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How a Company in the Healthcare Industry was able to Improve Access to Data through Cloning

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Agenda

- **The IMS Environment**

- **Conversion to IBM IMS Tools**

- **Replicating Databases**

- **Working to Improve Data Access and Availability**

The IMS Environment

The primary application:

- **35 million claims transactions are processed each business day - 180 million weekly**

- **Average host response time is .05 seconds.**

- **The peak transaction rate is 800 per second.**

- **200 Master HALDB's There are 1,906 total HALDB partitions**

- **IMS downtime scheduled thirty minutes per week.**

The IMS Environment

- **IMS is at Version 12 on 37 IMS Systems.**

- **16,000 available MIPS on IBM z10 family processors.**

- **There are 450 IMS message regions. The bulk of the online work is processed on two resource sharing plexed IMS control regions.**

- **Storage: 129 Terabytes of IBM DASD storage. 2,820,660 GB of data on IBM virtual tape.**

What is a BINQ?

- **Batch Inquiry Database**
  - A read-only copy of production databases that are used by various reporting and testing activities
  - Some applications need point-in-time view of data
    - Monthly
    - Weekly
    - Daily
- **Accessible by DLI applications**
  - Long running
  - Less complicated
  - No updates => No logging
  - Less resources than BMPs
  - Can be rerun from same point-in-time
- **Does not access online databases**

Conversion to IBM IMS Tools

Objective:

- Improve scalability, stability, efficiency, maintainability, and availability while lowering the costs of the IMS environment.

- This is to be accomplished by moving to an IBM Best Practices approach and leveraging IBM's IMS tool set and IMS enhancements.

Conversion to IBM IMS Tools

Compelling Reasons to Act

- Insurance membership is growing.
- Membership growth results in commensurate increases in:
  - Transaction volume
  - System loads
  - Batch processing times and online delays
  - Database contention
  - Individual database growth and maintenance
  - Multiple batch checkpointing methods in place
- Production environment requires system software and hardware updates to be completed in phases so as not to interfere with required application changes.
- Customer had reached the limits of existing architectural limits for partitioned databases.
- Desire to move to industry best practices.
- Positioning for future growth on a stable processing environment.
- Identified opportunities to lower the cost of ownership.
- Standardization of the mainframe software portfolio
- Simplify skills requirements
- Desire to process 24 X 7

Converting Neon's PDF to HALDB

- **Neon's PDF was implemented to address database growth**

  – Before HALDBs

- **PDF's needed to be converted to native IMS database type**

- **HALDB conversions**

  - 1,022 PDF's converted to HALDB

    - 68 production databases (6 full function; 62 to HALDB - 2 with partition selection exits)

    - 954 test databases (786 full function; 168 to HALDB - 6 with partition selection exits)

Replicating Databases

- **Full Function Databases**
  - Batch program to put database in read-only state
  - Image copy source database
    - All databases image copied weekly
    - Additional image copies needed for replicating
      - Daily
      - Month-end
  - Recover into target database
    - Leveraged ISV tool that enabled recovery into duplicate data set
    - If not recent IC, many logs needed to be applied
    - Non-recoverable indexes need to be rebuilt
- **Problems**
  - Many additional image copies were being run then needed for backup purposes
  - Recovery was run outside of DBRC -> potential for error

