



IBM Software Group

DB2 Test Database Generator for z/OS

Version 2.1

2 Février 2005

Catherine Chochoy (source: eBU presentation by Ed Lynch, 2004)

DB2 Information Management Software

@business on demand software

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Agenda

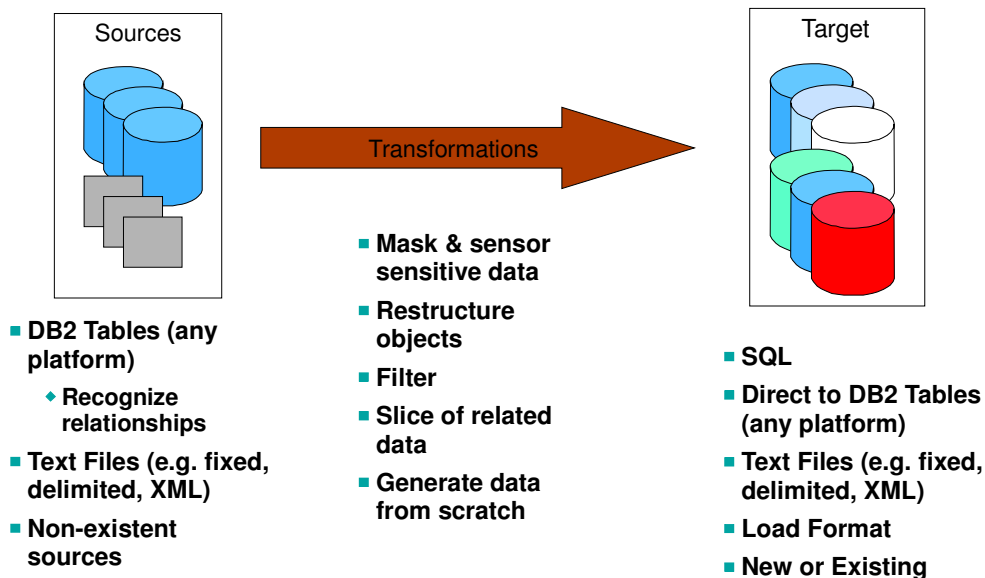
- Test Database Generation Objective
- IBM DB2 Test Database Generator for z/OS
Version 2.1 Today
 - ▶ Summary of Capabilities
- Terminology and Architecture
- Potential Configurations
- Transformations
 - ▶ Source & Target Specifications
 - ▶ Transformation Rules
- Generation & Results
- Hints & Tips

TDBG = Test Database Generator

Agenda

- **Test Data Generation Objectives**
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Test Data Generation: Customer Requirements



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IBM DB2 Test Database Generator for z/OS Version 2.1 (Today)

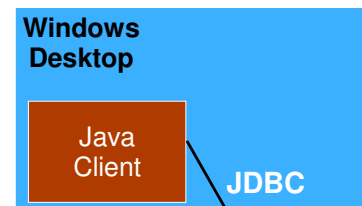
- Sources:
 - ▶ DB2 for z/OS Table(s)
 - All Rows
 - Every nth row
 - Random
 - Predicate Filter
 - ▶ Delimited/Fixed Text File
 - Local File
 - FTP site
 - HTTP site
- Relational Relationships (Grouper)
 - ▶ DB2 Defined RI
 - ▶ Application RI
- Choice of Tool Interface
 - ▶ Java Client (Windows)
 - ▶ ISPF
- Transformations
 - ▶ Columns (new, order, name)
 - ▶ Data Attributes - type, lengths, nulls
 - ▶ Filter
 - ▶ Rules:
 - Source Column
 - Static
 - Lookup
 - Mask
 - Expression
 - Random
 - Pattern
- Target Output Formats:
 - ▶ Limit Number of Rows
 - ▶ DB2 Tables (z/OS & Multiplatform)
 - ▶ SQL
 - ▶ Delimited/Fixed Text File
 - ▶ XML
 - ▶ DB2 for z/OS Load Format
- Transferable Outputs

Agenda

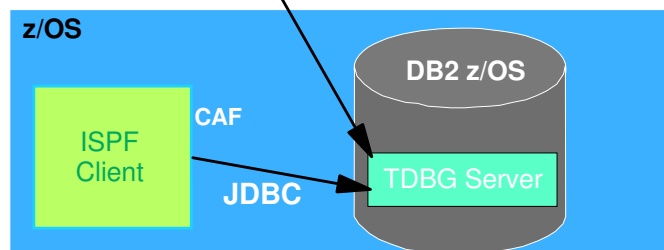
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TDBG Client



- Java Client
- ◆ Can also be launched from Control Center
 - ◆ and Visa versa



Java or ISPF Client - Same Capabilities

- ➔ Connect to TDBG Server
 - ◆ Implied Connect for ISPF client
- ➔ Select & Add Source(s)
- ➔ Create a Target
 - ◆ Define Transformations
- ➔ Save/Load Data "Profiles"
- ➔ Run the Generator
- ➔ Download Generated Data
 - ◆ Java Client only

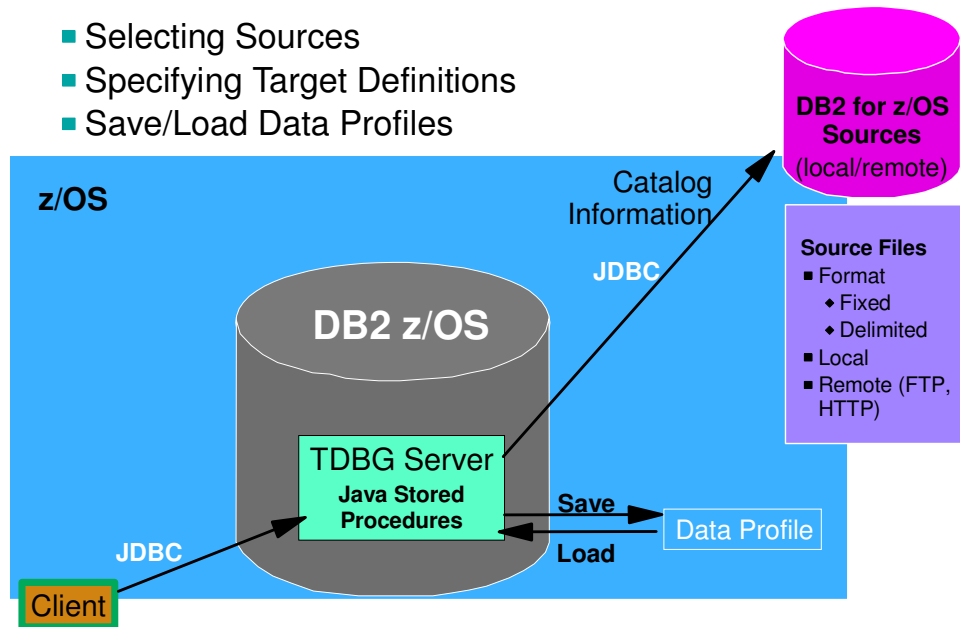
JDBC Drivers Supported

- ◆ Type 2 or
- ◆ Type 4



TDBG Server and Sources

- Selecting Sources
- Specifying Target Definitions
- Save/Load Data Profiles

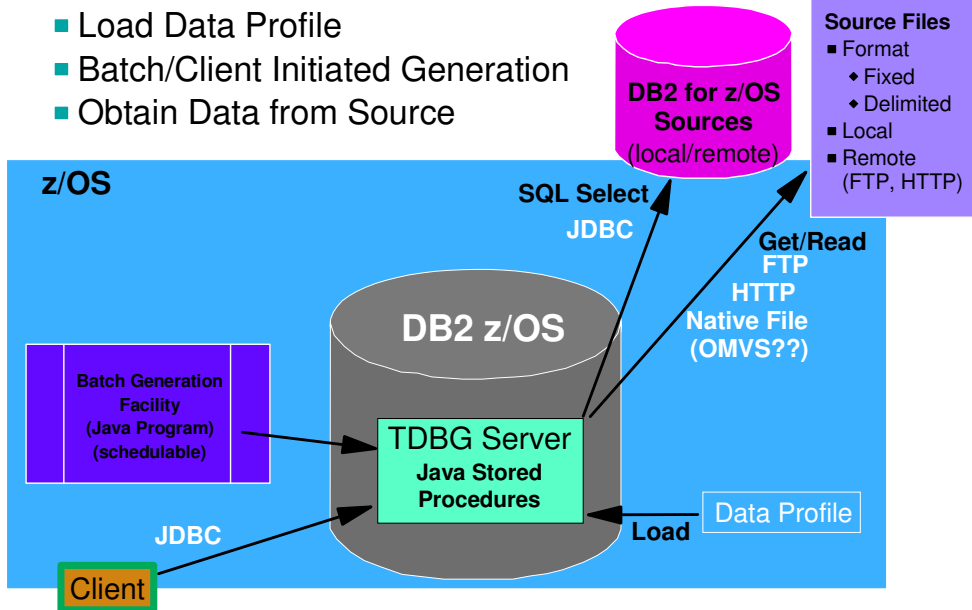


Data Profiles

- Data Profiles define the generation process
 - ▶ Source data objects used to seed generation
 - ▶ Definition and Relational Rules of the Targets
 - ▶ Describes how data will be copied, filtered, masked, and/or transformed
- Data Profiles
 - ▶ Created by the TDBG Server and
 - ▶ Stored in the HFS where the Server is running
- Data Profiles are written in Test Database Generator Markup Language (a.k.a. GRIML)
 - ▶ GRI: Internal product code
 - ▶ ML: Markup Language
 - ▶ GRIML is an XML-based markup language
- Can manually create using an XML Editor

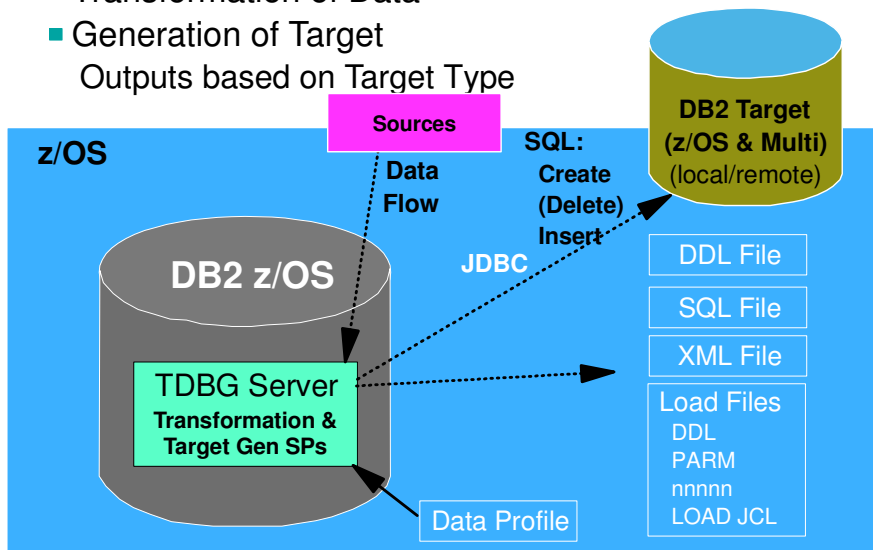
TDBG Data Generation from Source

- Load Data Profile
- Batch/Client Initiated Generation
- Obtain Data from Source



