# C02 A Data Definition Language for Multiple Data Types

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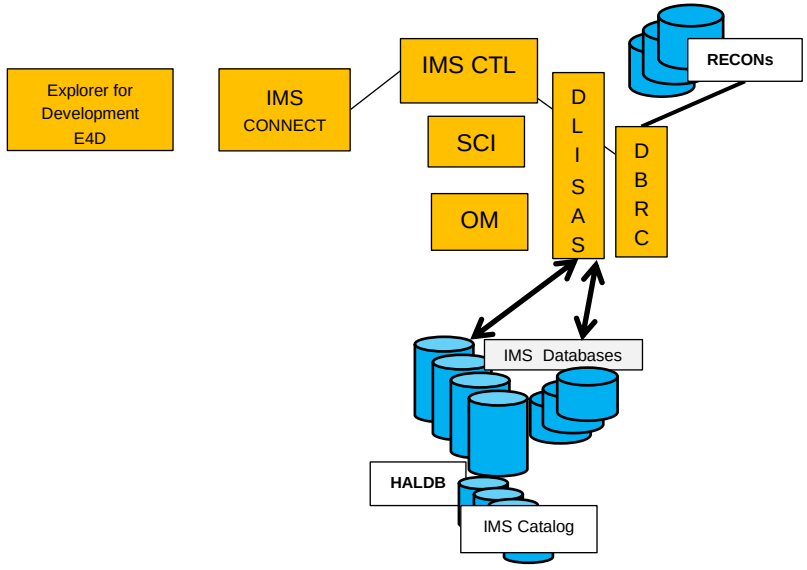
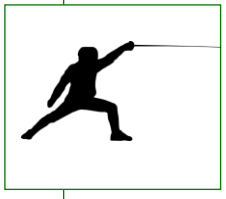
# Agenda

- Background
- Implementation and Usage
- Using IMS Explorer for Development with DDL
- Using the Batch SQL Utility for DDL
- Samples

# Dynamic Database Definition

- **Increasing the availability of IMS environments**
  - High Availability Large Database HALDB
  - IMS Connect
  - Dynamic Resource Definition DRD
  - IMS Catalog V12
  - SQL with COBOL V13
  - **IMS Managed ACBs V14**
  - **Data Definition Language V14**



## Why this is important

- DDL is the industry standard
- DDL-authoring tools are prevalent in the market

# Data Definition Language – DDL

- Generically, Data Definition Language refers to any formalized language that describes data, information structures of a data construct or access to those structures.

- The language uses a collection of command verbs to manipulate control schemas. Schemas can be manipulated: they may be added, changed or deleted during the life of the formalized data construct.

- DDL is often considered a subset of SQL.

## Dynamic Database Definition

- **Data Definition Language – DDL**

  All database systems have a uniqueness to the data structures required in their specific environment.

  – Standard DDL + DBMS specific Extensions

  – IMS is no different in this respect.

  – IMS 14 provides for using the standard DDL.

  – IMS 14 also includes extensions specific to IMS structures to allow more detailed database definitions. These extensions closely match the current non DDL definitions used in IMS.

# Dynamic Database Definition

- **Leverage the Industry standard Data Definition Language (DDL) to affect database and schema changes.**
  - Exploit DDL authoring tools such as the IMS Enterprise Suite Explorer for Development (E4D) to model database changes and create DDL.
    - DDL – authoring tools are prevalent in the market.
    - DDL – authoring tools use IMS Universal drivers or supporting tooling.
  - Align with industry practices and expectations.
- **Uses the IMS 14 Catalog as the trusted Repository**
  - IMS 14 provides for the IMS Catalog to be the central focal point for IMS database and program changes.
- **Dynamic implementation of IMS control blocks.**
  - Reduced time and complexity of creating IMS databases and program definitions.
  - An alternative to proprietary PSBGEN, DBDGEN, and ACBGEN processes.
  - Changes may be activated when committed
- **Provide an audit trail capturing changes made:**
  - Log record x'2A' for DDL Information.
  - Log record x'2B' for IMS Catalog changes.
  - SMF type 29 sub-type 3 for Catalog activity.

# IMS and DDL value additions

- **Simplifies the process of adding a new database resource**
  - Without DDL:
    - Define your database characteristics (DBD).
    - Compile/link database definitions (DBDGEN).
    - Define your program specifications (PSB).
    - Compile/link your program specifications (PSBGEN).
    - Perform ACBGEN.
    - Allocate database data sets.
    - Define DBRC definitions.
    - Define IMS database for dynamic allocation (MDA).
    - Initialize and Load IMS databases.
    - Define database and program online resource definitions:

      *CREATE DB / PGM command to create the database and program (DRD).*

      *Specify system definition macros and Online Change.*
    - Perform online change to load IMS application-related definitions (MOLC).
    - Establish database recovery point by taking an image copy (IC).
    - Start IMS resources: - Databases, Programs, Transactions, Route Codes

# IMS and DDL value additions

- **Simplifying the process of adding a database resource.**
  - With DDL:
    - Generate the DDL statements for the database and program views.
    - Submit DDL statements

      *DDL changes will be held in the IMS Catalog in a pending state.*
    - Allocate database data sets.
    - Define DBRC definitions.
    - Define IMS database for dynamic allocation (MDA).
    - Initialize and Load IMS databases.
    - Define database and program online resource definitions:

      *CREATE DB / PGM command to create the database and program (DRD).*

      *Specify system definition macros and Online Change.*
    - Activate the database and program definitions.

      *IMPORT DEFN SOURCE(CATALOG)*
    - Establish database recovery point by taking an image copy (IC).
    - Start IMS resources: - Databases, Programs, Transactions, Route Codes

## IMS and DDL value additions

- **Simplifies the process of adding new application metadata to the Catalog**
  - Without DDL:
    - The DBD source would have to be updated with the COBOL copybook or PL/I include information for each segment overlay
    - DBDGEN / ACBGEN needs to be performed
    - Online Change needs to be completed
  - With DDL:
    - DDL ALTER TABLE to add the information to the catalog and make it available with the IMPORT command

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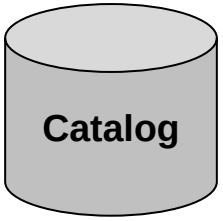
# Dynamic Database Definition

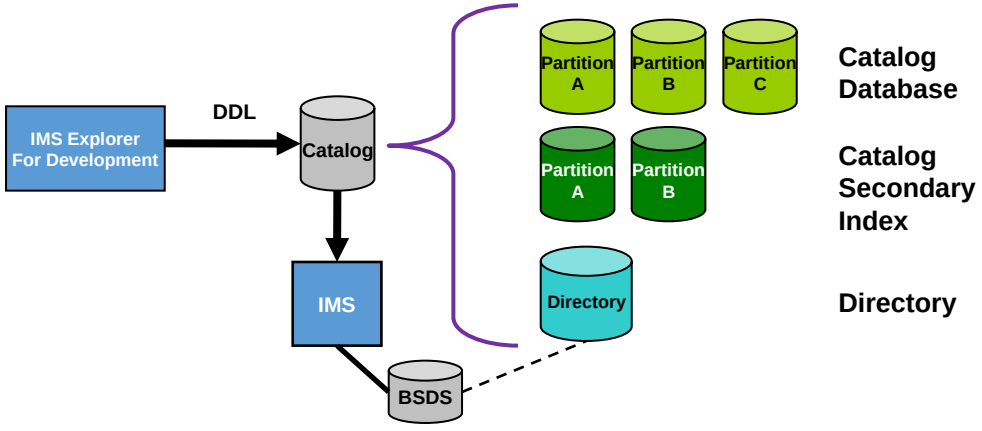



- IMS Catalog must be implemented.
- IMS Management of ACBs must be enabled.
- DDL is supported only through:
  - Java™ client using the IMS Universal drivers.
  - IMS Enterprise Suite Explorer for Development.
  - Additional tools that support the IMS Universal drivers.
- Manual steps are required for database changes.
  - User makes DDL change to the catalog.
  - Perform manual steps such as data base load/reload, image copy.
  - IMPORT the changes from the catalog into IMS.

