Update DB schema or PGM view in managed ACBs environment

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- He is software engineer and architect, sometimes solves customer cases too, but he was also part of product management.

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Agenda

- Environment description, prerequisites

- Populate utility DFS3PU00

- SQL Data Definition Language (DDL) way

- IMPORT CATALOG command

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Introduction

- This is continuation of IMS mACB Migration presentation which showed how to create and initialize IMS Catalog and Directory in easy/automatic way

- This presentation shows multiple ways updating IMS Catalog and Directory instances of DBDs and PSBs
  - Create and modify DBDs and PSBs

- Will progress from "static" DBD/PSB definitions to "dynamic changes"

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IMS Catalog and Directory configuration

- Two IMS regions
  - Registered in one DBRC region using shared recon data set
  - Database data set **block** sharing – using IRLM
  - Using shared ACB libraries (ACBSHR=Y)
  - Using CSL: SCI, OM, RM and RS

- Both IMS regions can access the same database data
  - DB schemas are actual for both

- One IMS can be brought down for maintenance
  - IMS catalog and directory remains "up" for the other system; it's a single point of failure
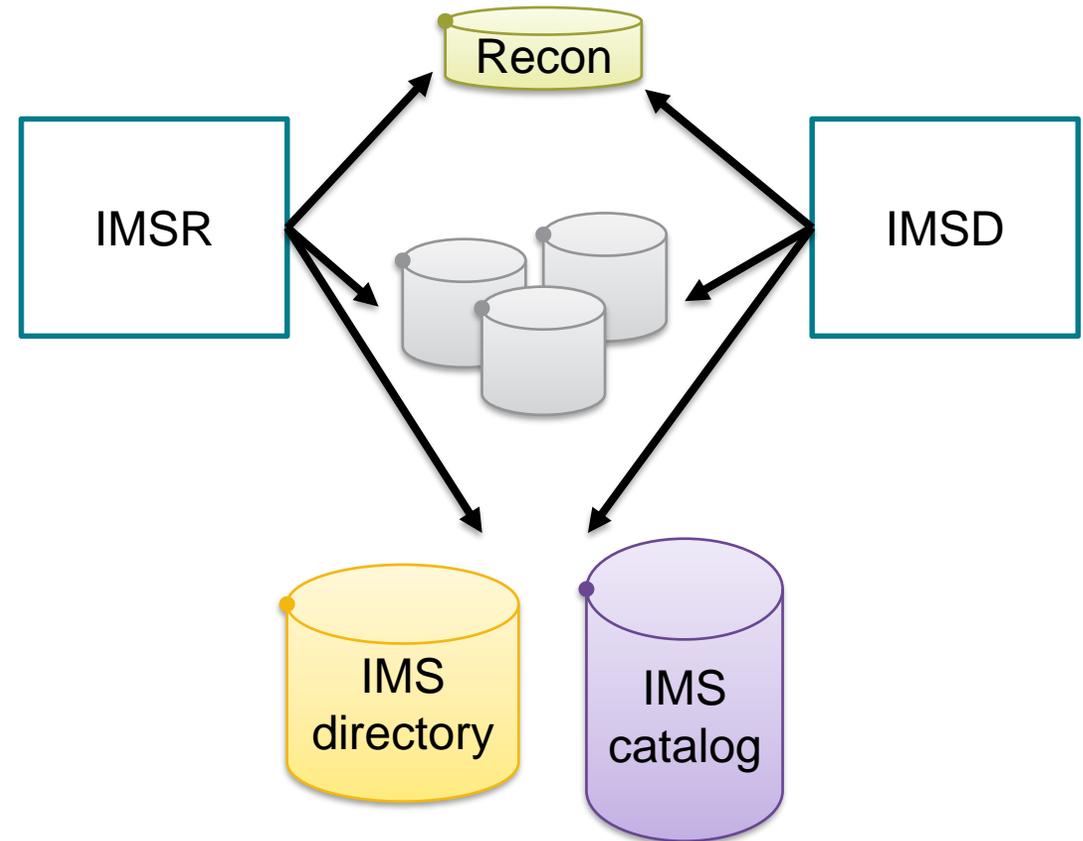
Batch update with Populate utility

DFS3PU00 usage

- Why would you update schema using IMS Catalog Populate utility (DFS3PU00) when you can use DDL?