Replicating Databases
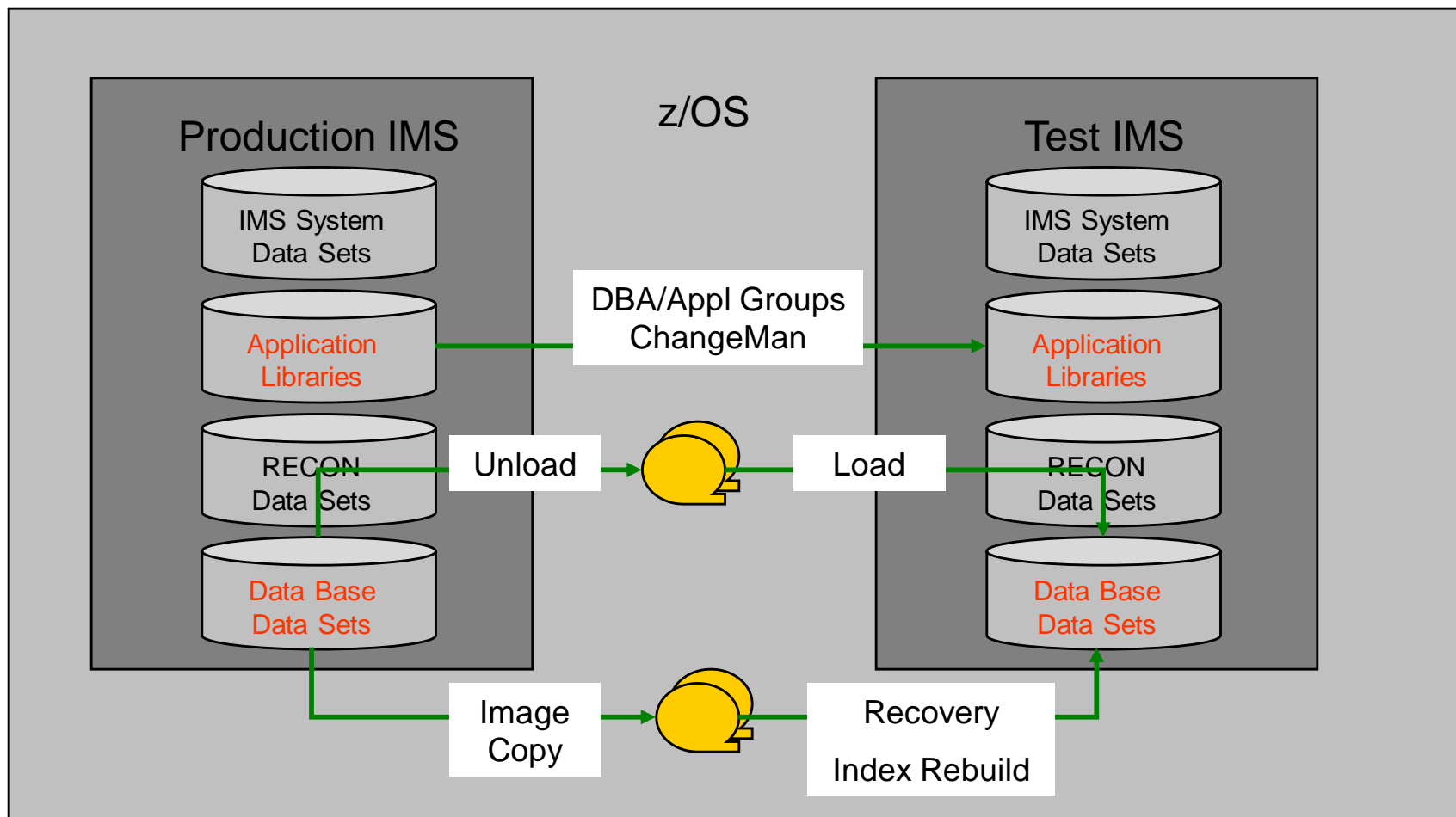
- **HALDB Databases**
  - Required to be registered to DBRC
  - A lot more work to use image copies
  - Batch program to put database in read-only state
  - Unload source database
    - Database must be unavailable for duration of unload
  - Reload into target database
    - All indexes need to be rebuilt
- **Problems**
  - Unload/reload is much slower than image copy/recovery
  - Source database availability is impacted for duration of unload
  - Needed to use for weekly BINQs
  - Two processes for replicating databases

IMS Database Cloning

z/OS

Production IMS

- IMS System Data Sets
- Application Libraries
- RECON Data Sets
- Data Base Data Sets

Test IMS

- IMS System Data Sets
- Application Libraries
- RECON Data Sets
- Data Base Data Sets