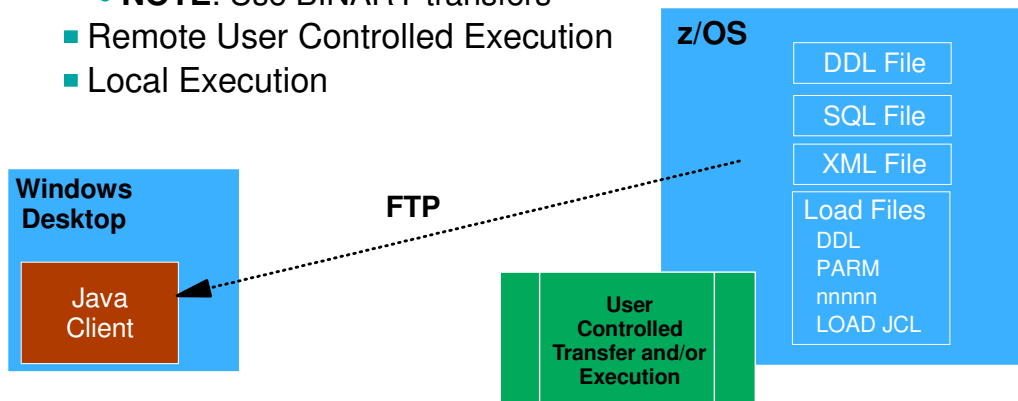
TDBG Generation of Target

- Transformation of Data
 - Generation of Target
- Outputs based on Target Type

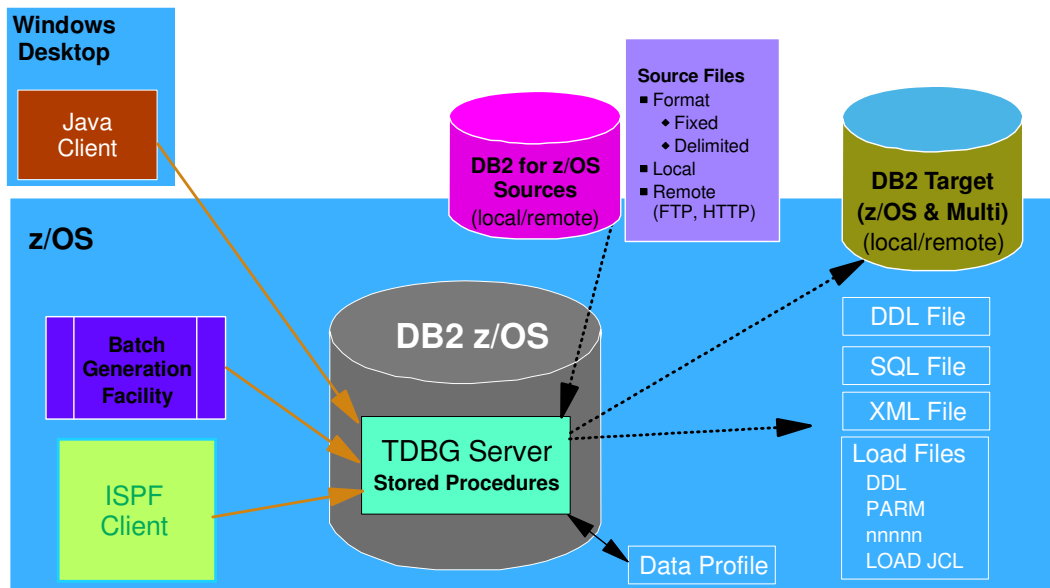


Using TDBG Outputs

- All output is UNICODE UTF-8
- Download Output
 - Using Java Client to Local or Network Disk Drive
 - User controlled file transfer (e.g. FTP)
 - **NOTE:** Use BINARY transfers
- Remote User Controlled Execution
- Local Execution



TDBG Overall Architecture



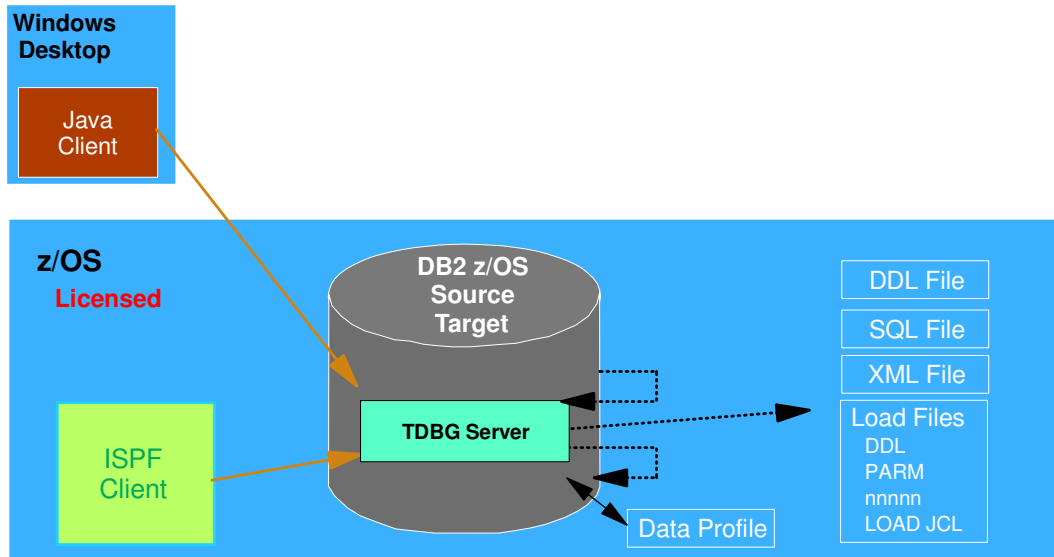
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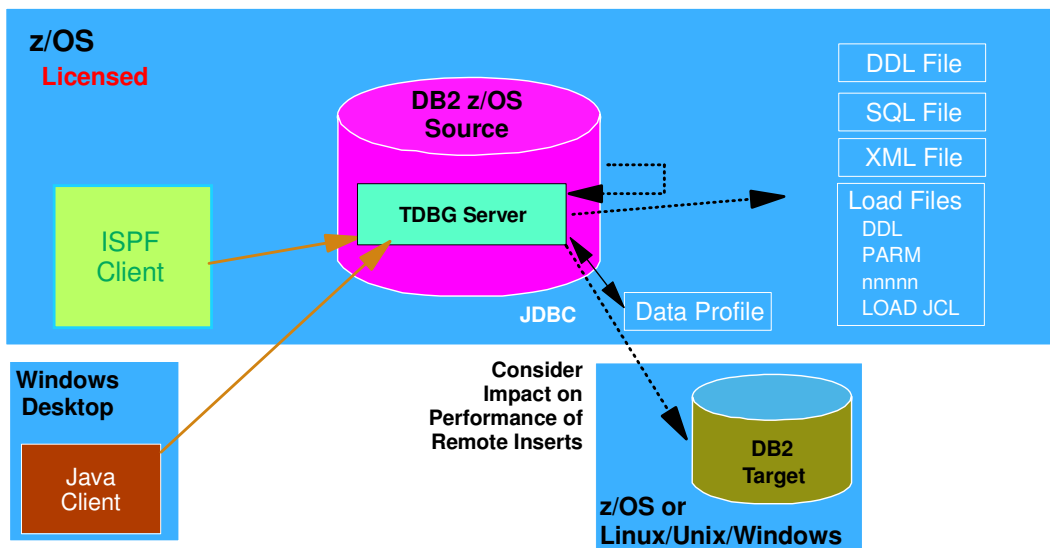
Licensing

- Charges for Licensing of DB2 Test Database Generator for z/OS is based upon:
 - ▶ Processor where the TDBG Server is Located,
and
 - ▶ Processor(s) where the Source(s) are Located

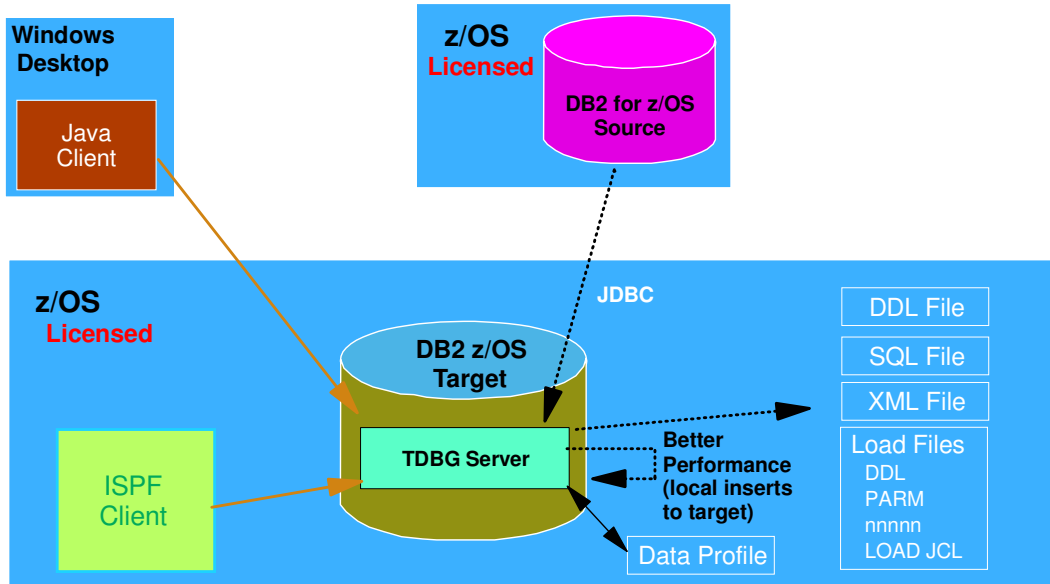
Combined Source/Target/Server



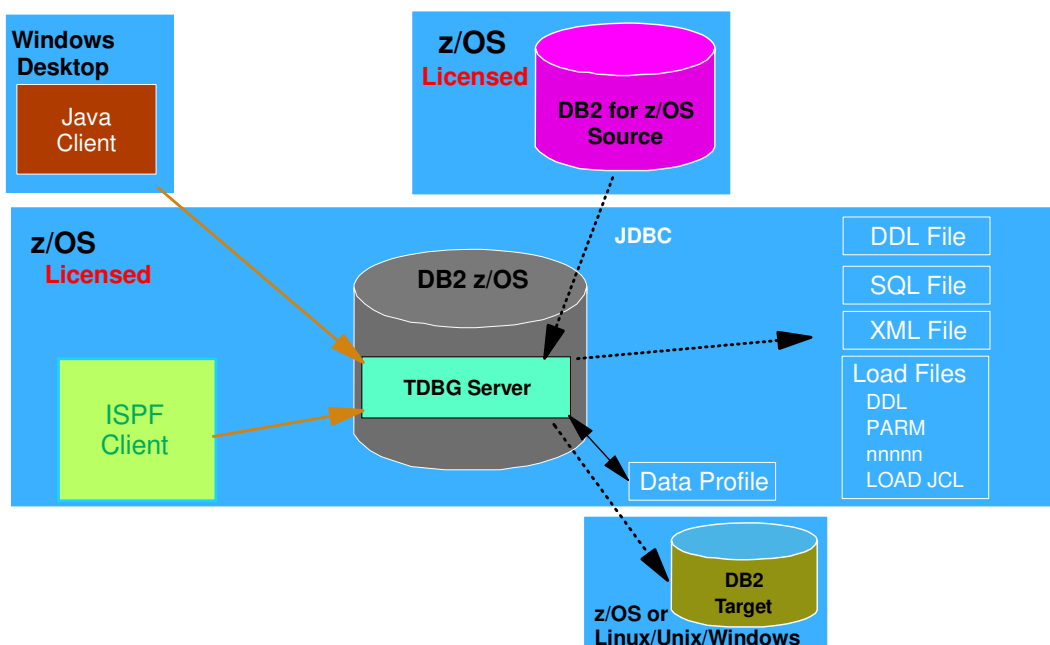
Combined Source & Server with Remote Target (any platform)



Combined Target & Server with Remote Source



Separate Source, Target, & Server



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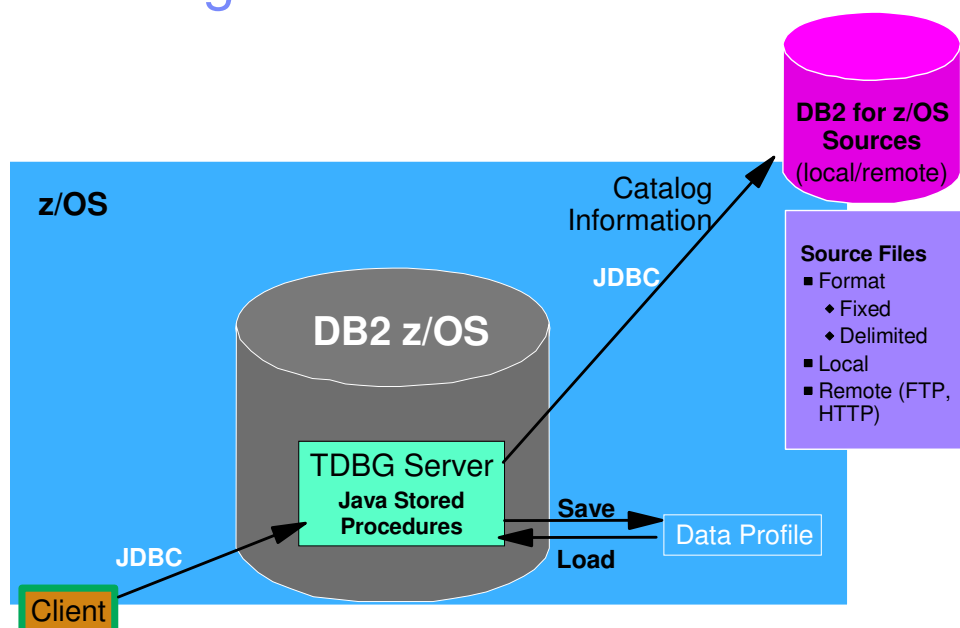
Data Transformation Capabilities