- Must implement IMS Catalog and IMS Managed ACBs, but…
  - Want to invest small effort
  - Don't want to convert all DBDs/PSBs into DDL
  - Don't want install and configure IMS Connect and ODBM
  - You have only batch applications and offline IMS Catalog and mACB

DFS3PU00 usage

Basic JCL

```
//CATALOG   EXEC PGM=DFS3PU00,
// PARM=(DLI,DFS3PU00,DFSCPL00,,,,,,,,,,,Y,N,,,,,,,,,,,'DFSDF=CAT')
//STEPLIB   DD DISP=SHR,DSN=&IMSID..SDFSRESL
//DFSRESLB  DD DISP=SHR,DSN=&IMSID..SDFSRESL
//IMS       DD DISP=SHR,DSN=&IMSID..DBDLIB
//          DD DISP=SHR,DSN=&IMSID..PSBLIB
//PROCLIB   DD DISP=SHR,DSN=&IMSID..PROCLIB.INITLOAD
//SYSABEND  DD SYSOUT=*
//SYSPRINT  DD SYSOUT=*
//IEFRDER   DD DISP=(,CATLG),DSN=&IMSID..SLDSP.LOG(+1),
//             SPACE=(TRK,(5,5),RLSE),UNIT=SYSALLDA
//DFSVSAMP  DD DISP=SHR,DSN=&IMSID..PROCLIB.INITLOAD(DFSVSAMP)
//IMSACB01  DD DISP=SHR,DSN=&IMSID..ACBLIBA
//RECON1    DD DISP=SHR,DSN=&RECONPFX..RECON1
//RECON2    DD DISP=SHR,DSN=&RECONPFX..RECON2
//RECON3    DD DISP=SHR,DSN=&RECONPFX..RECON3
//SYSINP    DD *
MANAGEDACBS=SETUP
```

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DFS3PU00 usage

- IMS Catalog Populate utility (DFS3PU00) common DDs
  - PROCLIB DD: for DLI batch job contains DFSDFxxx member. Suffix specified in EXEC PARM
  - IMS DD: specially for importing GSAM databases
  - IMSACB01, IMSACB02 … IMSACBxx DDs: input ACB libraries for import
  - SYSINP DD: control statements

- Control statements:
  - MANAGEDACBS={SETUP | UPDATE | STAGE}
  - DUPLIST, ISRTLIST
  - ERRORMAX=
  - RESOURCE_CHPK_FREQ=, SEGMENT_CHKP_FREQ=

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DFS3PU00 usage

- MANAGEDACBS=SETUP
  - Initial load of IMS Catalog and Directory
  - Automatically allocates catalog and directory data sets
    - Can drop mACB data sets and initially load them over and over, for example in testing environment
  - If the IMS catalog PSB DFSCP001 is specified in the utility JCL, the utility inserts any new or modified DBDs or PSBs into the active IMS Catalog and Directory.
  - Processes all ACBs from IMSACBxx DDs
  - Used for ACBMGMT=ACBLIB in DFSDFxxx member
  - Can not execute as BMP job
  - Needs exclusive access, online IMS needs to be down for both DFSCPL00 and DFSCP001
    - Suitable for pure batch manipulation with IMS Catalog