    *IMPORT DEFN SOURCE(CATALOG)*
- The user must have security authority to use the IMS Catalog PSB DFSCP001.

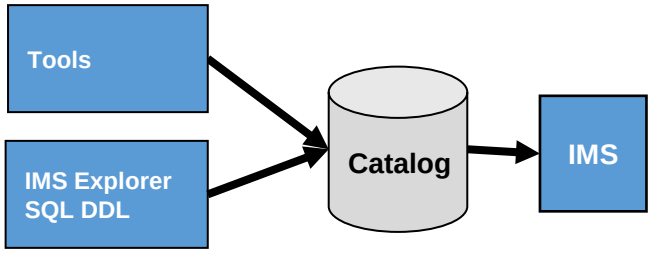
# Dynamic Database Definition

- **IMS 14 Catalog**
  - An IMS Catalog is made up of several components
    - A catalog HALDB database (many partitions, 4 Data Set Groups)
    - A Secondary Index
    - Directory dataset(s)



# Implementing DDL – IMS Managed ACBs Setup

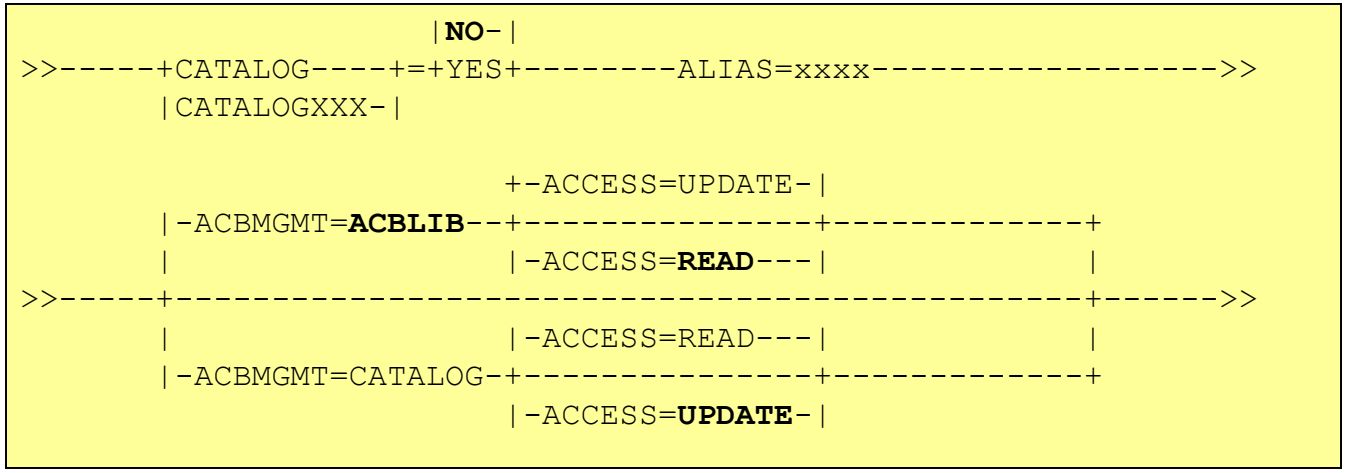
- **IMS Managed ACBs must be enabled before DDL processing is allowed**
- **New IMS Catalog user:**
  - Set up the IMS catalog database
    - Generate the supplied DBDs & PSBs
    - Generate the ACBs
    - DFSDFnnn proclib member update or DFS3CDX0 exit
    - DBRC definition
  - Populate the IMS catalog from running ACBLIB(s)
    - DFS3PU00 utility with MANAGEDACBS=SETUP
  - Enable IMS to use the IMS catalog and directory by specifying IMS Managed ACBs is enabled in the DFSDFxxx PROCLIB member or the equivalent user exit (DFS3CDX0)
  - Restart IMS region




- **Existing IMS Catalog user:**
  - Augment the catalog with information to allow IMS to use this as its ACB information source.
    - DFS3PU00 utility with MANAGEDACBS=SETUP
  - Enable IMS to use the IMS catalog and directory by specifying IMS Managed ACBs is enabled in the DFSDFxxx PROCLIB member or the equivalent user exit (DFS3CDX0) for DBCTL users
  - Restart IMS region

# Implementing DDL - – IMS Managed ACBs Setup (cont.)

## DFSDFxxx syntax




CATALOG default is **NO**
ACBMGMT default is **ACBLIB**
ACCESS default is **READ** when ACBMGMT is ACBLIB
ACCESS default is **UPDATE** when ACBMGMT is CATALOG

# Resource Name Comparison

- IMS will support the standard DDL syntax for CREATE, ALTER and DROP of Databases and Tables
  - Consume the standard DDL generated without IMS affinity
- The equivalent IMS to DDL statements are shown in the Table here.

| IMS | GEN statement | DDL |
|---|---|---|
| Database | DBD | DATABASE |
| Segment | SEGM | TABLE |
| Field | FIELD | COLUMN |
| Dataset | DATASET | TABLESPACE |
| Area | AREA | TABLESPACE |
| Program | PSBGEN | PROGRAMVIEW |
| PCB | PCB | SCHEMA |
| Senseg | SENSEG | SENSEGVIEW |

# IMS specific parameters in DDL

- **The DDL standard does not contain all of the options for IMS**
  - It is not IMS specific
  - Other DBMSs have similar specific requirements

- **Many options existing in the PSBGEN and DBDGEN macros are unique to IMS.**
  - e.g., DB Access Types: PHIDAM, HIDAM, PHDAM, etc.

- **IMS provides defaults based on access types**
  - Modifiable to user requirements
  - The recommended defaults can be seen in the syntax train tracks in the IMS SQL programming reference

# DDL defaults and Enhanced IMS syntax

- Overriding the IMS system defaults
  - Enhanced DDL syntax
- All parameters that can be specified in the DBDGEN or PSBGEN macros are optional parameters in the IMS Enhanced DDL syntax
- The IMS Enhanced DDL syntax can be used with existing defaults
  - Defaults values may be overridden when specified
- DDL syntax has also been Enhanced to fully specify their PSB definitions via PROGRAMVIEW

## Standard DDL syntax - continued

Multiple DDL statements are needed in order to describe an IMS database, such as: database organization type, access method, record mapping and record relationships.

- Database
- Table spaces (dataset/area)
- Tables (segments) and columns (field) mappings in a database record.
- Relationships with other databases Primary keys and foreign keys.
- Programview (PSB) describing a program's characteristics.
  - Tables and columns to which the program is sensitive

## Creating resources

**CREATE *resource_name***

- A resource can be created based on IMS defined defaults
- A resource can be created from scratch specifying all the needed attributes for the resource being defined.
- A created resource may be imported to active status in the IMS.
- A created resource is always a new resource.
  - A DRD or Sysgen is needed for IMS to be aware of the resource.