DBA/Appl Groups
ChangeMan

Unload → Load

Image Copy → Recovery / Index Rebuild

Database Cloning Statistics

- **Production or read-only DB control region clone jobs**
  - Approx. 60 jobs, most with several steps
    - Daily or Weekly
    - Monthly
  - Approx. 120 full function and HALDB databases
    - Most HALDBs have numerous partitions and growing
  - Additional copy of HALDBs cloned to DB control for read-only
  - Approx. 2.5 TB of IMS data is cloned
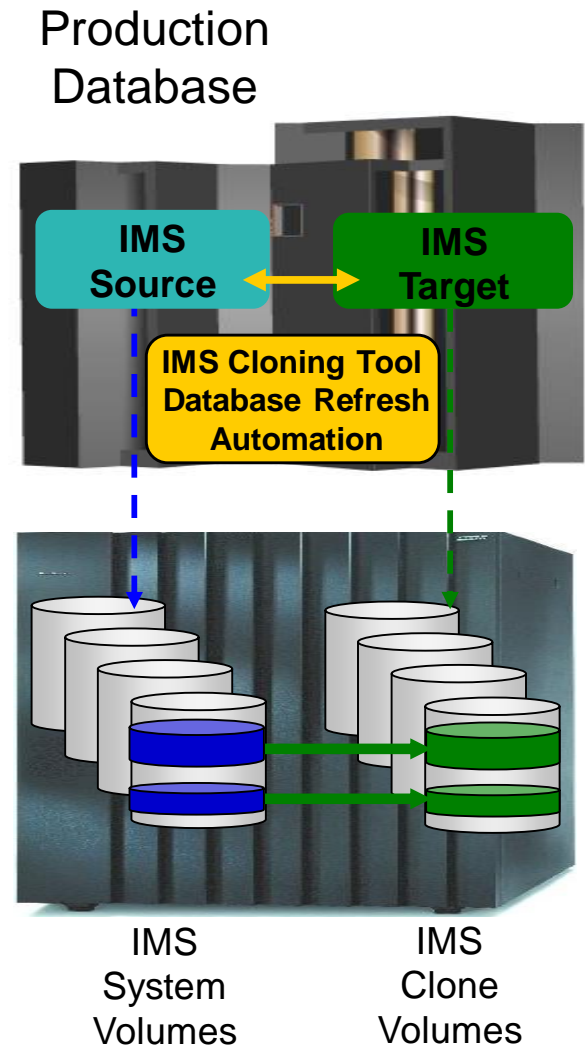 - Approx. 2500+ jobs access the BINQs databases