- Table
 - ▶ Change Table name
 - ▶ Change Table Creator
- Columns
 - ▶ Add (create) / Exclude
 - ▶ Name Change
 - ▶ Order of Columns
 - ▶ Specify / Change Data Attributes
 - Data Type
 - Length(s)
 - Nullability
 - ▶ SQL Transformations
 - ▶ Specify Transformation Rule(s):
 - Source Column
 - Static
 - Lookup
 - Mask
 - Expression
 - Random
 - Pattern
- Row Controls
 - ▶ Filtering via SQL Predicate
 - ▶ Row Range
 - All
 - From x to y
 - ▶ Selection within the Range
 - All
 - Every nth Row
 - Random
 - ▶ Generate data from scratch
 - ▶ Control Number of Rows Generated
- Join / Union Source Tables
- Single Source to Multiple Unique Targets
- Related Tables (Requires Grouper)
 - ▶ Identify and Include
- Target DDL Generation

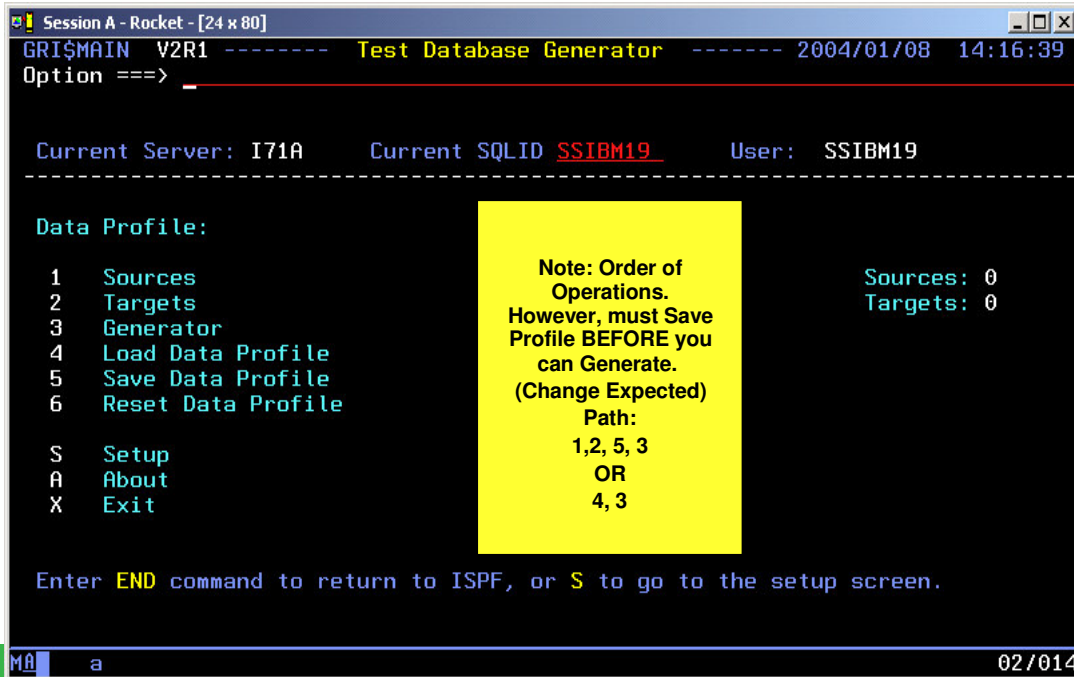
Source & Target Specifications

- Data Transformations are Specified
 - ▶ Using the TDBG Client Interface
 - With Either the Java or ISPF Client
 - ▶ While Specifying your Source Object(s) and
 - ▶ While Creating your Target Object(s)
- Start Your Client
 - ▶ Connect to the Server
 - Explicitly for Java
 - Implicit with ISPF
 - CLIST Invocation Specifies DB2 Subsystem

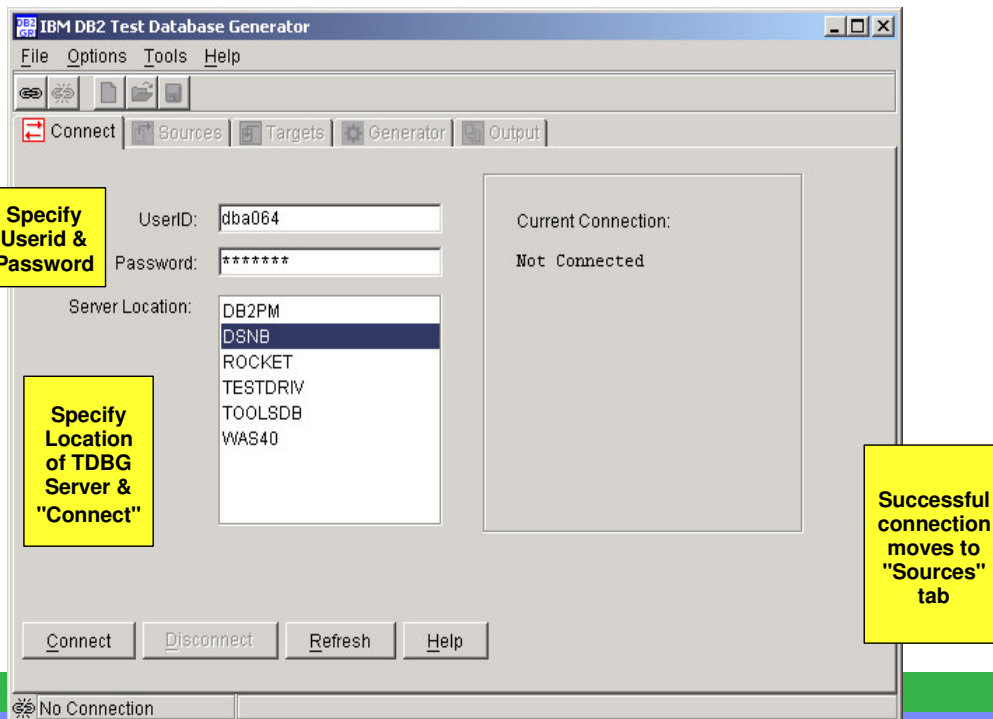
Connecting to a TDBG Server



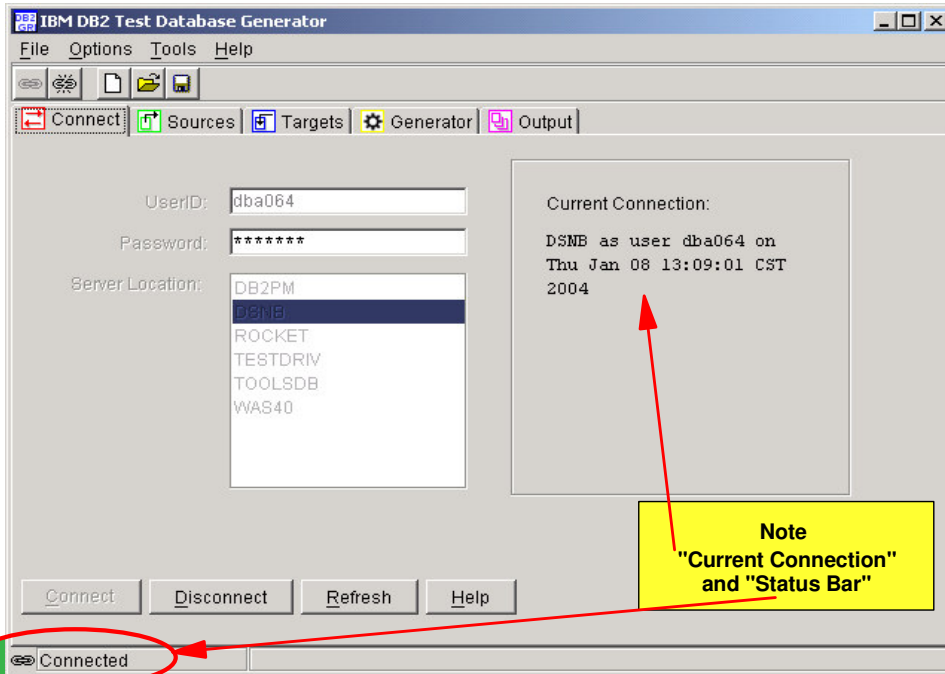
Initial TDBG ISPF Client Display



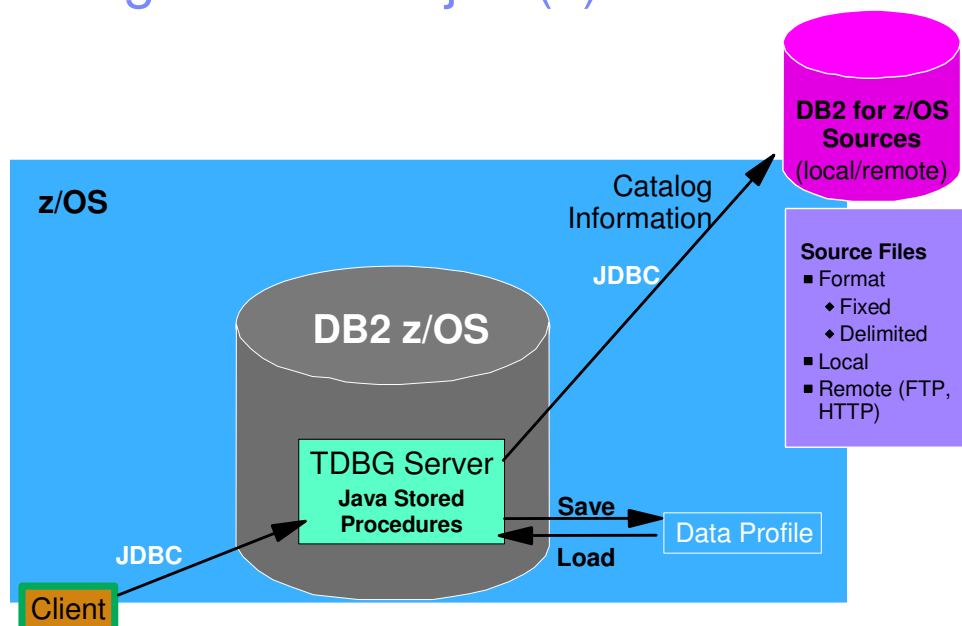
Connect to TDBG Server (Java Client)



Successful TDBG Connect Display



Defining Source Object(s)



Initial TDBG ISPF Client Display

```

Session A - Rocket - [24 x 80]
GRI$MAIN V2R1 ----- Test Database Generator ----- 2004/01/08 14:16:39
Option ==> 1

Current Server: I71A      Current SQLID SSIBM19      User: SSIBM19
-----
Data Profile:
1 Sources
2 Targets
3 Generator
4 Load Data Profile
5 Save Data Profile
6 Reset Data Profile

S Setup
A About
X Exit

Sources: 0
Targets: 0

Note: Order of
Operations.
However, must Save
Profile BEFORE you
can Generate.
(Change Expected)

Enter END command to return to ISPF, or S to go to the setup screen.

MA a 02/014
  
```

Sources Display (ISPF)

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 14:19:18
DB2 Subsystem: I71A

1 Add Source
2 Add Related
3 Remove All Sources

Create matching targets: Y (Yes, No)
No rows to display
-----
Cmd Source Name

Auto Create
option for
targets.

Enter "1" on
Option Line to
"Add Source"

Valid Line Commands: Edit, Delete

Option ==> 1 Scroll ==> PAGE
MA a 24/015
  
```

Add a Source - Specify Type of Source

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:04:55
                                         DB2 Subsystem: I71A

 1 Add Source
 2 Add Related
 3 Remove All Sources

Create matching targets: Y (Yes, No)

-
C  What type of source do you want to add?
   1. SQL
   2. Delimited Text
   3. Fixed Text
   2 _(1-3)

Valid Line Commands: Edit, Delete

Option ==> 1                               Scroll ==> PAGE
MA a                                         18/022

```

First Looking at options for source types:

- Delimited Text
- Fixed Text

Option 2 or 3 displays screen on next slide.

