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Data Archiving DB2 Data Archive Expert for z/OS

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Agenda

- Motivation for archiving data
- Data Archiving Concepts
- Introduction to Data Archiving
- Archiving with IBM DB2 Data Archive Expert for z/OS
 - Overview
 - Using IBM DB2 Data Archive Expert
 - Scenario
- DB2 Grouper
- Other Considerations

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Motivation for archiving data

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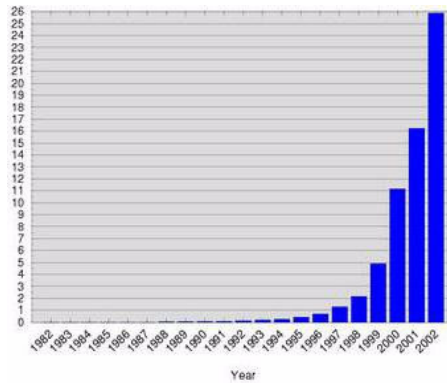


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Motivation for archiving data

- Pressing concern for IT shops is dealing with increasing volumes of data
- Databases are growing at an exponential rate



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Gale Research Inc.





Inactive (dormant*) Data

- **Inactive data exists everywhere**
 - Transactional histories
 - DW (Data Warehouses)
 - e-mail, ...
- **Inactive data is not unusable; it just has a lower probability of access**
- **Data that is unusable should be deleted**
- **Why keep inactive data?**
 - Legislated by government
 - Business need - Trend analysis, Previous customer history
- **Phenomenon that as databases grow in size, the percentage of inactive data grows -- e.g.,**

10GB	10% inactive
100GB	50% inactive
2TB	80% inactive
50TB	95% inactive

*Inmon, Bill. *Webinar on data warehousing and dormant data*. <http://archive.mshow.com/61039>

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The problem

- **Inactive data costs you**
 - Increased concern of IT executives is how to manage complex enterprise databases that keep growing larger
 - Expanding capacity is not always the most effective way to deal with growth
 - Allowing databases to grow without bounds can affect bottom line by increasing costs in the following ways:
 - Performance
 - Manageability
 - Hardware and storage costs

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Let's look closer at the costs...

- **Performance costs**
 - Additional I/O
 - Additional processing
 - Impacted users from poor performance
- **Manageability costs**
 - As size increases, so does the effort to manage the data (application tuning, backup/recovery, storage management, reorgs, monitoring, etc.)
 - Large objects may not be able to be reorganized
 - Hit maximum size limits
- **Hardware and storage costs**
 - Disks
 - Processors

Efficiency!

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The solution: Archiving

Transferring inactive data to an *archive* that can quickly be accessed when necessary

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Data archiving concepts

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Data archiving concepts

▪ What is archiving?

- One definition: The process of removing data from active data stores while providing the capability of accessing the removed data at a later time
- Archive/Retrieve (as opposed to Backup/Recover)
- Why isn't an archive the same as a backup?
 - Archives contain selective data
 - Backups are data store oriented
 - Archives are application oriented

However, an archive could be an important element in a backup/recovery scheme

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How is data being archived today?

- **Mostly by home-grown application code**
 - Tailored to each application
 - Costly to maintain
- **Some folks aren't archiving at all**
 - Purge and hope they don't need it later
 - Keep adding resources as data store grows
- **Strict data retention regulations require a robust solution**
- **Remember, data archiving is controlled by the application teams, not the system programmers**



Introduction to Data Archiving





Introduction to Data Archiving: Scenario

Task: archive projects that ended in 1982

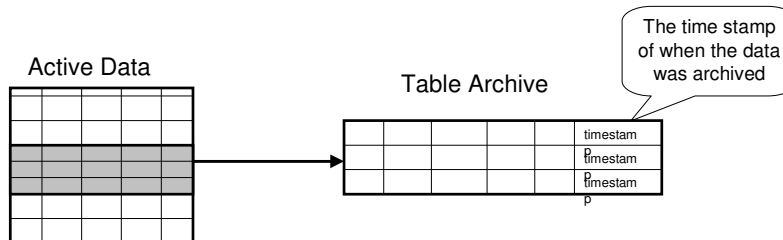
DB2 table
PROJECT

PROJNO	PROJNAME	DEPTNO	PRENDATE
IF2000	USER EDUCATION	C01	2/1/1983
MA2100	WELD LINE AUTOMATION	D01	2/1/1983
MA2110	W L PROGRAMMING	D11	2/1/1983
MA2111	W L PROGRAM DESIGN	D11	12/1/1982
MA2112	W L ROBOT DESIGN	D11	12/1/1982
MA2113	W L PROD CONT PROGS	D11	12/1/1982
OP1000	OPERATION SUPPORT	E01	2/1/1983
OP1010	OPERATION	E11	2/1/1983



Definition: Archiving

Archiving is the process of moving inactive data to another storage location that can be located and accessed when necessary.