# Altering resources

**ALTER resource_name**

- Resource must currently exist in the catalog.
- Resource defaults do not apply.
- The alter is applied only to the value(s) being altered.
- Values that are not specifically altered remain the same.
- An altered resource must be manually imported to Active status in the IMS in most cases.
- PRGRAMVIEWs cannot be altered

# Dropping resources

**DROP resource_name**

- Resource must currently exist in the catalog.
- Dropping some resources may cause an ALTER to occur to an existing resource.
  - e.g. the Drop of a TABLESPACE within a DATABASE
- A Dropped resource is manually imported to remove its active status in the IMS.
  - System definitions are not removed

# DDL Processing

- **Upon receiving the DDL statements**
  - Updates in catalog are locked until a COMMIT DDL

    *This can impact other catalog access.*
  - Once committed, changes are held pending activation

    *Some changes may be activated immediately*
  - Changes are activated via the IMPORT command

    *IMPORT DEFN SOURCE(CATALOG)*
- **No need to use Online Change or recycle IMS system to activate an ACB**

# DDL Update Activation

- **During the IMPORT from the IMS catalog IMS will do the following:**
  - Automatically quiesce and stop all activity on resources impacted by any catalog changes.
  - Remove all old copies of the resources from memory.
    - This will cast out DMBs and PSBs from their respective pools.
  - Coordinate the change across the IMSplex for sharing IMS catalogs.
  - Apply the pending changes from the IMS catalog into the directory.
  - Make all of the previously quiesced resources available after the change to the catalog has been activated.
- **IMS Resources are now available**

# DDL Activation – Impact

- Some DBRC commands are enhanced to either specify a catalog name or display the current default IMS catalog
- New messages may need to be monitored
- IMS Utility changes to access the catalog
- Exit DFS3CXD0 may need modification

# DDL Creating an IMS database

- The following scenario focuses on the elements of the database creation that apply to most database types.
  - User uses Explorer to model the database graphically
  - User uses Explorer to create the DDL
  - Create DDL for DBD(s)
    - CREATE DATABASE, TABLESPACE, TABLE, FIELD(s)
  - Create DDL for PSB (user or dynamic)
    - CREATE PROGRAMVIEW, SCHEMA
  - Explorer notifies user the impact of the DDL
  - User submits the DDL to IMS (this could be repeated)

# DDL Altering an IMS database

- **The following scenario focuses on the elements of the database alter that apply to most database types.**
  - User uses Explorer to model the database graphically
  - User uses Explorer to create the DDL
  - Alter DBD(s)
    - ALTER DATABASE
  - Change PROGRAMVIEW
    - DROP PROGRAMVIEW
    - CREATE PROGRAMVIEW (new)
  - Explorer notifies user the impact of the DDL
  - User submits the DDL to IMS
  - Any manually invoked changes e.g. Database unload/reload
  - IMPORT change to activate.

# DDL Dropping an IMS database

- **The following scenario focuses on the elements of the drop database that apply to all database types.**
  - User uses Explorer to determine which database to remove
  - User uses Explorer to build the DDL
  - Drop DBD
    - DROP DATABASE
  - Explorer notifies user the impact of the DDL
  - User submits the DDL to IMS
  - IMPORT to activate to IMS

## Some DDL usage scenarios

- **Tools can generate DDL based on Database metadata retrieved through standard discovery mechanisms like JDBC Database Metadata.**
  - e.g., IMS Explorer for Development and Optim Data Studio can generate DDL for an IMS database using JDBC discovery.

- **Tools can generate DDL for storing its own metadata repository**
  - e.g., Cognos generates DDL for its own content store that holds information on created reports.

- **Business Analytics can take existing data and enhance that data through analytics. The enhanced data can then be written back into the database for later use.**

# Dynamic Database Definition - Considerations

- **Utilities**
  - UDR and ULU type regions require DBDLIB and PSBLIB datasets
    - IMS Utilities and tools running as these region types
- **Scalability**
  - Storage for DDL use is limited
    - Limit resources changes to 40 per commit points (recommended)
- **Coexistence**
  - IMS must be Version 14
  - Shared ACB systems must all be Version 14
  - ACBMGMT=CATALOG

# Dynamic Database Definition - Benefits

- **Dynamic implementation of IMS control blocks.**
  - An alternative to PSBGEN, DBDGEN, and ACBGEN processes.
- **Single truster reposirory for metadata**
  - IMS will load from the catalog where changes are made through DDL
- **Use the industry standard DDL** to define and modify database and schema creation and changes.
- **Exploit DDL authoring tools** such as the IMS Enterprise Suite Explorer for Development (E4D) to model database changes and create DDL statements.
- **Provide an audit trail** capturing changes made**.**
- **Align with industry practices and expectations.**

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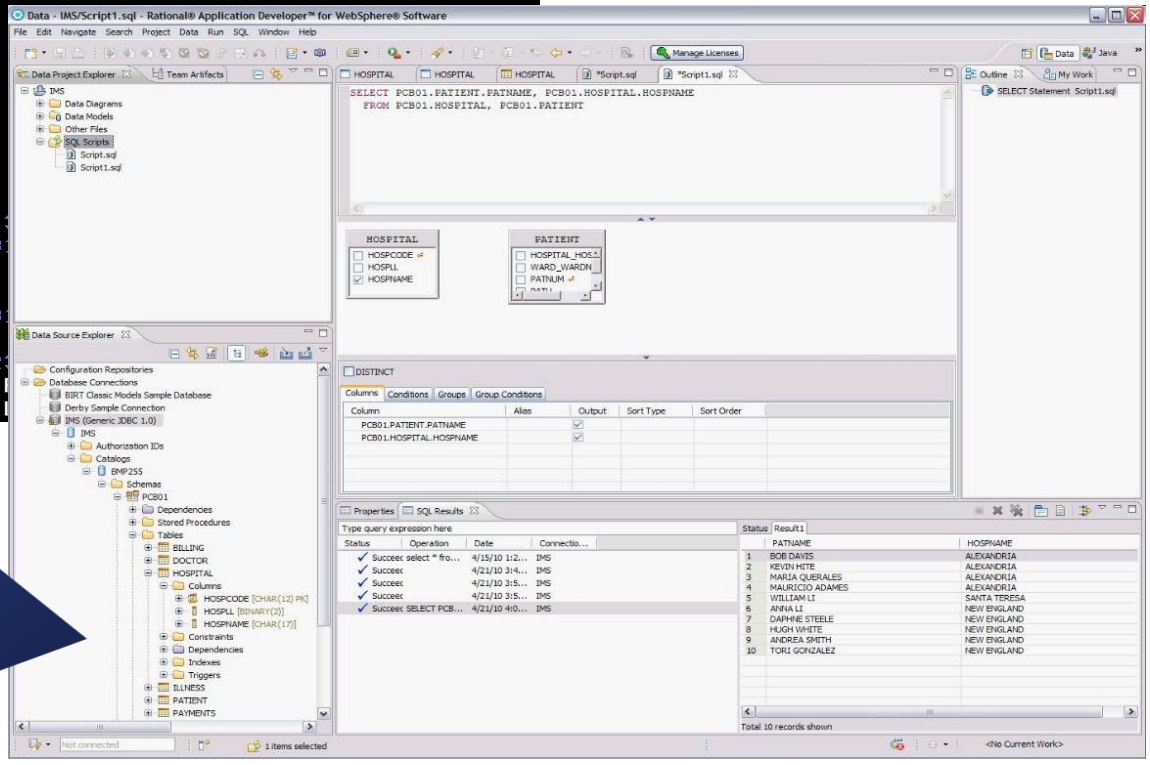
# IMS Explorer for Development