Add a Source- Method of Access

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:06:29
                                         DB2 Subsystem: I71A

 1 Add Source
 2 Add Related
 3 Remove All Sources

Create matching targets: Y (Yes, No)

-
C  How would you like to add the source?
   1. File
   2. FTP
   3. HTTP
   1 (1-3)

Valid Line Commands: Edit, Delete

Option ==> 1                               Scroll ==> PAGE
MA a                                         19/020

```

Specify Method of Access on this screen (File, FTP, or HTTP).

Then depending upon Source Type selection from previous screen (Delimited Text or Fixed Text), one of the following two screens would be displayed.

Delimited Text - Delimiter Specification

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:18:11
                                           DB2 Subsystem: I71A

1 Add Source
2 Add Related
3 Remove All Sources

Create matching targets: Y (Yes, No)

-
C Value Delimiter:          Field Delimiter:
  1. Quote                 1. Comma
  2. Apostrophe            2. Tab
  3. None                  3. Semicolon
                           4. Space
                           5. None

Continue? Y (Yes, No)

      1 (1-3)                3 _(1-5)

Option ==> 1
MA a
22/046
  
```

Specify Delimiters.

Translation:

- Quote = Double Quote
- Apostrophe = Single Quote

Change "Continue?" from "N" to "Y" to proceed.

OR

Fixed Text - Range Delimiter Specification

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 16:03:14
                                           DB2 Subsystem: I71A

1 Add Source
2 Add Related
3 Remove All Sources

Create matching targets: Y (Yes, No)

-
C Range Delimiter:
*
Continue? N (Yes, No)

      0,4,12,20

Valid Line Commands: Edit, Delete

Option ==> 1
MA a
19/012
  
```

Specify Range Delimiter - Comma separated list of positions (offsets) within the fixed text file that indicate column positions, must be listed in sequential order.

Change "Continue?" from "N" to "Y" to proceed.

Then based on Method of Access (File, FTP, HTTP), one of the following two screens will be displayed.

File & HTTP Specification

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:18:11
                                         DB2 Subsystem: I71A

1  Add Source
2  Add Related
3  Remove All Sources

Create matching targets: Y (Yes, No)

-
C
URL:
  /dir/subdir/subdir/.../filename

Continue? N (Yes, No)

Valid Line Commands: Edit, Delete

Option ==> 1                               Scroll ==> PAGE
MA a                                         19/007

```

Specify URL of file.
Change "Continue?"
from "N" to "Y" to
proceed.
OR

FTP Access to File

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:31:06
                                         DB2 Subsystem: I71A

1  Add Source
2  Add Related

URL:
  /dir/subdir/subdir/.../filename

User ID:
  myuserid

Password:
  *****

Continue? N (Yes, No)

D
MA a                                         GE
                                         23/007

```

Specify URL of file plus
userid & password.
Change "Continue?"
from "N" to "Y" to
proceed.
Then for both Delimited &
Fixed Text Files

Row Range Controls - ALL Source Types

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 15:18:11
                                         DB2 Subsystem: I71A

1  Add Source
2  Add Related
3  Remove All Sources

Create matching targets: Y (Yes, No)

-
C

Row Range:                               Row Selection:
All Rows Y (Y/N)                          A (All, Every _____, Random)
Row _____ to _____

Press PF3 to save and exit.

Source Name: SOURCE1

Option ==> 1                               Scroll ==> PAGE
MA a                                         14/012

```

Same Row Range and Row Selection options are presented.

Use F3 to save & exit.

Text "Name" used to refer to this source object.

Completion of Adding a Source

```

Session A - Rocket - [24 x 80]
GRI$SORC V2R1 ----- Sources ----- 2004/01/08 16:43:01
                                         DB2 Subsystem: I71A

1  Add Source
2  Add Related
3  Remove All Sources

Create matching targets: Y (Yes, No)

----- Row 1 of 1 -----
Cmd  Source Name
_   SOURCE1
***** Bottom of Data *****

Valid Line Commands: Edit, Delete

Option ==> 1
MA a

```

Choices for this display:

- Edit or Delete the source.
- Add Additional source(s).
- Add Related Objects.
- F3 to go back to TDBG Main Menu.

NOW TO ADD AN SQL SOURCE. Using Option 1

Add an SQL Source

```

Session A - Rocket - [24 x 80]
GRI$SDRC V2R1 ----- Sources ----- 2004/01/08 16:43:01
DB2 Subsystem: I71A

1 Add Source
2 Add Related
3 Remove All Sources

Create matching targets: Y (Yes, No)

-
C      What type of source do you want to add?
*
      1. SQL
      2. Delimited Text
      3. Fixed Text

      1_(1-3)

Valid Line Commands: Edit, Delete

Option ==> 1
Scroll ==> PAGE
MA a 18/022
  
```

Adding
SQL Source

Table Search / Selection Display

```

Session A - Rocket - [24 x 80]
GRI$TABL V2R1 ----- Table Selection ----- 2004/01/08 16:56:08
-----+-----
Location      RS01I71A (DB2)          DB2 Subsystem: I71A
Creator       Like  SYSIBM
Tables        Like  *
TableSpaces   Like  *
Databases     Like  *
-----+-----
Row 1 of 86

Cmd  Creator  Table Name      Table Space  Database
-
S  SYSIBM  INDEXSPACESTATS  DSNRTSTS    DSNRTSDB
-
  SYSIBM  IPNAMES          SYSDDF      DSND806
-
  SYSIBM  LOCATIONS        SYSDDF      DSND806
-
  SYSIBM  LULIST           SYSDDF      DSND806
-
  SYSIBM  LUMODES          SYSDDF      DSND806
-
  SYSIBM  LUNAMES          SYSDDF      DSND806
-
  SYSIBM  MODESELECT       SYSDDF      DSND806
-
  SYSIBM  SQLTABLETYPES    DSNATPTS    DSNATPDB

Valid Line Cmds: Select, Edit
Valid Option Cmds: change LOCation

Option ==>
Scroll ==> PAGE
MA a 24/015
  
```

Choices for this display:

- Local Location Displayed. To change to remote DB2, use LOC primary Option command.
- Can modify filter criteria for this display. Wildcarding allowed.
- E - invokes DB2 Table Editor (if available).
- S - select one or more tables.
- See USAGE HINTS for CSETUP primary option command for customizing display.

SQL Data Selection Display

Session A - Rocket - [24 x 80]

GRI\$TSQL V2R1 ----- Data Selection ----- 2004/01/08 17:07:46
+
DB2 Subsystem: I71A

Source Name: SOURCE2
Location: RS01I71A (DB2)

Row Range: Row Selection:
All Rows Y (Y/N) A (All, Every _____, Random)
Row _____ to _____

Cmd -----
-- Query from table SYSIBM.IPNAMES
-- Thu Jan 08 22:07:46 GMT 2004

SELECT
A.LINKNAME, A.SECURITY_OUT, A.USERNAMES,

Valid Line Cmds: Insert, Delete, Repeat

Option ==> _____ Scroll ==> PAGE
Mâ a 04/024

Choices for this display:

- SOURCE Name specification.
- Row Range
- Row Selection
- Display of the SQL Statement that will be used.
- SQL Statement CAN BE EDITED from this display.
- F3 to return to Main Source Display

Sources Specification Complete

Session A - Rocket - [24 x 80]

GRI\$MAIN V2R1 ----- Test Database Generator ----- 2004/01/08 17:22:32
Option ==> _____

Current Server: I71A Current SQLID SSIBM19 User: SSIBM19

Data Profile:

1	Sources	Sources: 2
2	Targets	Targets: 0
3	Generator	
4	Load Data Profile	
5	Save Data Profile	
6	Reset Data Profile	
S	Setup	
A	About	
X	Exit	

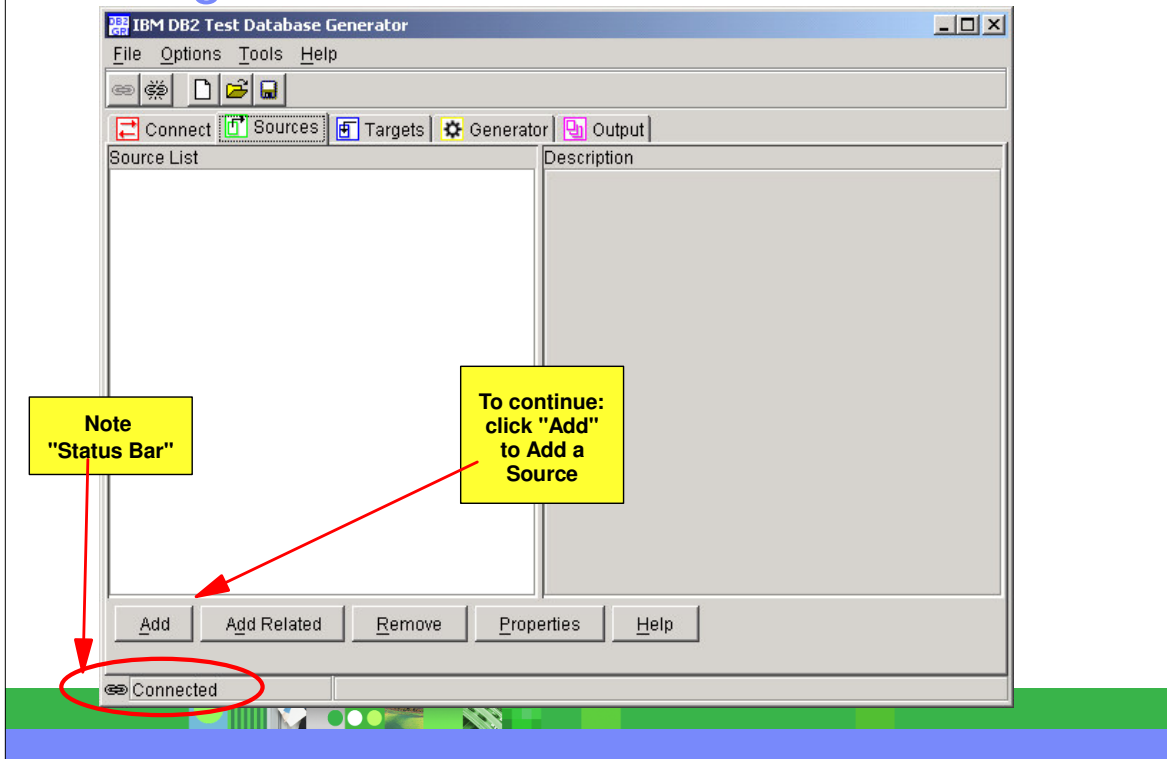
Enter **END** command to return to ISPF, or **S** to go to the setup screen.

Mâ a 02/014

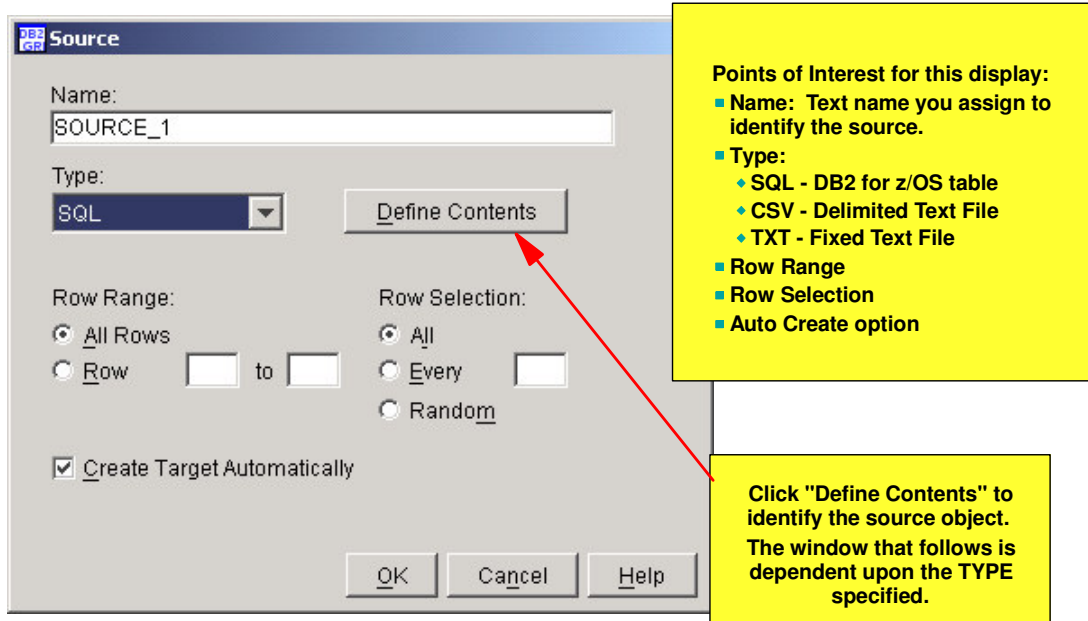
Points of Interest for this display:

- May wish to Save the Data Profile (option 5).
- Note COUNT of number of SOURCES and TARGETS.
- After specifying Sources, use option 2 to specify Targets.