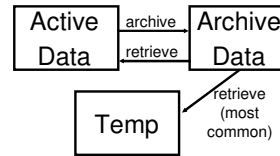




Archiving Terminology

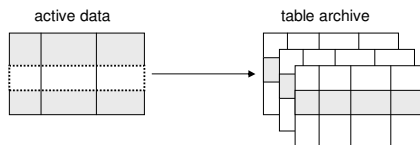
Terminology

- Active data
- Archive data
- Types of archives
 - Archive tables: Tables directly accessed via SQL (aka "History tables")
 - Archive files
 - Flat files (not in the same data store i.e., DBMS) - Expected delays in access
 - Choices of disk(\$\$\$\$\$), tape(\$), or optical(\$)
- Archive metadata - Data about the archive
 - Captured for each archive

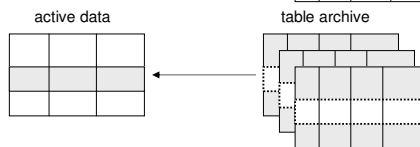


Archiving Terminology...

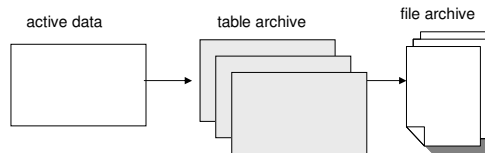
Archive



Retrieve



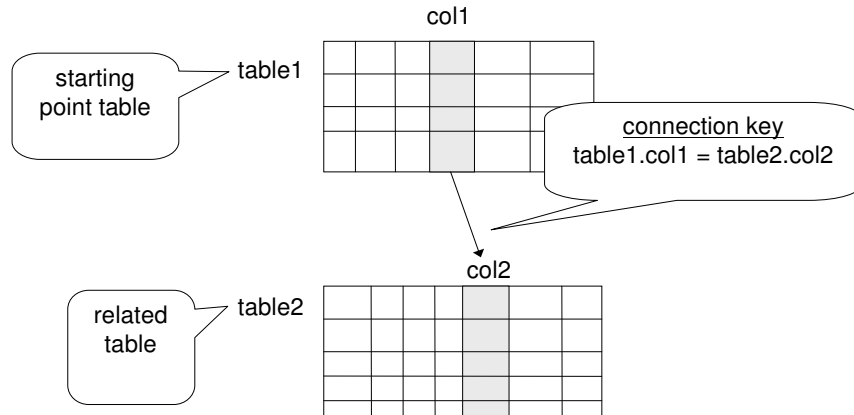
Multi-tiered archiving strategy





Archiving Terminology...

▪ Archive Unit



Overview of Archiving with DB2 Data Archive Expert

|





Benefits of Using DB2 Data Archive Expert

- **Archive data across a set of related tables.**
 - DB2 Grouper Component
- **Choice of archiving strategies.**
 - Tables, Files, Multi-tier
- **Choose when to remove the archived data from the source.**
 - Immediate or Deferred Delete
- **Captures information about the archive.**
 - Metadata
- **Allows you to schedule archiving activity.**
 - Callable API



What does DB2 Data Archive Expert do?