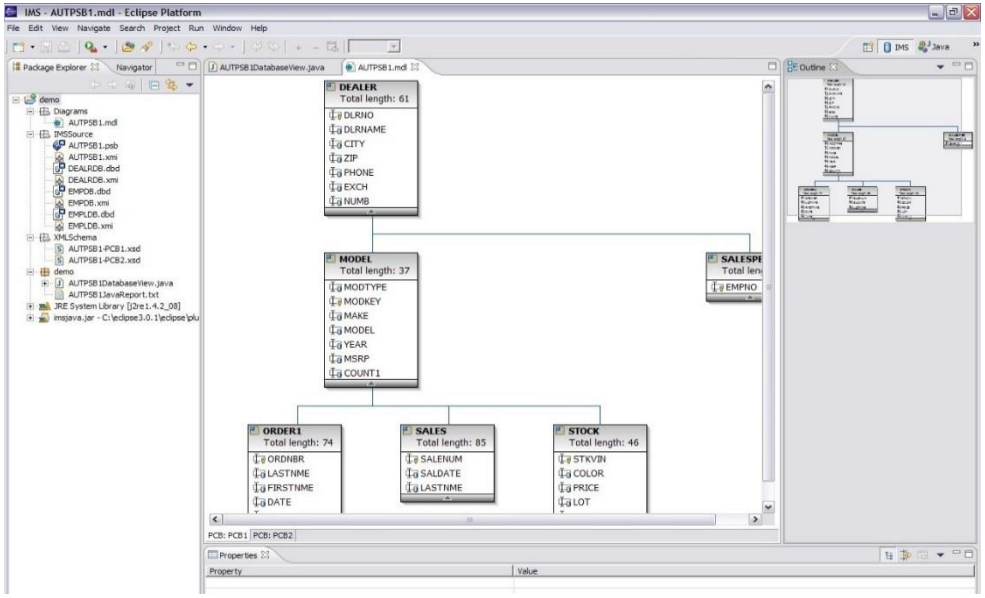
The IMS Explorer for Development is a tool to help with database visualization and querying.

```
 $DDLT0    NEWJCL    F1  V 80  Trunc=80 Size=96 Line=25 Col=1 Alt=0
====>
00022 U ********************************************************************
00023 WTO Start of the DDLT0 stream
00024 U status card has all 1's so all tracing is ON.
00025 U status card has 00002 so we use the second PCB in the PSB
00026 S 1 1 1 1 1       00002
00027 WTO Now doing GN through the database
00028 L         GN
00029 E         DATA  KAA11**K1*
00030 E   01     K1        0005KAA11
00031 L         GN
00032 E         DATA  KBBB11**K2
00033 E   02     K2        0011KAA11KBBB11
00034 L         GN
00035 E         DATA  KAA31KEE31K313111312131
00036 E   03     K3K5      0021KAA11KBBB11KAA3
00037 L         GN
00038 E         DATA  KAA31**K1*
00039 E   04     K1X       0026KAA11KBBB11KAA3
00040 L         GN
00041 E         DATA  KAA31KEE32K313211322132
PF 1 FIG         2 SCREEN 2    3 QUIT        4
PF 7 BACKWARD    8 FORWARD     9 XFILE      10
```



# IMS Explorer for Development – DDL creation

- The IMS Explorer for Development has Enhanced DDL editing and generation features
  - A full text DDL editor
    - users can manually write their own DDL scripts
  - A graphical interface for Creating, Altering & Dropping DDL resources
- The generated DDL uses the enhanced IMS DDL syntax



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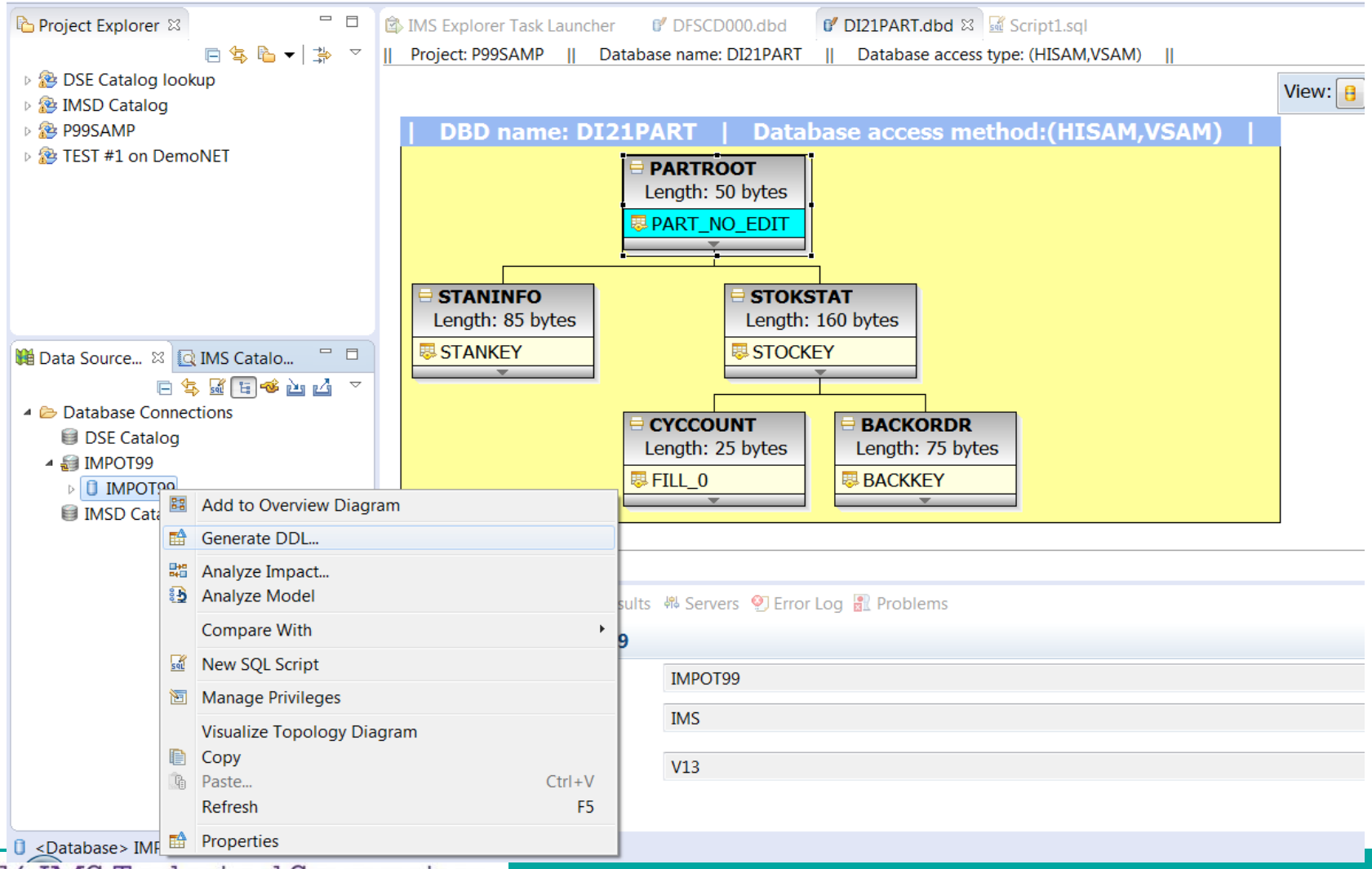