Adding a Source with Java Client



Source Type & Row Selection Criteria



CSV Type - Delimited Text File

Specify Value Delimiter:

- none, quote, or apostrophe

Specify Field Delimiter:

- None, comma, Tab, Semicolon, Space

Source contents access methods:

- Embed - data is placed in "Contents" portion of this panel. (not available on ISPF client)
- FTP - specify URL, userid, & password
- File - specify URL
- HTTP - specify URL

TXT Type - Fixed Text File

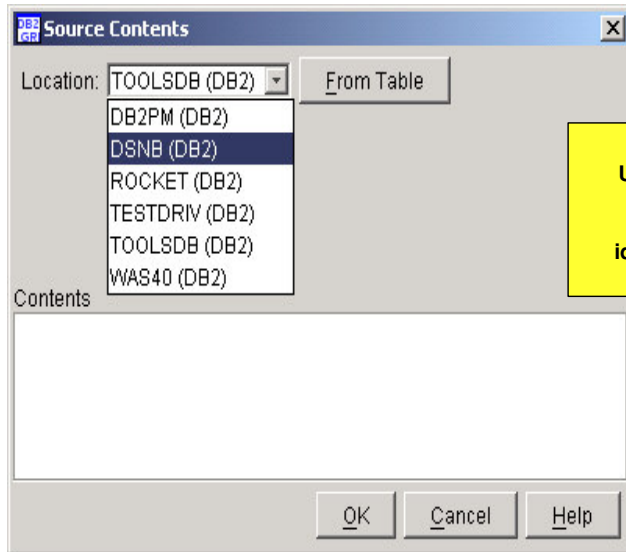
Specify Value Delimiter:

- Range Delimiter - Comma separated list of "offset" positions within the fixed text file that indicate column positions, must be listed in sequential order. Start at zero.

Source contents access methods:

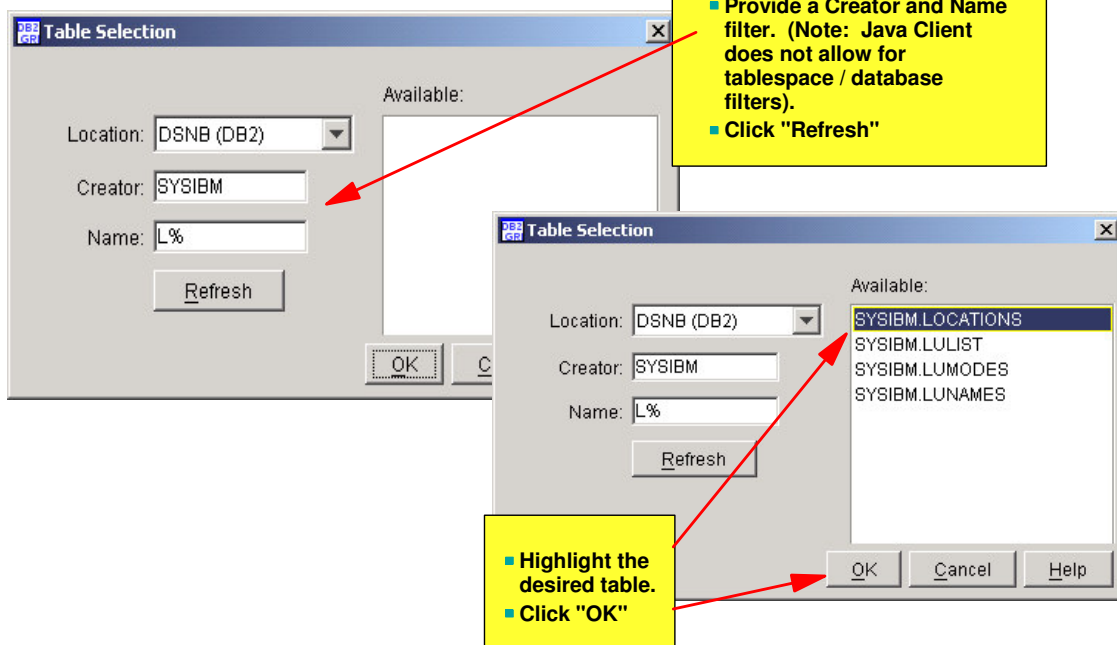
- Embed - data is placed in "Contents" portion of this panel.
- FTP - specify URL, userid, & password
- File - specify URL
- HTTP - specify URL

SQL Type - Location Specification



Use pulldown to specify source Location.
Click "From Table" to identify the source table.

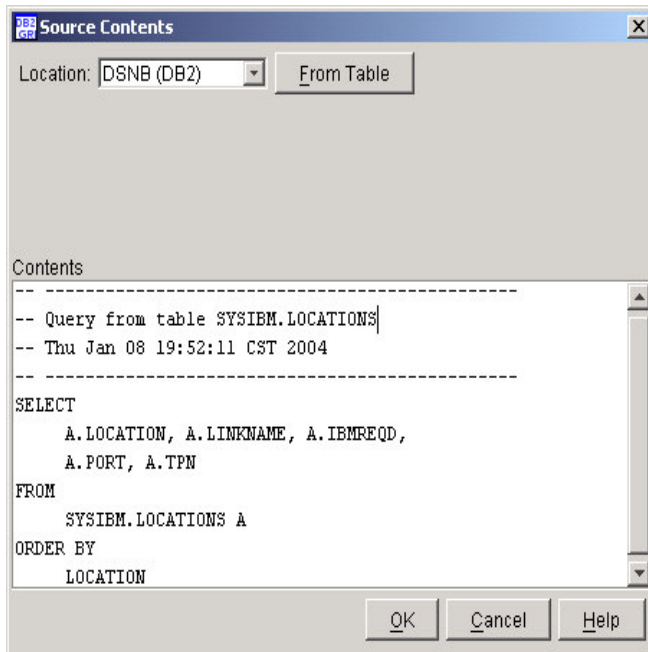
SQL Type - Table Identification



- Provide a Creator and Name filter. (Note: Java Client does not allow for tablespace / database filters).
- Click "Refresh"

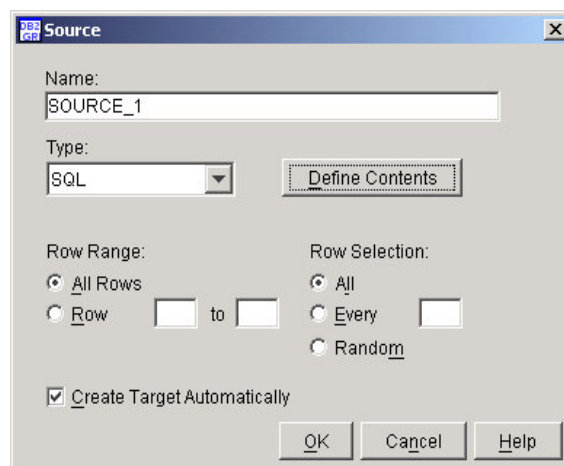
- Highlight the desired table.
- Click "OK"

SQL Type - Editable Query is Displayed



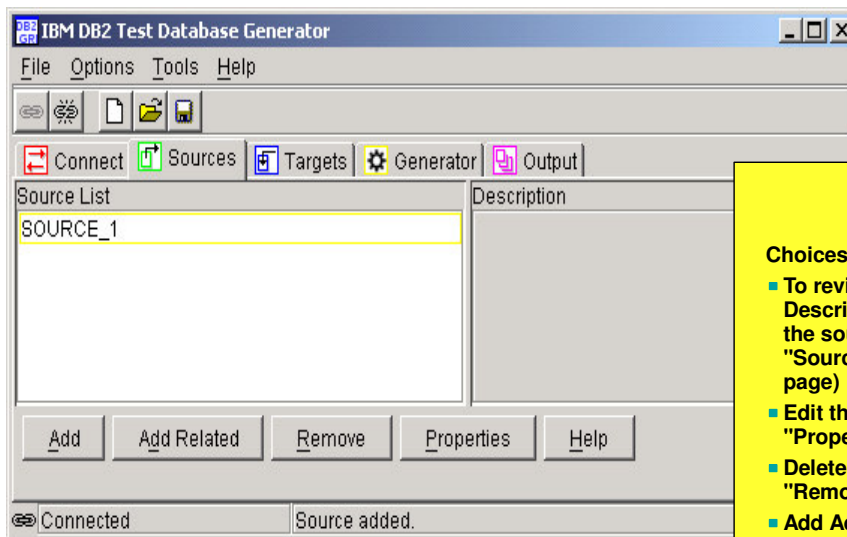
- If desired, Edit the SELECT statement..
- Joins / Unions specified in source SQL specification by either:
 - ◆ Editing the SQL statement
 - ◆ Use a View as a source
- Click "OK"

SQL Type - Source Table Specification Completion



Click "OK" to return to Source List Window.

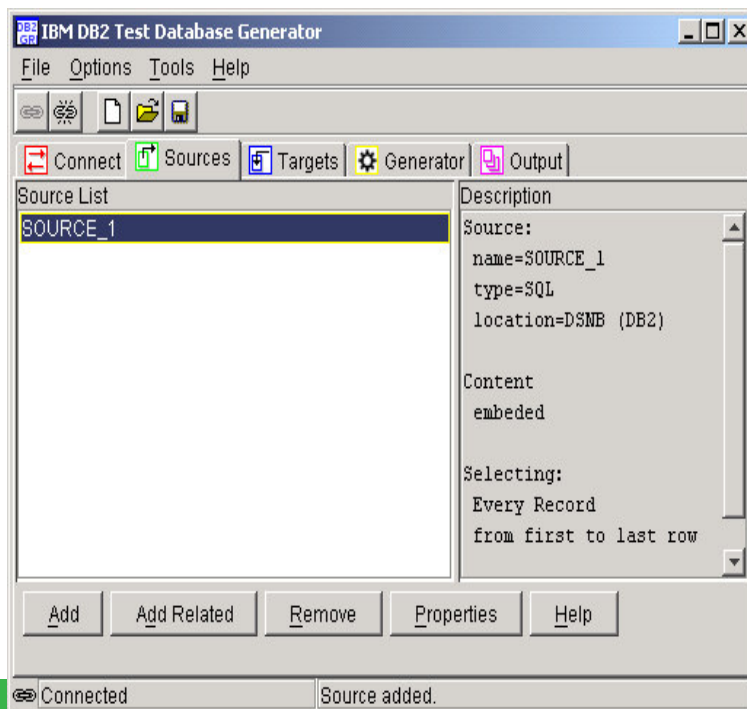
Source Table Display Summary



Choices for this display:

- To review Source Description, single click the source item in the "Source List". (see next page)
- Edit the Source, click "Properties"
- Delete the source, "Remove".
- Add Additional source(s).
- Add Related Objects.
- Click "Targets" tab to proceed.