DFS3PU00 usage

or DFSCP001

```
//CATALOG   EXEC PGM=DFS3PU00,
//  PARM=(DLI,DFS3PU00,DFSCPL00,,,,,,,,,,,Y,N,,,,,,,,,,,'DFSDF=CAT')
//STEPLIB  DD DISP=SHR,DSN=&IMSID..SDFSRESL
//DFSRESLB DD DISP=SHR,DSN=&IMSID..SDFSRESL
//IMS      DD DISP=SHR,DSN=&IMSID..DBDLIB
//         DD DISP=SHR,DSN=&IMSID..PSBLIB
//PROCLIB  DD DISP=SHR,DSN=&IMSID..PROCLIB.INITLOAD
//SYSABEND DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//IEFRDER  DD DISP=(,CATLG),DSN=&IMSID..SLDSP.LOG(+1),
//            SPACE=(TRK,(5,5),RLSE),UNIT=SYSALLDA
//DFSVSAMP DD DISP=SHR,DSN=&IMSID..PROCLIB.INITLOAD(DFSVSAMP)
//IMSACB01 DD DISP=SHR,DSN=&IMSID..ACBLIBA
//RECON1   DD DISP=SHR,DSN=&RECONPFX..RECON1
//RECON2   DD DISP=SHR,DSN=&RECONPFX..RECON2
//RECON3   DD DISP=SHR,DSN=&RECONPFX..RECON3
//SYSINP   DD *
MANAGEDACBS=SETUP
```

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DFS3PU00 usage

- MANAGEDACBS=UPDATE
  - updates active instances directly
    - requires exclusive access, so catalog and directory must go offline and so IMS too
  - Processes all ACBs from IMSACBxx DDs, can not select DBD/PSB by name
    - IMS Catalog instances added always with whatever timestamp
    - LATEST – only updates Directory when ACB timestamp is higher
    - UNCOND – updates Directory always regardless ACB timestamp
  - Use PSB DFSCP001 in the utility JCL
  - Processes all ACBs from IMSACBxx DDs
  - Used for ACBMGMT=CATALOG in DFSDFxxx member

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DFS3PU00 usage

```
//CATALOG   EXEC PGM=DFS3PU00,
//  PARM=(DLI,DFS3PU00,DFSCP001,,,,,,,,,,,Y,N,,,,,,,,,,,'DFSDF=CAT')
//STEPLIB  DD DISP=SHR,DSN=&IMSID..SDFSRESL
//DFSRESLB DD DISP=SHR,DSN=&IMSID..SDFSRESL
//IMS      DD DISP=SHR,DSN=&IMSID..DBDLIB
//         DD DISP=SHR,DSN=&IMSID..PSBLIB
//PROCLIB  DD DISP=SHR,DSN=&IMSID..PROCLIB
//SYSABEND DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//IEFRDER  DD DISP=(,CATLG),DSN=&IMSID..SLDSP.LOG(+1),
//            SPACE=(TRK,(5,5),RLSE),UNIT=SYSALLDA
//DFSVSAMP DD DISP=SHR,DSN=&IMSID..PROCLIB.INITLOAD(DFSVSAMP)
//IMSACB01 DD DISP=SHR,DSN=&IMSID..ACBLIBA
//RECON1   DD DISP=SHR,DSN=&RECONPFX..RECON1
//RECON2   DD DISP=SHR,DSN=&RECONPFX..RECON2
//RECON3   DD DISP=SHR,DSN=&RECONPFX..RECON3
//SYSINP   DD *
MANAGEDACBS=(UPDATE,LATEST)
```

DFS3PU00 usage

- MANAGEDACBS=STAGE

- Imports from ACBLIB into IMS Catalog and Directory staging level
  - Operates truly online, no Catalog and Directory outage/offline
  - Needs IMPORT DEFN SOURCE(CATALOG) command later

- Used for ACBMGMT=CATALOG in DFSDFxxx member

- Can execute as DLI or BMP
  - BMP job requires less parameters (no IRLMNM, DFSDF suffix, DFSVSAMP)

- Processes all ACBs from IMSACBxx DDs, can not select DBD/PSB by name
  - IMS Catalog instances added always with whatever timestamp
  - LATEST – only updates Directory when ACB timestamp is higher
  - UNCOND – updates Directory always regardless ACB timestamp

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DFS3PU00 usage

```
//CATALOG  EXEC PGM=DFS3PU00,
// PARM=(BMP,DFS3PU00,DFSCP001,,,,,,,,,,,IMSR,,,,,,)
//STEPLIB  DD DISP=SHR,DSN=&IMSID..SDFSRESL
//DFSRESLB DD DISP=SHR,DSN=&IMSID..SDFSRESL
//IMS      DD DISP=SHR,DSN=&IMSID..DBDLIB
//         DD DISP=SHR,DSN=&IMSID..PSBLIB
//SYSABEND DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//IMSACB01 DD DISP=SHR,DSN=&IMSID..ACBLIBA
//RECON1   DD DISP=SHR,DSN=&RECONPFX..RECON1
//RECON2   DD DISP=SHR,DSN=&RECONPFX..RECON2
//RECON3   DD DISP=SHR,DSN=&RECONPFX..RECON3
//SYSINP   DD *
MANAGEDACBS=(STAGE,LATEST)
```