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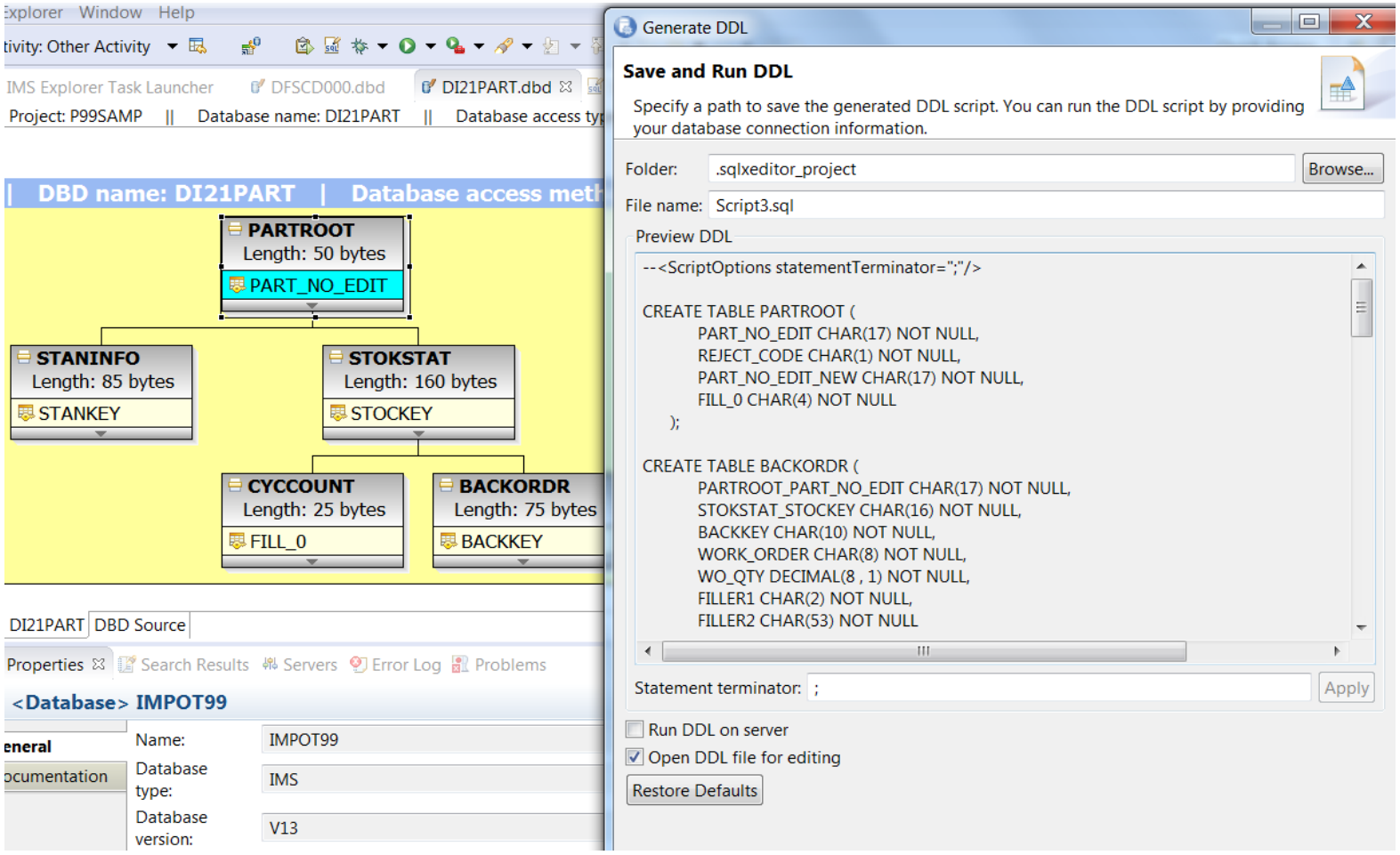
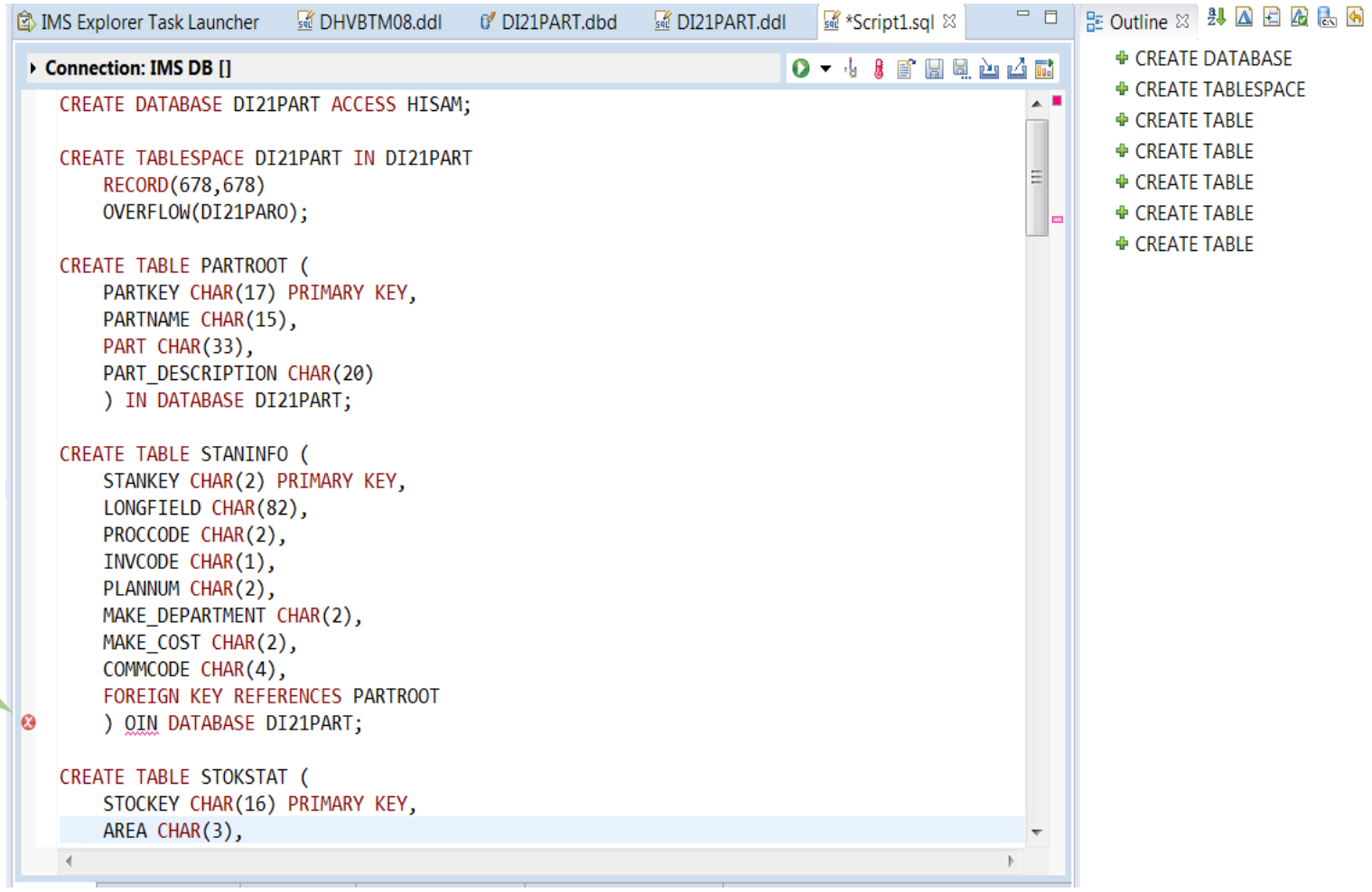
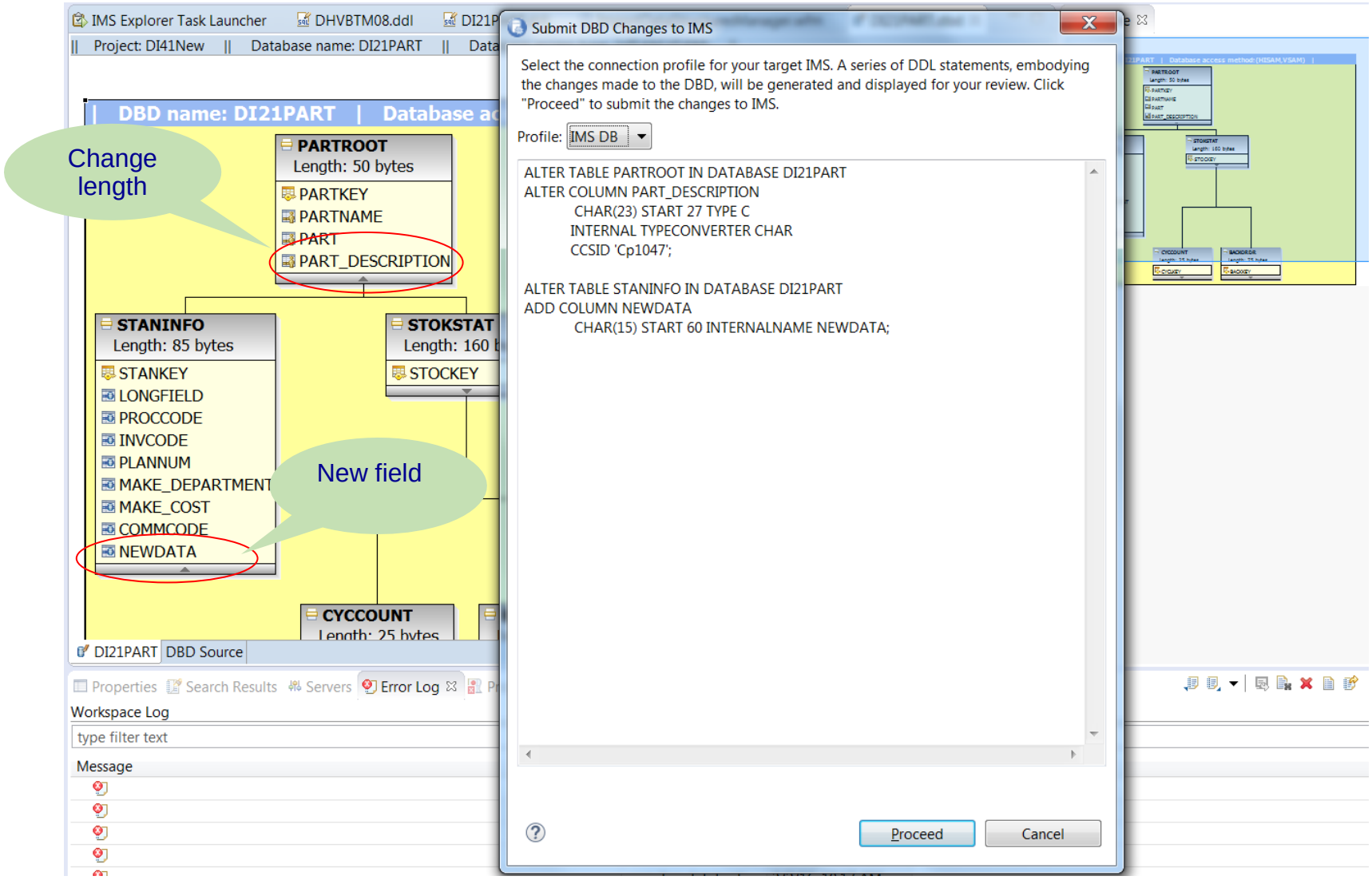