- **Testing environments**
  - All clone jobs also done in production-like environments
  - SIT -> Systems Integration Testing
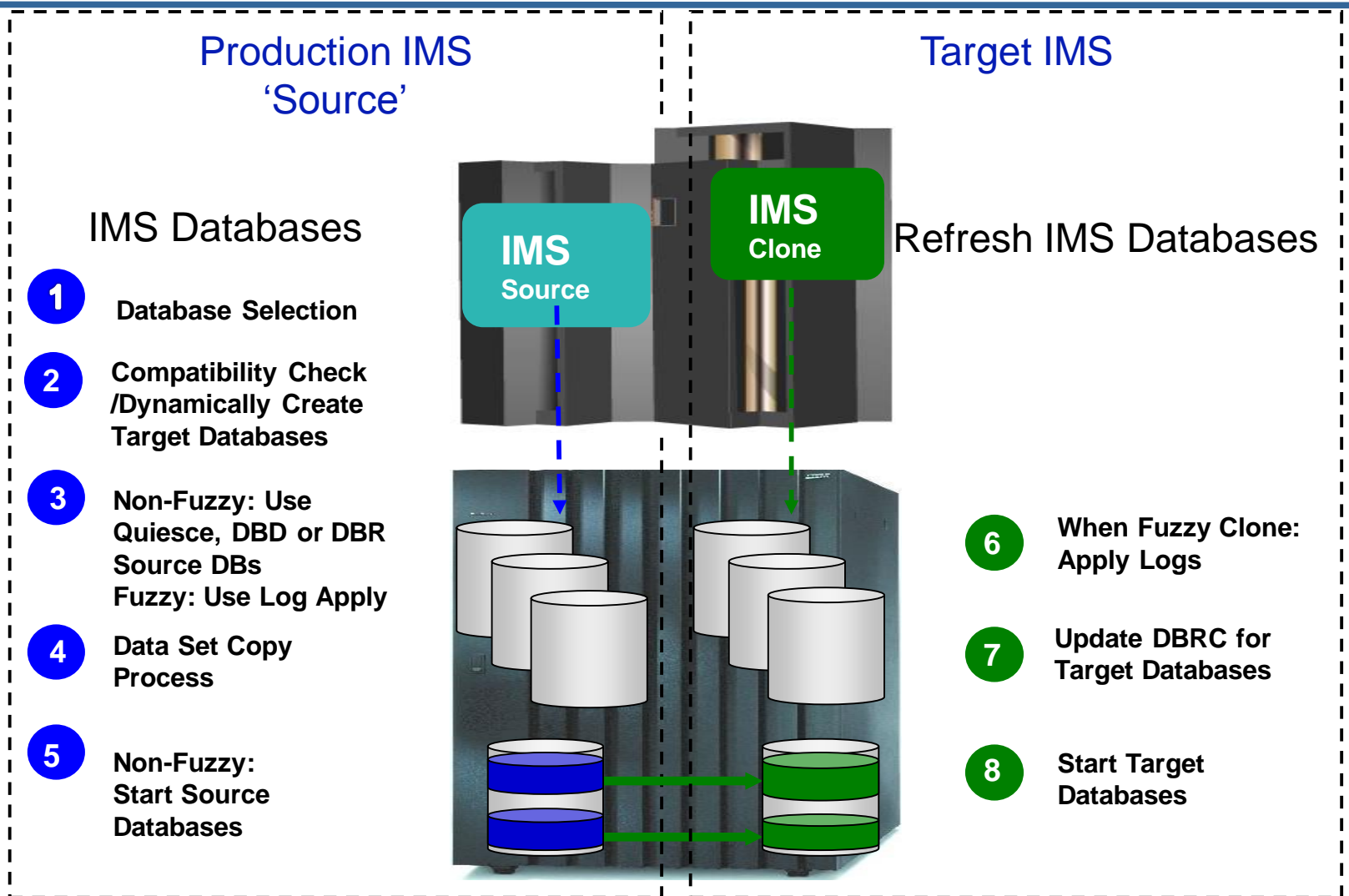 - UAT -> Unit Acceptance Testing

IMS Cloning Tool
Database Cloning Automation

- **Performs automated database refresh operations**
  - Fast refresh of IMS databases
  - IMS DB support (FF, HALDB, DEDB)

- **Verifies source and target database compatibility**

- **IMS data can be copied using storage-based data set fast-replication**
  - Target takes up the same amount of space as the source
  - Host-based copy can also be used

- **Performs target system meta-data management**
  - Updates DBRC information for target databases
  - Supports HALDB special requirements
    - Primary and secondary indexes and ILDS can be copied to eliminate index and ILDS rebuild time
    - Partition and reorg numbers will reflect the source RECON

- **Only read access needed to production data**

Production Database

IMS Source

IMS Target

IMS Cloning Tool Database Refresh Automation

IMS System Volumes

IMS Clone Volumes

Refresh IMS Databases Using IMS Cloning Tool

Production IMS 'Source'

Target IMS

IMS Databases

IMS Source

IMS Clone

Refresh IMS Databases

1 Database Selection

2 Compatibility Check /Dynamically Create Target Databases

3 Non-Fuzzy: Use Quiesce, DBD or DBR Source DBs Fuzzy: Use Log Apply

4 Data Set Copy Process

5 Non-Fuzzy: Start Source Databases

6 When Fuzzy Clone: Apply Logs

7 Update DBRC for Target Databases

8 Start Target Databases

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IMS Cloning Tool
Automation and Simplification