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Data Definition Language (DDL)

- Already supported Data Manipulation Language (DML)
  – select, insert, update and delete queries

- Data Definition Language (DDL)
  – Create, alter, drop
  – Database or Program view

- Replaces only DBD, PSB and ACB gen
  – Similar as population utility DFS3PU00
  – DBRC registration, data set allocation must be done manually afterwards

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zDDL

- New utility DFS3ID00 to issue DDL from mainframe batch job environment
  - Database and program views put on staging or active directory level

- Executes as BMP
  - doesn't require IMS Connect nor ODBM region

- Introduced in IMS 15.3

- Additional control statements:
  - VERBOSE, AUTOCOMMIT, SIMULATE
  - DYNAMICPROGRAMVIEW
    - allows overriding AUTOIMPORT from <CATALOG> section

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zDDL

```
//BMP      EXEC PGM=DFS3ID00,PARM=(BMP,DFS3ID00,DFSCP001,,,,,,,,,,IMSR,,,,,)
//STEPLIB  DD  DISP=SHR,DSN=&IMSID..SDFSRESL
//DFSRESLB DD  DISP=SHR,DSN=&IMSID..SDFSRESL
//PROCLIB  DD  DISP=SHR,DSN=&IMSID..PROCLIB
//SYSPRINT DD  SYSOUT=*
//SYSABEND DD  SYSOUT=*
//SYSINID  DD  *
  VERBOSE AUTOCOMMIT
//IMSSQL   DD  *
  CREATE DATABASE SAMPLE1;

  CREATE TABLE TABLE1(COLUMN1 INT PRIMARY KEY,
                      COLUMN2 DECIMAL(8,3),
                      COLUMN3 CHAR(20),
                      COLUMN4 DOUBLE);
```

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zDDL

VERBOSE AUTOCOMMIT

```
|-------------------------------------------------------------------------------------------------|
| PARSED  | DROP DATABASE SAMPLE1 IF EXISTS;                                                       |
| PARSED  | CREATE DATABASE SAMPLE1;                                                               |
| PARSED  | CREATE TABLE TABLE1(COLUMN1 INT PRIMARY KEY, COLUMN2 DECIMAL(8,3), COLUMN3 CHAR(20), COLUMN4 DOUBLE); |
| PARSED  | CREATE TABLE TABLE2(COL1 INT PRIMARY KEY, COL2 CHAR(50), COL3 INT, FOREIGN KEY REFERENCES TABLE1); |
| PARSED  | DROP PROGRAMVIEW SAMPLEP1 IF EXISTS;                                                   |
| PARSED  | CREATE PROGRAMVIEW SAMPLEP1 (CREATE SCHEMA PCB1 USING SAMPLE1 (CREATE SENSEGVIEW TABLE1, CREATE SENSEGVIEW TABLE2) ) L |
|         | ANGASSEM;                                                                             |
| SUCCESS | AUTO COMMIT DDL                                                                        |
|-------------------------------------------------------------------------------------------------|
```

```
|==================================================================|
|                         DDL EVENTS                               |
|==================================================================|
| Event     | Resource | Return   | Reason   | Status | Timestamp    |
|           |          | Code     | Code     | Code   | (TSVERS)     |
|==================================================================|
| INIT DMU  | DFSD0002 | 00000000 | 00000000 |        |              |
| GHU       | SAMPLE1  | 00000000 | 00000000 |        |              |
| GHU       | SAMPLEP1 | 00000000 | 00000000 |        |              |
| IR        | SAMPLE1  | 00000000 | 00000000 |        | 2307909233135 |
| IR        | SAMPLEP1 | 00000000 | 00000000 |        | 2307909233135 |
| CHKP      | DFSCD000 | 00000000 | 00000000 |        |              |
|------------------------------------------------------------------|
```