# IMS Explorer for Development – DDL creation




Syntax Validation

# Generated DDL for Alter



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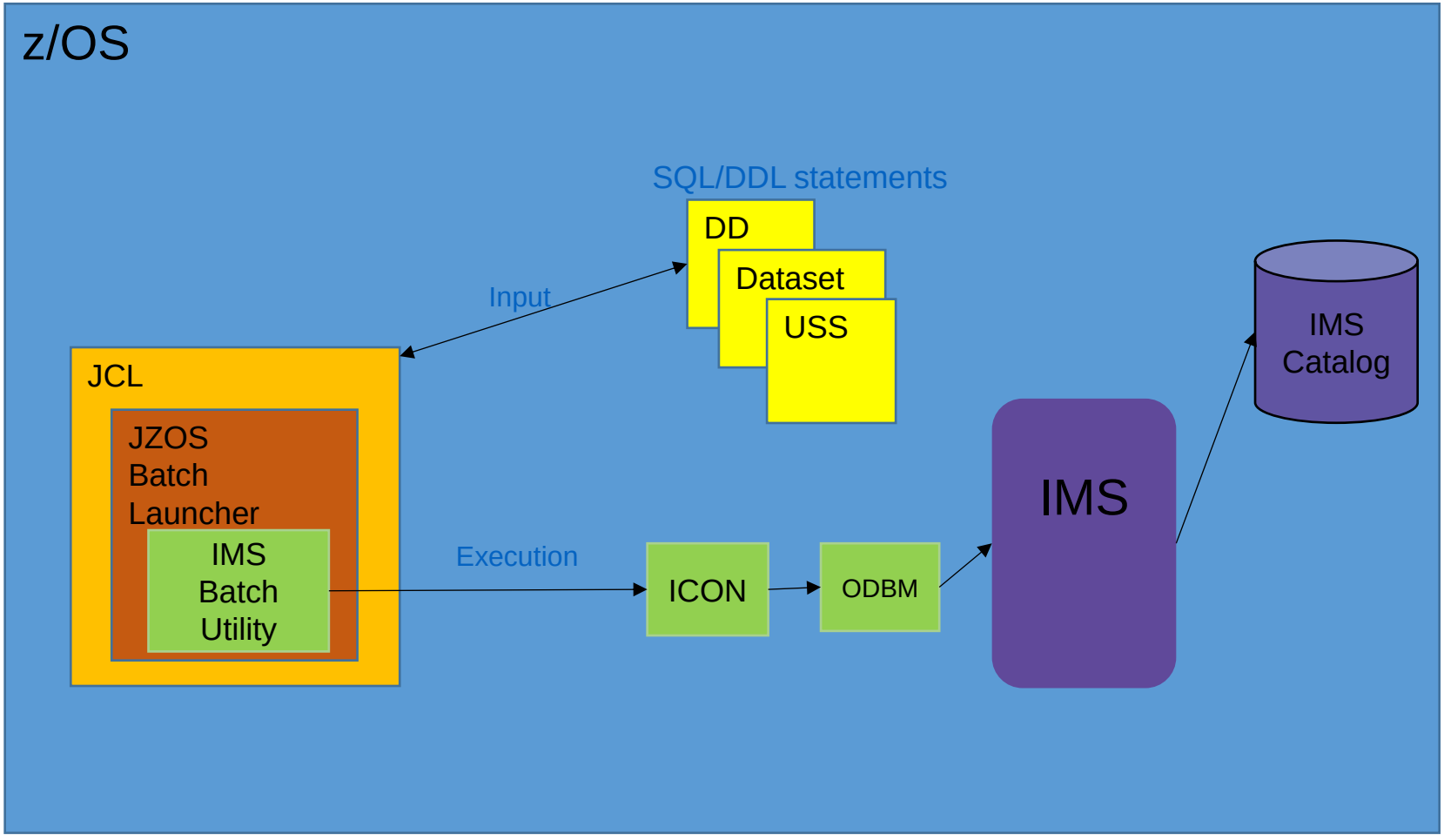
# Batch SQL Utility

- The Batch SQL Utility is made as a way to invoke DDL statements via a JCL on the z platform

- **Requirements:**
  - The utility is bundled in the IMS JDBC driver (imsudb.jar)
    - APAR PI30848
  - Uses IMS JDBC Type-4 connections to invoke SQL statements
    - IMS Connect, ODBM, SCI
  - IBM Java for z/OS (JZOS) Batch Launcher