Example of Source Description Display



Adding Related Objects

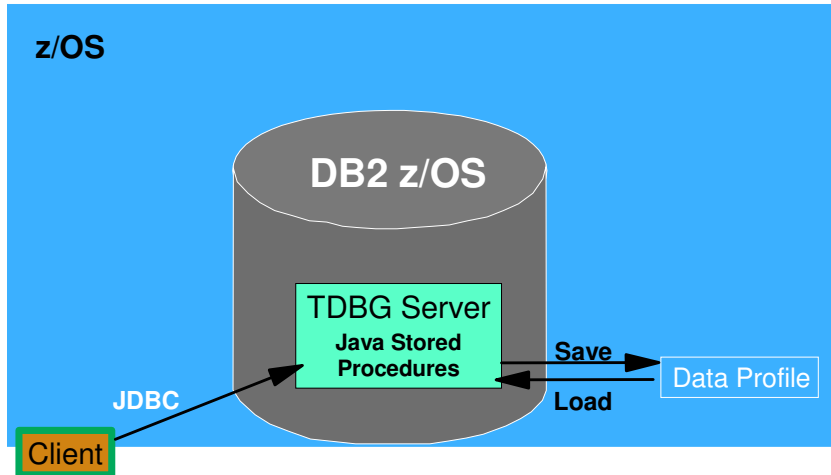
- DB2 Grouper for z/OS Version 1.1 is shipped with
 - ▶ DB2 Test Database Generator for z/OS
 - ▶ DB2 Data Archive Expert for z/OS
- Installation of DB2 Grouper is a Separate Process
- Execution of DB2 Grouper is a Separate Process
- The "Add Related" function of the TDBG's ISPF and Java Client REQUIRES DB2 Grouper.
- DB2 Grouper Provides the Following Capabilities:
 - ▶ Define non DB2-enforced referential constraints (Application RI)
 - ▶ Unit of Work Discovery - Examines DB2 archive log records for objects updated in same UOW.
 - ▶ Group Discovery - discovers relationships between tables combining Application RI, DB2 RI, and UOW Discovery information.
 - ▶ Enables Editing of Group Composition

Source Specification Data Transformation Capabilities (underlined)

- | | |
|--|--|
| <ul style="list-style-type: none"> ■ Table <ul style="list-style-type: none"> ▶ Change Table name ▶ Change Table Creator ■ Columns <ul style="list-style-type: none"> ▶ <u>Add (create) / Exclude</u> ▶ Name Change ▶ Order of Columns ▶ Specify / Change Data Attributes <ul style="list-style-type: none"> ● Data Type ● Length(s) ● Nullability ▶ <u>SQL Transformation</u> ▶ Specify Transformation Rule(s): <ul style="list-style-type: none"> ● Source Column ● Static ● Lookup ● Mask ● Expression ● Random ● Pattern | <ul style="list-style-type: none"> ■ Row Controls <ul style="list-style-type: none"> ▶ <u>Filtering via SQL Predicate</u> ▶ <u>Row Range</u> <ul style="list-style-type: none"> ● <u>All</u> ● <u>From x to y</u> ▶ <u>Selection within the Range</u> <ul style="list-style-type: none"> ● <u>All</u> ● <u>Every nth Row</u> ● <u>Random</u> ▶ Generate data from scratch ▶ Control Number of Rows Generated ■ <u>Join / Union Source Tables</u> ■ <u>Single Source to Multiple Unique Targets</u> ■ <u>Related Tables (Requires Grouper)</u> <ul style="list-style-type: none"> ▶ <u>Identify and Include</u> ■ Target DDL Generation |
|--|--|

Target Specification

Source Information kept in the Data Profile is used by Client and user to Build/Define Target Specifications



ISPF Client - Starting the Target Specification

```

Session A - Rocket - [24 x 80]
GRI$MAIN  V2R1  -----  Test Database Generator  -----  2004/01/08  23:20:46
Option ==> 2

Current Server: I71A      Current SQLID SSIBM19      User: SSIBM19
-----
Data Profile: presentation

1 Sources                Sources: 2
2 Targets                Targets: 0
3 Generator
4 Load Data Profile
5 Save Data Profile
6 Reset Data Profile

S Setup
A About
X Exit

Enter END command to return to ISPF, or S to go to the setup screen.
    
```

Use Option 2 on the main TDBG panel to start the Target Specification Process

Target List

Session A - Rocket - [24 x 80]

GRI\$TARG V2R1 ----- Target Structure -----

- 1 Add Target
- 2 Remove All Targets
- 3 Change Output Type: DELIMITED TEXT
- 4 Edit Target Options

Create DDL: Y (Yes, No)
z/OS Target: Z (Z/os, Multiplatform, Default)
Creator: SSIBM19 >

No rows to display

Cmd	Target Name	Records
No rows to display		

Valid line commands: Edit, Delete

Option ==> 1 Scroll ==> PAGE

M& a 24/015

Points to note:

- Add / Delete / Edit Targets
- Specify Output type (same for all target objects).
- Target options (#4) also for all targets.
- Can have table DDL generated to match the target objects; otherwise, user responsible to assure proper target object exists.
- Note targets can be z/OS, Linux, Unix, or Windows.
- Creator same specified & is same for all target objects.

If the SOURCE option "Create Matching Targets = Y" is used, the Targets will be predefined and can then be modified.

If set to "N", then targets are created target object and column at a time.

Adding a Column to the Target

Session A - Rocket - [24 x 80]

GRI\$STRC V2R1 ----- Target Structure ----- 2004/01/08 23:23:56

- 1 Add Column DB2 Subsystem: I71A
- 2 Add Columns from Table

Target Name: TARGET1
Rows: 100

Cmd	Order	Column	Type	Length	Scale	Nullable	Rules
No rows to display							

Valid line commands: Delete, Rules, data Type

Option ==> 1 Scroll ==> PAGE

M& a 24/015

Column Customization

```

Session A - Rocket - [24 x 80]
GRI$STRC V2R1 ----- Target Structure ----- 2004/01/08 23:24:55
-----
1 Add Column DB2 Subsystem: I71A
2 Add Columns from Table

Target Name: TARGET1
Rows: 100
-----
Cmd Order Column Type Length Scale Nullable Rules
-----
1 NAME2 CHAR 5 0 Y 0
***** Bottom of Data *****
-----
Valid line commands: Delete, Rules, data Type

Option ==> 2
-----

```

Customizing the Column(s) you Added:

- Column Order
- Column Name
- Data Type (use Line Command)
- Length (scale)
- Null Attribute.

Pull columns from another table.

Selecting the Additional Table

```

Session A - Rocket - [24 x 80]
GRI$TABL V2R1 ----- Table Selection ----- 2004/01/08 23:27:08
-----
Location RS01I71A (DB2) DB2 Subsystem: I71A
Creator Like SYSIBM
Tables Like *
TableSpaces Like *
Databases Like *
-----
Row 1 of 86
-----
Cmd Creator Table Name Table Space Database
-----
SYSIBM INDEXSPACESTATS DSNRTSTS DSNRTSDB
SYSIBM IPNAMES SYSDDF DSND806
SYSIBM LOCATIONS SYSDDF DSND806
SYSIBM LULIST SYSDDF DSND806
SYSIBM LUMODES SYSDDF DSND806
SYSIBM LUNAMES SYSDDF DSND806
SYSIBM MODESELECT SYSDDF DSND806
SYSIBM SQLTABLETYPES DSNATPTS DSNATPDB
-----
Valid Line Cmds: Select, Edit
Valid Option Cmds: change LOcation

Option ==>
-----

```

Adding Columns from other tables to the target:

- Use Filters to identify the desired table
- Select the desired table(s)

Modifying Target Data Type

```

Session A - Rocket - [24 x 80]
GRI$STRC V2R1 ----- Target Structure ----- 2004/01/08 23:29:22
-----
1  Add Column                               DB2 Subsystem: I71A
2  Add Columns from Table

Target Name: TARGET1
Rows: 100

-----
Cmd Order  Column                Type          Length  Scale  Nullable Rules
-----
1  NAME2                   CHAR          5        ---    Y      0
2  LOCATION                CHARACTER     16        ---    N      0
3  LINKNAME                CHARACTER     8         ---    N      0
4  IBMREQD                 CHARACTER     1         ---    N      0
I 5  PORT                    CHARACTER     32        ---    N      0
6  TPN                     VARCHAR       64        ---    N      0
-----
***** Bottom of Data *****

Valid line commands: Delete, Rules, data Type

Option ==>
a
16/005
    
```

T - data Type line command enables modification of the target data type

Column Data Type Modification

```

Session A - Rocket - [24 x 80]
GRI$STRC V2R1 ----- Target Structure ----- 2004/01/08 23:29:22
-----
Select a data type.
-----
1.  INTEGER                10.  VARGRAPHIC
2.  SMALLINT               11.  LONG VARGRAPHIC
3.  FLOAT                  12.  DATE
4.  REAL                   13.  TIME
5.  CHAR                   14.  TIMESTAMP
C 6.  VARCHAR                15.  CLOB
7.  LONG VARCHAR           16.  DBCLOB
8.  DECIMAL                17.  ROWID
9.  GRAPHIC
-----
* (1-17)
-----
Valid line commands: Delete, Rules, data Type

Option ==>
a
18/026
    
```

Note that ALL data types are available for assignment to the target column. Rules or Select list expression must provide for the transformation of the source data to the target data type.

Rules for Target Columns

```

Session A - Rocket - [24 x 80]
GRI$STRC V2R1 ----- Target Structure ----- 2004/01/08 23:29:22
-----
1 Add Column
2 Add Columns from Table
DB2 Subsys

Target Name: TARGET1
Rows: 100

-----
Cmd Order  Column                Type      Length  Scale  Nullable  Rules
-----
1  NAME2                CHAR      5
2  LOCATION             CHARACTER  16
3  LINKNAME             CHARACTER  8
4  IBMREQD              CHARACTER  1
R 5  PORT                 CHARACTER  32
6  TPN                  VARCHAR   64
-----
***** Bottom of Data *****

Valid line commands: Delete, Rules, data Type

Option ==>
Scroll ==> PAGE
Mâ a 16/005

```

Rules MUST be defined for ALL target columns. The R (Rules) line command is used.

Note: If during source specification, the "Create Matching Target = Y" option was used, the "source column" would be assigned.

Adding a Rule

```

Session A - Rocket - [24 x 80]
GRI$RULS V2R1 ----- Target Rules ----- 2004/01/08 23:31:25
-----
DB2 Subsystem: I71A

1 Add Rule

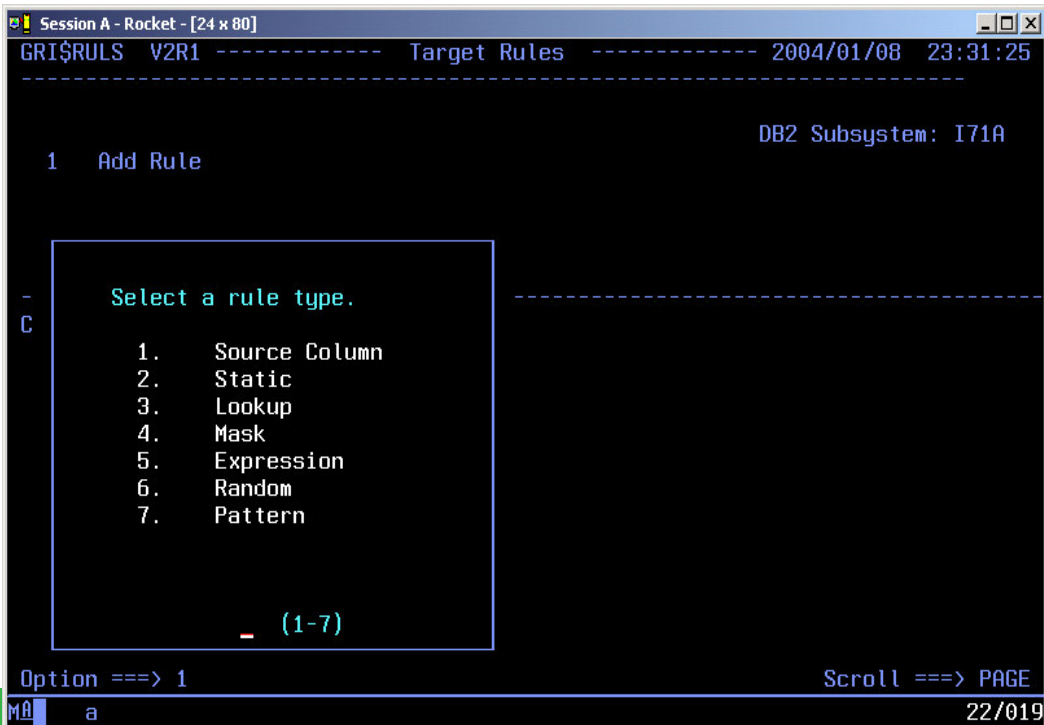
-----
Cmd Description

Valid line commands: Edit, Delete

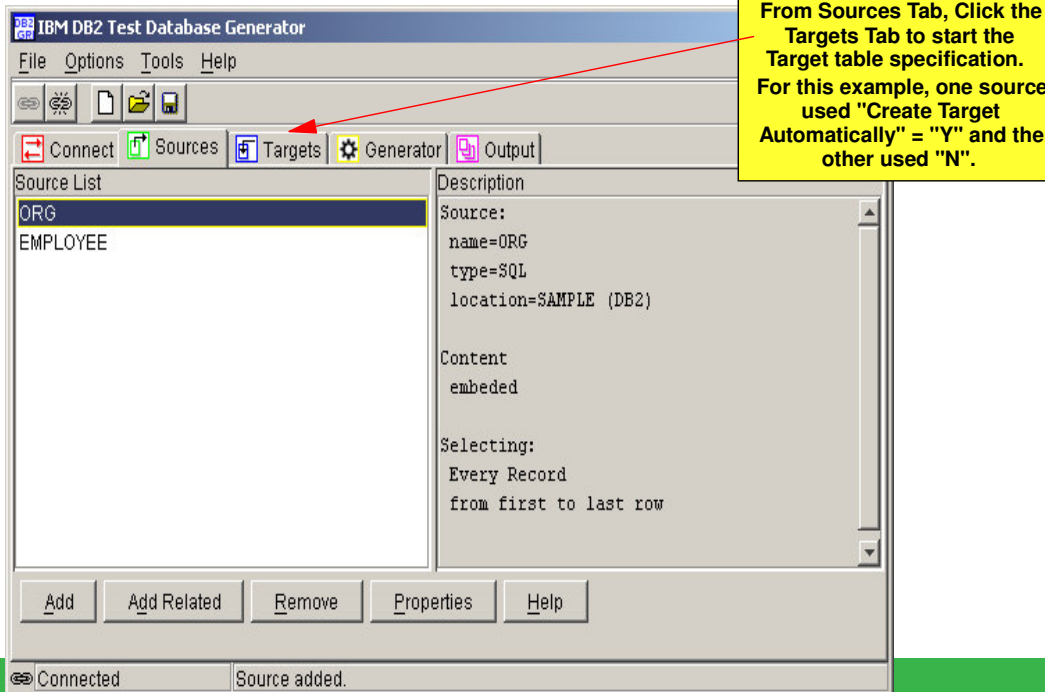
Option ==> 1
Scroll ==> PAGE
Mâ a 24/015

```


Available Rules



Java Client - Moving from Source to Target Specification



Target List

Points to note:

- ORG table's target created automatically.
- Can ADD or REMOVE targets
- The OPTIONS for ALL targets can be modified/specified
- Columns for a specific target table can be modified.