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Database Console using JDBC

- Java Database Connectivity

- Supports connection to IMS from MF system or outside using TCP/IP

- Requires IMS Connect and ODBM region

- Java application using JDBC driver to connect to database
  - User written application in Java
  - IBM IMS Explorer for Development
  - Any other database console, e.g. IntelliJ IDEA plugin DB Navigator

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Database Console using JDBC

- Requires IMS Universal JDBC driver
  - usually from IMS installation in IMS.ADFSJHFS data set

- JDBC connection string
  - jdbc:ims://host:port/psbName:options
  - Some options are:
    - user= and password=
    - currentSchema=DFSCP001;
    - llField=true;
    - maxRows=xx;
  - IMS Explorer for Development helps wit assembling the string

Database Console IMS Explorer for Development

Database Console IntelliJ IDEA plugin DB Navigator
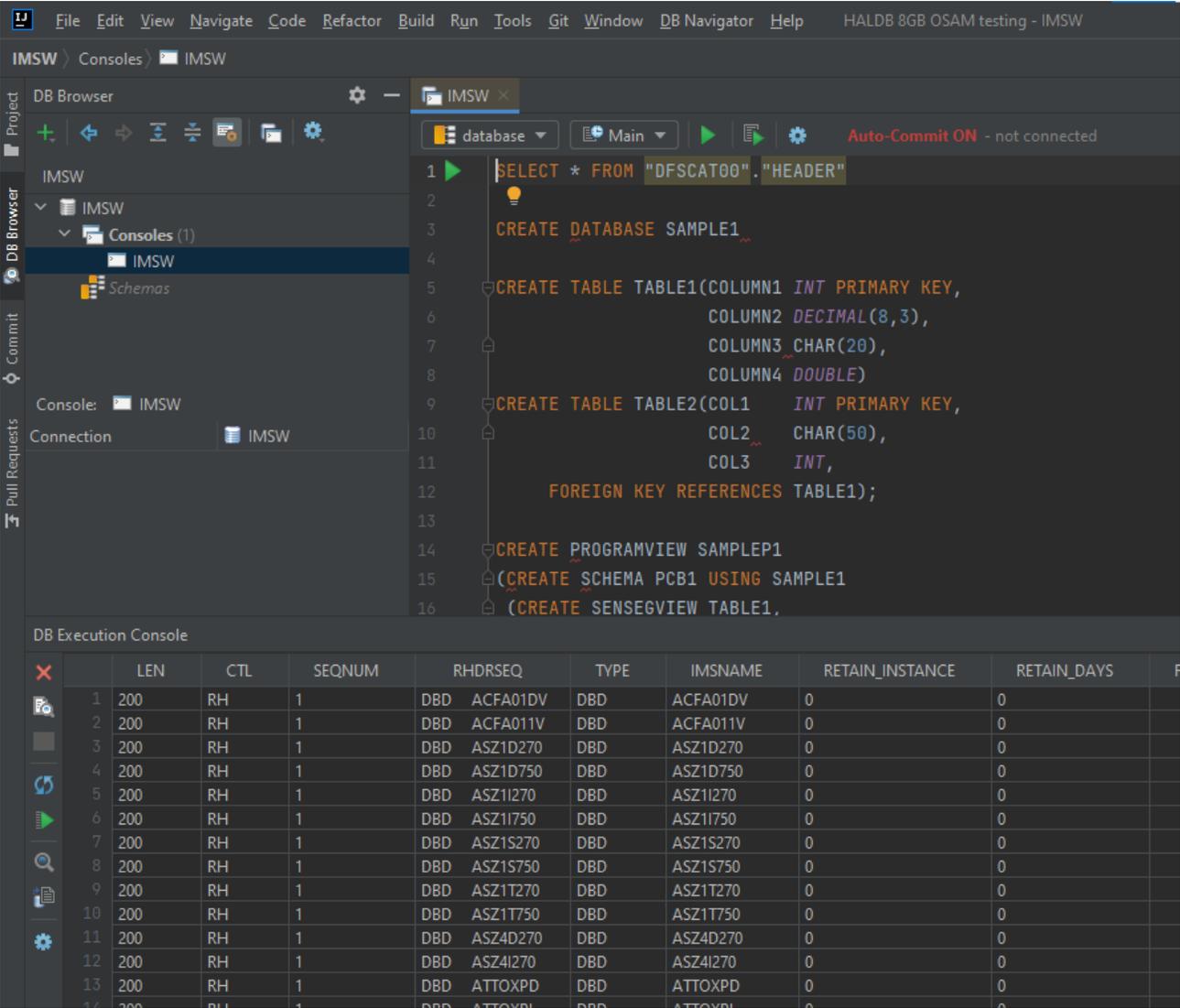
IMPORT CATALOG command

