Data Set* Snap support

- An option was added to always copy indexes for selected table spaces in both the parmlib and COPY command

DB2 Cloning Tool Table Space Cloning Enhancements – V2.2

- **Data Masking**

  – Option to mask one or more columns during the table space refresh process

  – The masking changes are made during OBID translation step based on masking rules that are enabled during the copy

  – All referential integrity columns will have same masking function applied

    - Examples of fields that a user might change are US--- >Social Security numbers< --- credit card numbers, names and addresses

DB2 Cloning Tool Table Space Cloning Enhancements – V2.2

- Data Masking
  - Types of data masking functions are provided, such as:
    - STATIC RULE , FIELD = CONSTANT VALUE
    - MASK RULE, FIELD = [a-z0-9]*10
    - PATTERN RULE (Sir | Mr) Bill
    - RANDOM RULE, FIELD = RAND(1, 100)
    - USER EXIT RULE , FIELD = USER_EXIT()
    - SEQUENCE RULE , SEQ(1, 1)
    - SCRAMBLE RULE , SCRAMBLE(FIELD)
    - CURRENT DATE, CURRENT TIME, CURRENT TIMESTAMP RULES
    - CURRENT USER RULE

DB2 Cloning Tool Table Space Cloning Enhancements – V2.2

- New keywords have been added to the COPY command to over-ride PARMLIB parameters allow users to adjust performance of DFSMSdss copy commands. The keywords include:

  – **DSNS-PER COPY()** tells DB2 Cloning Tool how many data sets to send to DFSMSdss in a single copy command

  – **DSS-COPY-COMMANDS()** tells DB2 Cloning Tool the number of DFSMSdss copy commands to send to DFSMSdss in a single invocation

DB2 Cloning Tool Table Space Cloning Enhancements – V2.2

- New keywords have been added to the SET command to over-ride PARMLIB parameters and provide greater functionality. The keywords include:

  - **DB2-PLAN** provides for the specification of the DB2 plan name for source and target DB2 subsystem connects

  - **MAX-COPY-RC** specifies the maximum return code for dataset copy. When the specified return code is exceeded, the job ends in error.

  - **MAX-RC** specifies the maximum job return code. When the specified return code is exceeded, the job ends in error

  - **MAX-SUBTASKS** specifies the number of subtasks to start

  - **MERGE-PRINT** message output to CKZPRINT and CKZLOG can be combined into CKZPRINT

  - **TCPIP-SERVER-PORT** specifies the port the TCPIP server uses to wait for requests from the source job and the source job uses to connect to the TCPIP server job

  - **TCPIP-STC-NAME** specifies the name of the TCPIP address space the source job and TCPIP server connect to

DB2 Cloning Tool
Both Subsystem and Table Space Cloning Enhancements – V2.2

- **An ISPF interface has been added for both subsystem and table space cloning**

  – This feature allows the user to create the necessary jobs using interactive panels if desired

  – The ISPF interface uses a VSAM data repository to hold cloning profile information for both subsystem and table space cloning

DB2 Cloning Tool Session Summarization

- **DB2 Cloning Tool simplifies and automates database administration tasks**

  - Integrates and coordinates database and storage activities

- **Promote high availability solutions**

  - DB2 Cloning Tool clones DB2 systems fast and effectively
  - DB2 Cloning Tool provides fast and effective refresh operations

- **Integrates storage-based fast replication**

  - Provides fast and non-intrusive cloning operations
  - Copy process is done in the storage processor
  - Reduces host CPU and I/O resource utilization

Q & A