This target created automatically from "Create Target Automatically" option on Source Definition

Options will be reviewed first

Target Options Window

Target Platform choices:

- DB2 for z/OS
- DB2 for Multiplatforms

Output format choices:

- SQL
- Delimited Text
- Fixed Text
- XML
- DB2 (directly to any)
- DB2 for z/OS Load

Also Note:

- Creator id to be used for ALL target tables
- Option to generate DDL for target object.
- Options for DB2 as output type
- Options for DB2 Load output type

Click OK when completed.

Modifying Target Column Properties

To modify or review the properties of individual columns, or to add/remove columns from the target:

- Highlight desired table
- Click "Properties" button

The screenshot shows the 'Target List' with 'AUTOTARGET_1' selected. The 'Description' pane shows target details (name=AUTOTARGET_1, rows=100) and a list of columns: DEPTNUMB SMALLINT (5, 0) 1 Rules, DEPTNAME VARCHAR (14, 0) 1 Rules, MANAGER SMALLINT (5, 0) 1 Rules, DIVISION VARCHAR (10, 0) 1 Rules, and LOCATION VARCHAR (13, 0) 1 Rules. The 'Properties' button is highlighted at the bottom.

Column Customization

Target Object Properties:

- Specify Name of target table (Note: creator id specified in Target Options window).
- The number of rows inserted WILL MATCH the ROWS specification. Use -1 to have row count match number in source.

Options for Column Customization:

- Column Order is changed using "UP" and "DOWN" buttons.
- "ADD" / "REMOVE" columns with button
- Include columns from other tables
- Change Column Name by overtyping
- Change Data Type (using pulldown on the column)
- Length (scale)
- Null Attribute.

To Review or Modify column RULES, click RULES tab.

The 'Target Properties' dialog shows 'Name: AUTOTARGET_1' and 'Rows: 100'. The 'Selected Column' is '#1 DEPTNUMB SMALLINT'. The 'Rules' tab is active, showing a table of column properties:

Column	Data Type	Length	Precision	Nullable	Rules
DEPTNUMB	SMALLINT	5	0	<input type="checkbox"/>	1
DEPTNAME	VARCHAR	14	0	<input checked="" type="checkbox"/>	1
MANAGER	SMALLINT	5	0	<input checked="" type="checkbox"/>	1
DIVISION	VARCHAR	10	0	<input checked="" type="checkbox"/>	1
LOCATION	VARCHAR	13	0	<input checked="" type="checkbox"/>	1

Rules for Target Columns

Rules MUST be defined for ALL target columns.

Note: If during source specification, the "Create Matching Target = Y" option was used, the "sourcecol" is assigned.

Multiple rules can be created. Order of application can be changed using UP/DOWN buttons.

To modify an existing rule, highlight it, make changes, and click "Update" button.

To add an additional rule, enter properties and click "Add".

Target Specification Data Transformation Capabilities (underlined)

- Table
 - ▶ Change Table name
 - ▶ Change Table Creator
- Columns
 - ▶ Add (create) / Exclude
 - ▶ Name Change
 - ▶ Order of Columns
 - ▶ Specify / Change Data Attributes
 - Data Type
 - Length(s)
 - Nullability
 - ▶ SQL Transformation
 - ▶ Specify Transformation Rule(s):
 - Source Column
 - Static
 - Lookup
 - Mask
 - Expression
 - Random
 - Pattern
- Row Controls
 - ▶ Filtering via SQL Predicate
 - ▶ Row Range
 - All
 - From x to y
 - ▶ Selection within the Range
 - All
 - Every nth Row
 - Random
 - ▶ Generate data from scratch
 - ▶ Control Number of Rows Generated
- Join / Union Source Tables
- Single Source to Multiple Unique Targets
- Related Tables (Requires Grouper)
 - ▶ Identify and Include
- Target DDL Generation

Agenda

- Test Data Generation Objectives
- IBM DB2 Test Database Generator for z/OS
Version 2.1 Today
 - ▶ Summary of Capabilities
- Terminology and Architecture
- Potential Configurations
- **Transformations**
 - ▶ Source & Target Specifications
 - ▶ **Transformation Rules**
- Generation & Results
- Hints & Tips

Transformation Rules

- Transformation rules define the target test data
 - ▶ How to generate test data from source data
 - ▶ How to generate test data from scratch
- Examples
 - ▶ Create a target column PHONE which is the combination of a country code (derived from COUNTRY file), an area code from TABLE1, and a phone number from TABLE2.
 - ▶ Create a target column ACCT_BALANCE which is a random number that falls within a specified range.
 - ▶ Create a target column that is exactly the PIN column with the 3rd and 5th positions replaced (masked) with the letter X.

Rule Terminology - Scopes and Sets

- You define your test data one target column at a time
- The scope of a transformation rule set is target column
- Multiple rules can be specified for each target column
- Transformation rules are applied in order
- Each rule can modify, replace, append, or preface the previous value to allow for incremental building of a target column



Transformation Rules

- Static Values
- Source Column Values
- Data Lookup
- Data Masking
- Expressions
- Random Values
- Pattern Generation



Rule 1: Static Values

- Specify static data value
- Source data not used as input for this rule
- Examples
 - ▶ Set target column DIVISION to 12
 - ▶ Set target column STATE to CA
 - ▶ Set target column EXP_DATE to 2030-12-31

The screenshot shows the 'Target Properties' dialog box for a target named 'AUTOTARGET_1' with 100 rows. The selected column is '#4 DIVISION VARCHAR'. The 'Rules' tab is active, showing a rule named 'static'. The 'Value' field contains '12' and the 'Operation' is set to 'replace'. The 'Applied Rules' list shows the rule configuration: 'type="static" op="replace" value="12"'. Buttons for 'Update', 'Add', 'Remove', 'Up', 'Down', 'OK', 'Cancel', and 'Help' are visible at the bottom.

Rule 2: Source Column Values

- Generate target column value based on source column value
- No transformation (use source data as-is)
- Copies a column value from the currently selected row in a source object
- Used to perform a "copy" function
- Used to supply initial column value from a data source
- TDBG Auto-Target feature uses this rule as the default

The screenshot shows the 'Target Properties' dialog box for a target named 'AUTOTARGET_1' with 100 rows. The selected column is '#3 MANAGER SMALLINT'. The 'Rules' tab is active, showing a rule named 'sourcecol'. The 'Source' field is set to 'ORG' and the 'Column' field is set to 'MANAGER'. The 'Applied Rules' list shows the rule configuration: 'type="sourcecol" op="replace" source="'. Buttons for 'Update', 'Add', 'Remove', 'Up', 'Down', 'OK', 'Cancel', and 'Help' are visible at the bottom.

Rule 3: Data Lookup

- Provides a method to replace data based on table lookups
- Uses the current value of the generated column as a key to the lookup
- Specify replacement column
- Example:
 - ▶ Source data has a product code which needs to be represented as a product name
 - PROD_NAME =
LOOKUP(PRODUCT_CODE
in PRODUCT_TABLE)

Target Properties

Name: AUTOTARGET_1 Rows: 100

Selected Column: #2 DEPTNAME VARCHAR

Structure Rules

Rule: lookup

Applied Rules: type="lookup" op="replace" source="OR

Source: ORG

Index Column: DEPTNUM

Value Column: DEPTNAME

Not Found: null

Operation: replace

Update Add Remove Up Down

OK Cancel Help

Rule 4: Mask

- Replace or hide sensitive data
- Masks can be set with static text
 - ▶ Replace account number with a string of X's
 - ▶ Replace last four digits of License ID with 9999
- Mask can be set using a pattern rule (see rule #7)
 - ▶ Replace first character with a letter in the range A-F and then replace the next position with a number between 0 and 9
- Mask can be applied to the entire column or to a substring of the column

Target Properties

Name: AUTOTARGET_1 Rows: 100

Selected Column: #5 LOCATION VARCHAR

Structure Rules

Rule: mask

Applied Rules: type="mask" op="replace" positions="0-

Value: [0-9]*3

Positions: 0-2

Operation: replace

Update Add Remove Up Down

OK Cancel Help

Rule 5: Expression

Expression provides a method to call database specific functions

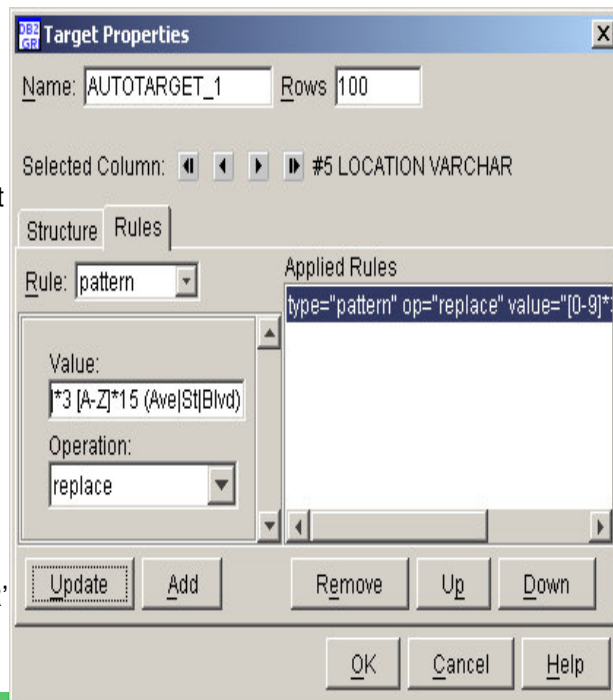
- Supports any expression that can be evaluated by the DBMS in which TDBG is installed
 - ▶ String manipulation, calculations, etc.
- Examples
 - ▶ Calculate the current date / time / timestamp
 - ▶ Evaluate a mathematical expression
 - Target column =
source column * 1.1

Rule 6: Random

- Generate a random value
- Allows for creating random date, time, timestamp, integer, and decimal values
- Specify min / max ranges for the generated values
- Randomly generated values are propagated across related tables
 - ▶ Only applies to primary/foreign key relationships that are system or user defined
 - ▶ A DEPT_CODE that is randomly generated shows up in both the DEPT table and the EMPLOYEE table

Rule 7: Pattern

- Generate data based on a specified pattern
 - Numeric pattern
 - ▶ [0-9] evaluates to any single-digit number
 - Character pattern
 - ▶ [A-Z]*3 evaluates to any three-character uppercase string
 - ▶ Character patterns are randomly selected at generation runtime
 - String pattern
 - ▶ (Mrs|Mr|Ms) evaluates to 'Mrs', 'Mr', or 'Ms'.
 - ▶ (C[ATO] | A[KLR]) evaluates to 'CA', 'CT', 'CO', 'AK', 'AL', or 'AR'