IMPORT DEFN SOURCE(CATALOG)

- Using DFS3PU00 or DDL leaves DBDs/PSBs in Staging directory data set

- IMPORT DEFN SOURCE(CATALOG) moves them to Active Directory

- Type-2 command with no type-1 equivalent

- Various command options
  - NAME(A*)
  - OPTION(NOCHECK), OPTION(UPDATEPSB), OPTION(REFRESHPSB)

- Not required for DDL CREATE when AUTOCREATE= or AUTOIMPORT (CREATE)
  - Applies for Full Function, Fast Path and HALDBs

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Comparison of available schema changes approaches

Modernize →

Availability →
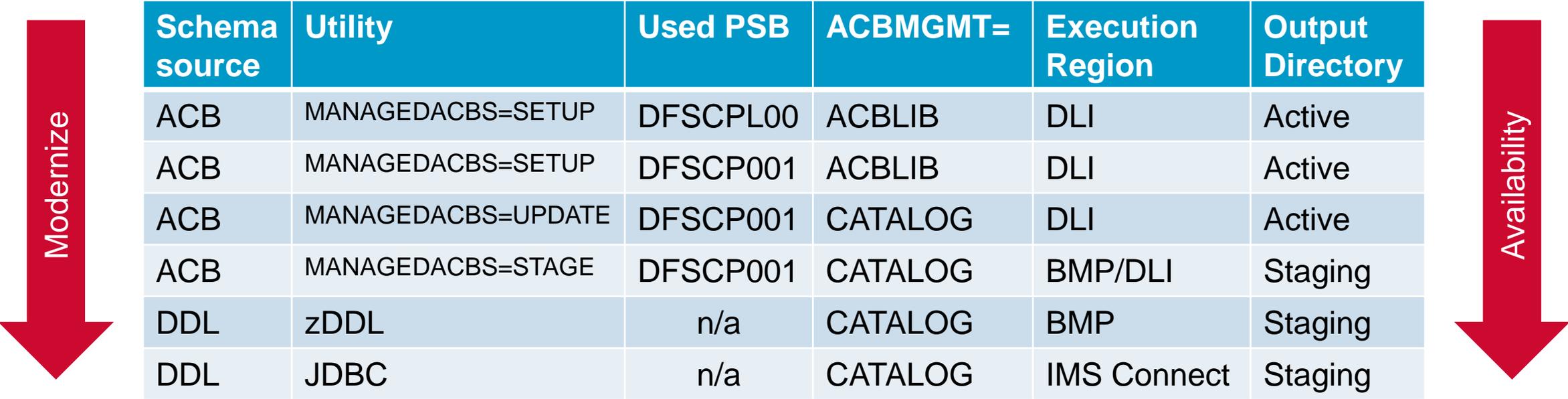
Schema source	Utility	Used PSB	ACBMGMT=	Execution Region	Output Directory
ACB	MANAGEDACBS=SETUP	DFSCPL00	ACBLIB	DLI	Active
ACB	MANAGEDACBS=SETUP	DFSCP001	ACBLIB	DLI	Active
ACB	MANAGEDACBS=UPDATE	DFSCP001	CATALOG	DLI	Active
ACB	MANAGEDACBS=STAGE	DFSCP001	CATALOG	BMP/DLI	Staging
DDL	zDDL	n/a	CATALOG	BMP	Staging
DDL	JDBC	n/a	CATALOG	IMS Connect	Staging

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Thank you.

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