- **Specify database names**

  - Finds the IMS subsystem name and whether it is active

  - Finds the source and target databases and indexes

  - Determines data set names for each database and index

  - Verifies their existence and compatibility

  - Clones the databases

```
IMSDBREFRESH                          -
   IMS-SSID(ssids,ssidt)              -
   DBD(LIFE*)                         -
   INDEXES(Y)                         /* This is the default */
```

Implementation of IMS Cloning Tool

- **Why?**
  - Solve HALDB issues
    - HALDBs required to be registered to DBRC
    - Unload/Reload
  - Standardize method for cloning all databases
    - Full Function
    - HALDB
  - Better manage proliferation of cloning tool jobs
- **Challenges**
  - Source and target database availability
  - Some target databases not defined to an IMS system

Changes Needed in IMS Cloning Tool

- **VERIFY-NO-UPDATERS**

  - IMS CT allows for 'fuzzy' copy, but we needed to guarantee consistent copies

  - No response from /DBD commands

  - Provides list of PSBs with R/W access

- **NOAUTH-TARGETS**

  - Cloning tool must relinquish control of target data sets if they are changing in size

  - Sets PROHIBIT AUTH=YES to prevent access to target database before fully cloned

  - PROHIBIT AUTH = YES reset after clone completed

Benefits over Previous 'Cloning' Solution

- **Data is copied once**
  - Reduces host resources used to replicate data
  - Can leverage FlashCopy to reduce host resources even more
- **Cloning process is the same for Full-Function and HALDB**
- **HALDB partition changes are automatically cloned**
- **Compatibility check guarantees source/target database definitions are in-sync**
  - Prevents potential errors accessing the clone
  - Potentially lengthy errors to diagnose
- **Additional image copies are not registered for source database**
  - Easier to maintain IC GENMAX

IMS Cloning Tool V1.2 Updates – Availability

- **Reduce Source Database Unavailability**
  - DBR command (available in V1.1)
  - DBD command
  - QUIESCE command (requires CSL)
  - Fuzzy copy with log apply

- **Customer Plan:**
  - Evaluate impact of log apply
    - Log archiving
    - Longer running 'clone' jobs
  - Complete CSL implementation
  - Implement either DB QUIESCE or log apply

IMS Cloning Tool V1.2 Updates – Ease of Use

- **ISPF UI**
  - Shared UI with DB2 Cloning Tool
  - IMS system information can be defined and saved in shared control file
  - Database refreshes can be done by end user

- **Customer Implementation Plan:**
  - Look at exposing DB refresh capabilities to non-DBAs in non-production environments

IMS Cloning Tool V1.2 Updates – Data Protection

- **Data Masking**
  - Sensitive or private data can be masked during database cloning

  - No restrictions on what data can be masked
    - Compressed segments
    - Key fields
    - Logically related segments
  - Segment data can be described by FIELD statements or IMS Cloning Tool definitions

- **Customer Plan:**
  - Evaluate masking rules

  - Understand cloning process when masking
    - Unload/reload versus data set copy

  - Look at use cases for masking IMS data only

Future improvements suggested and accepted by IBM

- **Clone only subset of data**
  - Not all partitions need to be cloned to test environments
  - Without impact to source database availability

- **More granular security settings**
  - Needed to enable database refreshing to non-DBAs
  - Control functionality by IMS subsystem
  - Restrict changing/overriding of parameters

Summary

- **Cloning databases enhances applications through:**
  - Query/reporting type applications without affecting OLTP
  - Simpler logic/process to provide point-in-time reporting

- **Improvements in the cloning process has:**
  - Reduced impact to source databases
  - Allowed cloning to be looked at as a quick way to make data available to end users
  - Reduces resources needed to maintain and change cloning process

- **Working with IBM on future changes to expand 'cloning' capabilities even further**

Thank You