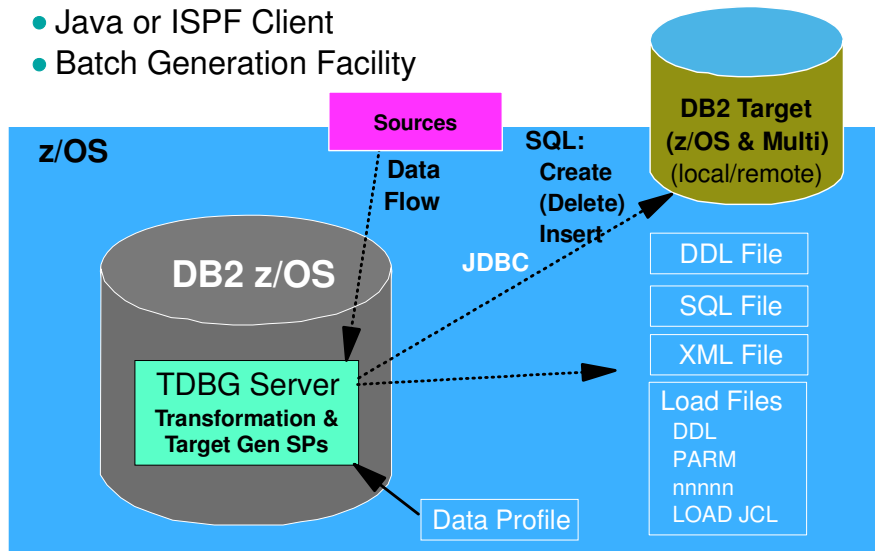


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- IBM DB2 Test Database Generator for z/OS Version 2.1 Today
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- Hints & Tips

TDBG Generation

- Initiated by:
 - Java or ISPF Client
 - Batch Generation Facility



Data Generation

```

Session A - Rocket - [24 x 80]
GRI$MAIN V2R1 ----- Test Database Generator ----- 2004/01/11 18:18:04
Option ==>

Current Server: I71A      Current SQLID SSIBM19      User: SSIBM19
-----

Data Profile: presentation

1 Sources                Sources: 2
2 Targets                Targets: 0
3 Generator              -
4 Load Data Profile
5 Save Data Profile
6 Reset Data Profile

S Setup
A About
X Exit

Enter END command to return to ISPF, or S to go to the setup screen.
    
```

■ Before Generating (Option 3), first use option #5 Save Data Profile.
 ■ Then use Option #3 Generator to proceed.

Start the Generation Process

```

Session A - Rocket - [24 x 80]
GRI$GENE V2R1 ----- Data Generation ----- 2004/01/11 18:24:31
-----
DB2 Subsystem: I71A
1 Start Generating      Data Profile: presentation
2 Stop Generating
3 View Existing Log

Current Status:
-----

Option ==> 1          Scroll ==> PAGE
MA a                                     24/014
  
```

- Start or Stop Generating
- View generation log

Generation Results Log

```

Session A - Rocket - [24 x 80]
GRI$GENE V2R1 ----- Data Generation ----- 2004/01/11 18:27:18
-----
DB2 Subsystem: I71A
1 Start Generating      Data Profile: presentation
2 Stop Generating
3 View Existing Log

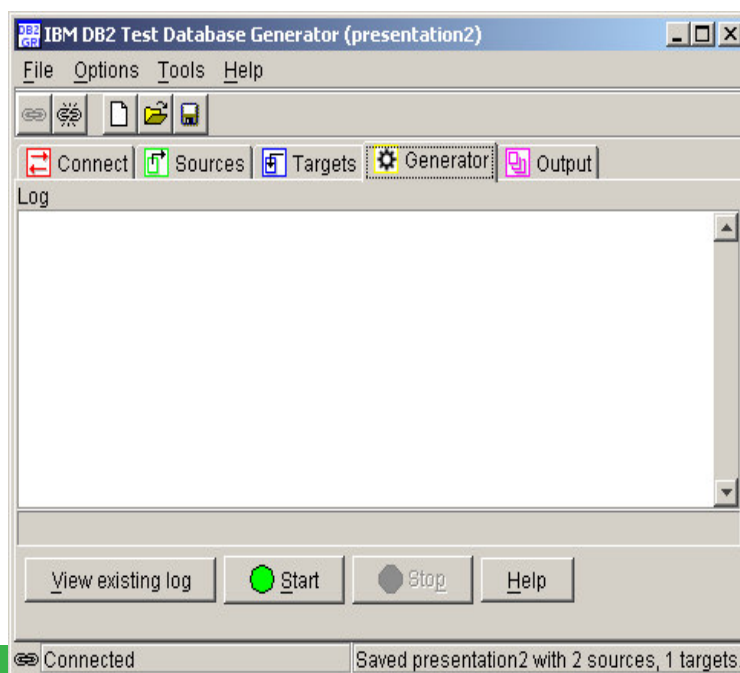
Current Status: STOPPED
-----
18:24:44 (5655) DB2 Test Dbase Generator z/OS
18:24:48 init: Location RS01I71A (DB2)
18:24:48 init: Location Driver=DSNAJDBC DSN0701
18:24:48 init: Location isolation = READ_COMMITTED
18:24:48 init: Locations 1 of 1
18:24:48 init: Source SOURCE1
18:24:48 Generator.init(): S:com.ibm.db2.gri.server.GriException: SourceProcess
18:24:48 deinit: Sources end
18:24:48 deinit: Targets end
18:24:48 deinit: Locations end
18:24:48 deinit: end=Sun Jan 11 18:24:48 EST 2004
18:24:48 deinit: runningTime=4 sec.
-----

Option ==>          Scroll ==> PAGE
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```

Result Files from USS

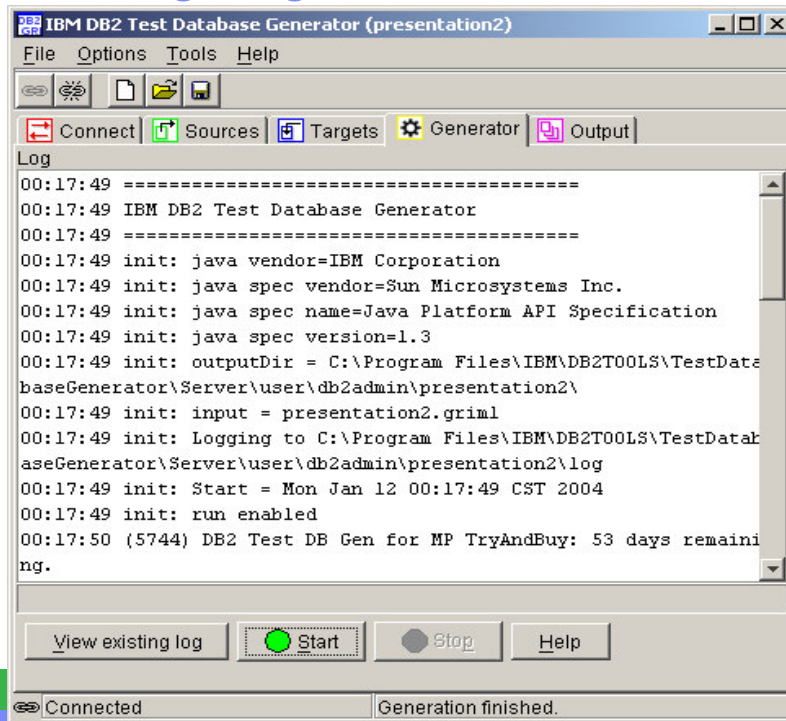
- To determine placement of output files, query the SYSTOOLS.GRI_ENV table. Row with userPATH environment variable specifies the directory.
 - ▶ Setting established during product configuration
- The outputs generated are dependent upon the output type option selected (e.g. XML, DB2, Generated DDL) plus execution logs.
- The GRIML file is also in this directory.

Generator Window (Java Client)

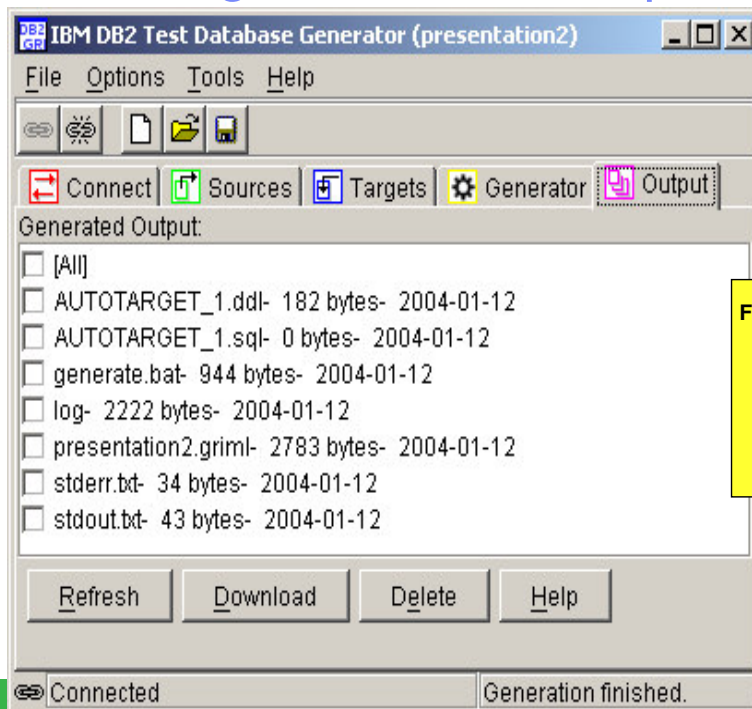
**From the Generator Tab:**

- Retrieve and View Log from last execution
- Start or Stop Generator

Viewing Log After Generation



Accessing Generated Outputs



From the Output Tab:

- Select and Download Generated Output.
- Generated Output is dependent upon Target Type (e.g. SQL, DB2)
- Delete output files.

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TDBG = Test Database Generator



Usage Hints - ISPF Panel Display Customization

- Some ISPF panel fields contain long fields and are left/right scrollable
- TDBG supports Long Object Names, default ISPF Client displays are set to max column width
- Some users Want to Control Other Panel Display Options
 - ▶ CSETUP command when executed on ISPF panels with column objects enables customization of following ISPF columns attributes:
 - FIX - keep selected columns on Left Side of Panel
 - ORDER - control horizontal placement of columns
 - SIZE - size of the column
 - SORT - select column(s) to sort
 - RESET - rollback recent customizations
 - REMOVE - use product defaults
 - Make Customization Permanent or Temporary for User doing customization
 - ▶ See Appendix B of TDBG User's Guide



Usage Hints - Downloading the Java Client

- Must be FTPed from Host to Workstation. In addition, documentation does not identify the proper file to download.
- FTP in binary
- Instructions for Locating and FTPing Java Client code from Windows workstation:
 - ▶ Start a DOS prompt window
 - ▶ cd to the directory that you will place the code: e.g. c:\temp\tdbg
 - ▶ ftp
 - ▶ open <hostname> (e.g. Dallas demo hostname: demomvs.demopkg.ibm.com)
 - ▶ enter host userid when prompted
 - ▶ enter host password when prompted
 - ▶ cd /usr/lpp/griv2r1/client (or other directory if default install dir not used)
 - ▶ binary
 - ▶ get TDBGClient32.exe (file is about 40 meg)
 - ▶ quit
- Using the "Run" window, locate the file and execute it.

Additional Hints

- RULE descriptions and examples are documented in Chapter 3 and Appendix D of the DB2 Test Database Generator User's Guide.
- Installation and Configuration requires following skill sets in addition to typical skills used in installing z/OS systems software products:
 - ▶ z/OS
 - z/OS ISPF
 - Java Virtual Machines (JVM)
 - Working with DB2 for z/OS and JDBC installation & configuration
 - Working with OMVS segments
 - Unix Systems Services (USS)
 - DB2 for z/OS Stored Procedure Address Space Enablement and using SQL to create stored procedures.
 - Workload Manager (WLM)
 - ▶ Windows
 - DB2 Connect Installation and Configuration
- DB2 Grouper provides ALL Referential Integrity functionality.
- Any users of DB2 TDBG must have a complete OMVS segment with a shell and home directory

Documentation & Reference Material

Document Name	Document Number
Program Directory for DB2 Test Database Generator for z/OS Version 2.1	GI10-8516
IBM DB2 Test Database Generator User's Guide	SC18-7411
Fact Sheet - TDBG	GC18-9148
Program Directory for DB2 Grouper for z/OS Version 1.1	GI10-8569
IBM DB2 Grouper User's Guide	SC18-7409

Website for all DB2 Tools, including links to product information, documentation and support information:

<http://www.software.ibm.com/data/db2imstools>

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