# Batch DDL Utility architecture



# Batch DDL Utility Sample JCL

```
//IMSSAMPL JOB (999,XXX),'JAVA BPXBATCH',CLASS=A,MSGLEVEL=(1,1),
//   MSGCLASS=E,REGION=0M,NOTIFY=&SYSUID
// SET P1='com.ibm.ims.jdbc.batch.BatchUtil'
//JAVAJVM EXEC PGM=JVMLDMxx,REGION=0M,
//   PARM='/ &P1'
//STEPLIB   DD DISP=SHR,
//      DSN=USER.CUSTOM.JZOS.LOADLIB
//SYSPRINT DD  SYSOUT=*
//SYSOUT DD  SYSOUT=*
//STDOUT  DD  SYSOUT=*
//STDERR DD  SYSOUT=*
//CEEDUMP DD  SYSOUT=*
//ABNLIGNR DD DUMMY
//MAINARGS DD *
//IMSSQL DD DISP=SHR,
//       DSN=MYPDS(MYSCRIPT)
//STDENV DD *
export JAVA_HOME=myJavaHomePath
export PATH=/bin:"${JAVA_HOME}"/bin
LIBPATH=/lib:/usr/lib:"${JAVA_HOME}"/bin
export LIBPATH="$LIBPATH":
APP_HOME=$JAVA_HOME
CLASSPATH=$APP_HOME:"${JAVA_HOME}"/lib:"${JAVA_HOME}"/lib/ext
CLASSPATH="$CLASSPATH":myLibPath/imsudb.jar
```

# Batch SQL Utility syntax

- The input statements supported by the Batch DDL Utility include all supported SQL and DDL statements by the IMS JDBC driver
- The following additional statements are supported:
  - CONNECT [JDBC URL];
    - This will create a JDBC connection to the IMS system using the specified JDBC URL
  - COMMIT;
    - This will commit work on the open connection.
  - ROLLBACK;
    - This will rollback work on the open connection.
  - DISCONNECT;
    - This will disconnect the current connection.
- Statements must be delimited by a semi-colon.

# Batch DDL Utility Sample Input

```
CONNECT jdbc:ims://myConnectServer:5555/DFSCP001;

CREATE DATABASE ACCUNTDA ACCESS HDAM OSAM
    RMNAME(DFSHDC40 RMANCH 5 RMRBN 280);

CREATE TABLESPACE ACCUNTDA IN ACCUNTDA
    SIZE PRIMARY 4096;

CREATE TABLE ACCT0001 (
    ACCT0KEY CHAR(10)
        START 3 TYPE C
        PRIMARY KEY
) IN ACCUNTDA.ACCUNTDA
    MAXBYTES 34 ;

COMMIT;
DISCONNECT;
```

# Batch DDL Utility error codes

**The following error codes will be thrown by the JZOS Batch Launcher**

| Return Code | Description | Action |
|---|---|---|
| 11 | There was a connection error to IMS Connect | Verify that the connection parameters are correct |
| 12 | There was an error with the SQL statement execution. All work will be rollback to the prior commit point. | Verify that the SQL statement is valid |
| 13 | There was an issue with the commit | Check the JDBC error messages |
| 14 | There was an issue with the rollback | Check the JDBC error messages |
| 15 | There was an issue cleaning up the connection | Check the JDBC error messages |
| 16 | An invalid command was specified | Verify that valid commands were provided in the input file |

# Thank You!

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# CREATE DATABASE

- The CREATE DATABASE statement defines a database. This creates a definition of the database only. Segments and Datasets are created separately.
  - Options will vary depending on database type.
- The creation of database is always a new resource.
- A created database is manually imported to active status in the IMS.
- Other definitions usually entered on the DBDGEN are created with separate CREATE resource_name statements.
  - Dataset
  - Area
  - Segment
  - Field

```
>>-CREATE--DATABASE--database_name---| Organization Specific Options |---->
```

# IMS DDL - CREATE DATABASE (HDAM)

```
DBD   NAME=COGDBD,                                                    C
         ENCODING=Cp1047,                                             C
         ACCESS=(HDAM,OSAM),                                          C
         RMNAME=(DFSHDC40,3,3,25),                                    C
         PASSWD=NO,                                                   C
         VERSION='Latest version of COGDBD'
```

```
CREATE DATABASE COGDBD
  ACCESS HDAM OSAM
  RMNAME(DFSHDC40 RMANCH 3 RMRBN 3 RMBYTES 25)
  VERSION 'Latest version of COGDBD'
  PASSWDNO
  CCSID 'Cp1047';
```

# IMS DDL syntax – ALTER DATABASE

- The ALTER DATABASE statement changes attributes of the database.
- The ALTER DATABASE keywords are the same as the keywords of CREATE DATABASE.
- There are no defaults for an ALTER DATABASE.
  - Any keywords entered are will override the existing values.
  - Keyword values not entered will remain the same value.
- An Altered database must be manually Imported in order Active status in the IMS.

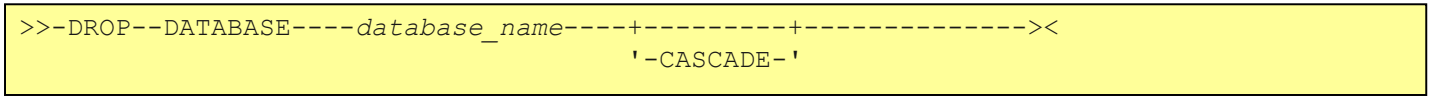
```
>>-ALTER--DATABASE—database_name--| Options |---->
```

# IMS DDL syntax – DROP DATABASE

DROP DATABASE database_name

- Identifies the database to drop. The name must identify a database that exists to IMS. When a database is dropped, all of its tables and indexes are also dropped.

- A dropped database is Imported to remove it from IMS.
- Resources may need to be removed via DRD or Sysgen source



# DDL syntax: CREATE TABLESPACE

- CREATE TABLESPACE
- The CREATE TABLESPACE statement defines a group dataset within the database or an area for a DEDB. This is equivalent to the DATASET or AREA statements used in the IMS DBDGEN source.
- The ddnames used on the CREATE TABLESPACE statement must be unique within an IMS system. Non-unique ddnames in two or more DBDs may result in destruction of the database.

  Options vary depending on dataset type.

- Note:
  - Tablespace created with a Database may be automatically Imported with the Database to Active status in the IMS.
  - A Tablespace added to an existing Database must be manually Imported.

```
>>-CREATE--TABLESPACE--ddname---IN--database_name---| Options |---->
```

# IMS DDL syntax – CREATE TABLESPACE Example

```
DBD    NAME=COGDBD,                                          C
          ENCODING=Cp1047,                                   C
          ACCESS=(HDAM,OSAM),                                C
          RMNAME=(DFSHDC40,3,3,25),                          C
          PASSWD=NO
DATASET   DD1=COGDATA,                                       C
          DEVICE=3390,                                       C
          SIZE=(8192),                                       C
          REMARKS='Dataset Group 1'
SEGM   NAME=ROOT,                                            C
          PARENT=0,                                          C
          BYTES=(20),                                        C
          RULES=(LLL,HERE)
FIELD  NAME=(ROOTKEY,SEQ,U),                                 C
          BYTES=12,                                          C
          START=1,                                           C
          TYPE=C,                                            C
          DATATYPE=CHAR
FIELD  NAME=TABTYPE,
          BYTES=8,
          START=13,
          TYPE=C,
          DATATYPE=CHAR
```

```
CREATE DATABASE cogdbd
  ACCESS HDAM OSAM
  RMNAME(DFSHDC40 3 3 25);

CREATE TABLESPACE cogdata
  IN cogdbd
  SIZE PRIMARY 8192;
COMMENT ON TABLESPACE cogdata IN cogdbd IS 'Dataset Group 1';
```

# DDL syntax – ALTER TABLESPACE

- The ALTER TABLESPACE statement changes attributes of the data set group within the database or an area for a DEDB. This is equivalent to the DATASET or AREA statements as defined in IMS DBDGEN source.
- The ALTER TABLESPACE keywords are the same as the keywords of CREATE TABLESPACE.
- There are no defaults for an ALTER TABLESPACE.
  - Any keywords entered are overrides to the existing values.
  - Keyword values not entered will remain the same value.
- An Altered Tablespace must be manually Imported.

```
>>-ALTER--TABLESPACE--ddname---IN--database_name---| Options |---->
```

# CREATE TABLE

- The CREATE TABLE statement defines a segment.  This creates a definition of the database only.
  - Options will vary depending on database type.
- The creation of table is always a new resource.
- A created table is manually Imported to Active status in the IMS.
- Other definitions usually entered on the DBDGEN are created with separate CREATE resource_name statements.
  - Dataset
  - Area
  - Segment
  - Field

# IMS DDL syntax – CREATE TABLE Example

```
      SEGM     NAME=TDEC,                                              C
               PARENT=ROOT,                                            C
               BYTES=(10,6),                                           C
               REMARKS='This describes table TDEC.',                   C
               RULES=(LLL,HERE)
      FIELD    NAME=RNUM,                                              C
               BYTES=4,                                                C
               START=3,                                                C
               DATATYPE=INT
      FIELD    NAME=LL,                                                C
               BYTES=2,                                                C
               START=1,                                                C
               DATATYPE=SHORT
      FIELD    NAME=CDEC,
               EXTERNALNAME=CDECIM
               BYTES=4,
               START=7,
               DATATYPE=DECIMAL(7,
```

```
CREATE TABLE table_decimal (
    r_number INT INTERNALNAME RNUM,
    ll SHORT INTERNALNAME LL,
    c_decimal DECIMAL(7,2) INTERNALNAME CDEC,
    FOREIGN KEY REFERENCES table_root
) IN COGDBD.COGDATA
  INTERNALNAME TDEC
  MAXBYTES 10
  MINBYTES 6
  INSERT LOGICAL
  DELETE LOGICAL
  REPLACE LOGICAL
  AMBIGUOUS INSERT HERE;

COMMENT ON TABLE table_decimal IN COGDBD IS 'This describes table TDEC.';
```

## IMS DDL syntax – ALTER TABLE

- The ALTER TABLE statement changes attributes of the table within the database or an area for a DEDB. This is equivalent of a SEGMENT as defined in IMS DBDGEN source.
- The ALTER TABLE keywords are the same as the keywords of CREATE TABLE.
  - There are no defaults for an ALTER TABLE.
  - Any keywords entered are will override the existing values.
  - Keyword values not entered will remain the same value
- An Altered Table is manually Imported.

# IMS DDL – Alter Table

**Original DATABASE DBD (generated version 0):**

```
DBD    NAME=COGDBD,                                              C
          ENCODING=Cp1047,                                       C
          ACCESS=(HDAM,OSAM),                                    C
          RMNAME=(DFSHDC40,3,3,25),                              C
          PASSWD=NO
DATASET   DD1=COGDATA,                                           C
          DEVICE=3390,                                           C
          SIZE=(8192)
SEGM   NAME=ROOT,                                                C
          PARENT=0,                                              C
          BYTES=(28),                                            C
          RULES=(LLL,HERE)
FIELD  NAME=(ROOTKEY,SEQ,U),                                     C
          BYTES=12,                                              C
          START=1,                                               C
          TYPE=C,                                                C
          DATATYPE=CHAR
FIELD  NAME=TABTYPE,                                             C
          BYTES=8,                                               C
          START=13,                                              C
          TYPE=C,                                                C
          DATATYPE=CHAR
```

```
ALTER DATABASE COGDBD;
ALTER TABLE root
  IN COGDBD
  MAXBYTES 28
  ADD COLUMN New_Field_01 INTERNALNAME newfld01 DOUBLE START 21 ;
```

# IMS DDL syntax – DROP TABLE

- All the tables (segments) in an hierarchy can be dropped by a single DROP TABLE statement.
- The DROP TABLE statement will drop child segments.
- A Dropped Table is Imported to activate the removal of the segments from the active IMS database.
- IMS resources may be removed from DRD or SYSGEN source.

```
>>-DROP--TABLE--table_name-IN-database----------------------------><
```

# CREATE PROGRAMVIEW Syntax

- CREATE PROGRAMVIEW is the equivalent of a PSB statement.
- SCHEMA is equivalent to a PCB.
- SENSEGVIEW is the equivalent of a SENSEG.
- DDL syntax has been Enhanced for users to write their own PSBs instead of relying on system defaulted ones.

# ProgramView Generation

- Nested in the CREATE PROGRAMVIEW must be **one or more** CREATE SCHEMA statements. SCHEMA statements describe the PCBs.
- Nested in each CREATE SCHEMA for a DBs must be one or more CREATE SENSEGVIEW statements to describe the SENSEGs.
- Nested in each SENSEGVIEW may be sensitive fields.

  e.g. CREATE SENSEGVIEW segment ( flda WITH START (1), WITH START (m)) …

- **A Program view is Imported to be active in an IMS.**

# CREATE PROGRAMVIEW - (PSB) Example

```
DFSIVP2  PSBSOR:
         PCB    TYPE=TP,MODIFY=YES
         PCB    TYPE=DB,DBDNAME=IVPDB2,PROCOPT=A,KEYLEN=10
                SENSEG NAME=A1111111,PARENT=0,PROCOPT=A
                PSBGEN LANG=ASSEM,PSBNAME=DFSIVP2
         END
```

```
    CREATE PROGRAMVIEW DFSIVP2 (
        CREATE SCHEMA TP pcb01 MODIFYYES,
        CREATE SCHEMA pcb02 USING IVPDB2 (
            CREATE SENSEGVIEW A1111111 WITH
    PROCOPT 'A',
        ) PROCOPT 'A',
    ) LANGASSEM;
```

# IMS DDL syntax – ALTER PROGRAMVIEW

- The ALTER statement does not apply to a PROGRAMVIEW.
- Altering a PROGRAMVIEW is performed by:

  DROP PROGRAMVIEW

  Must identify an existing defined program.

  CREATE PROGRAMVIEW

  With the new information for the Application Program.

# Drop PROGRAMVIEW

- The DROP statement removes a resource from IMS. Any resources that are directly or indirectly dependent on that resource are deleted.  Whenever a resource is deleted, its description is deleted from the catalog of the current IMS.
- The CASCADE keyword will drop any associated transactions and routing codes for that PSB.

```
>>-DROP--PROGRAMVIEW--psb_name---+---------+---------------><
                                 '-CASCADE-'
```

  - Resources may need to be removed via DRD or Sysgen source

# COMMENT ON Syntax

- This statement provides optional user comments.
- Equivalent to the REMARKs keyword on the DBD / PSB source.
  - Optional user comments. A 1- to 256-character string enclosed in single quotation marks. The value specified cannot contain the following characters:
  - Less than (< ) and Greater than ( >) symbols.
  - Ampersands (&).
  - Double quotation marks.
  - Single quotation marks, except when they are used to enclose the full comment string. The following examples show correct and incorrect usages of single quotation marks:
    - CORRECT

    … IS 'These remarks apply to the XYZ application’
    - INCORRECT

    …IS 'These remarks apply to the 'XYZ' application'