- Provides an ISPF interface that helps you to configure and use DB2 Data Archive Expert.

```

AHKV11 ----- IBM DB2 Data Archive Expert for z/OS -----
Select Archive Expert Action ==>_____

                                     DB2 system : DSN7
                                     Schema      : AHKCT1
                                     User ID    : BDREHER
                                     Time       : 14:19

0  Archive Expert Settings
1  Archive Specifications           (Create, Update, Delete, Run)
2  Retrieve Specifications         (Create, Update, Delete, Run)
X  Exit

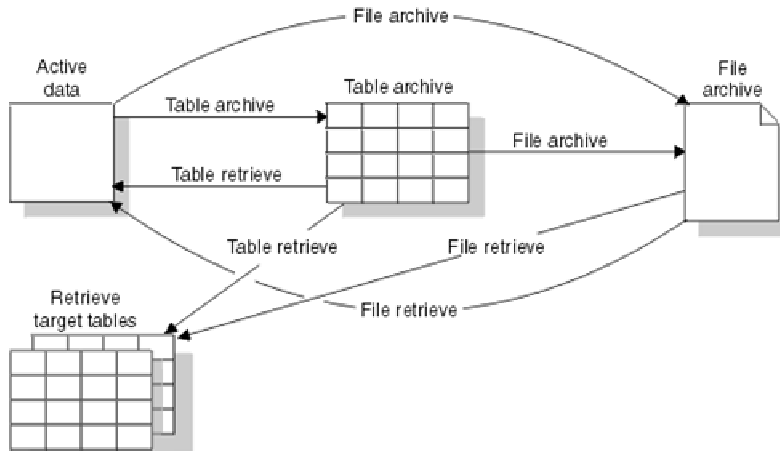
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F1=HELP      F2=SPLIT    F3=END      F4=RETURN   F5=RFIND   F6=RCHANGE
F7=UP        F8=DOWN     F9=SWAP    F10=LEFT   F11=RIGHT  F12=RETRIEVE
    
```





DB2 Data Archive Expert Model

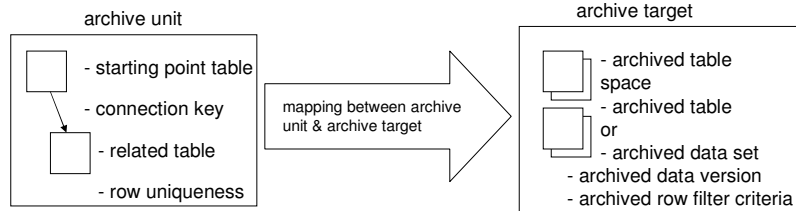


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DB2 Data Archive Expert Components

- An ISPF interface
- Specifications



- DB2 Data Archive Expert metadata
- A callable Application Programming Interface (API)
- DB2 Grouper

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Archiving with DB2 Data Archive Expert for z/OS

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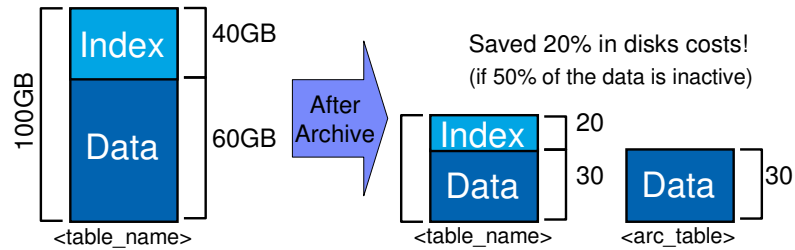


What does DB2 Data Archive Expert for z/OS do?



Archive

- To table
 - Retain SQL access
 - Save disk space (by not requiring fast index access to archived data):



- Archive is a copy and a delete operation
 - The deletes can be deferred; junction tables can be defined
 - Product insures that no data is deleted that is not safely in the archive

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What does DB2 Data Archive Expert for z/OS do?

▪ Archive

–To file

- No SQL access, but cheaper media options available
 - Consider media format when upgrading storage devices
 - Tape is still about 5 times cheaper than disk
- Can use products like SAS or a 4GL to access data
- DFHSM can be used to automatically migrate files to cheaper storage media
- Like archive tables, rows are timestamped in order to know when they were archived



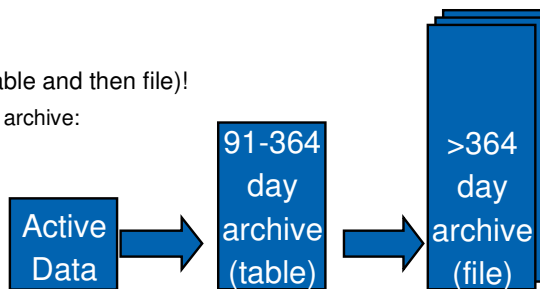
What does DB2 Data Archive Expert for z/OS do?



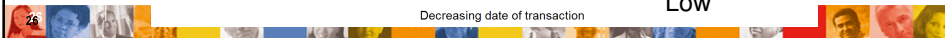
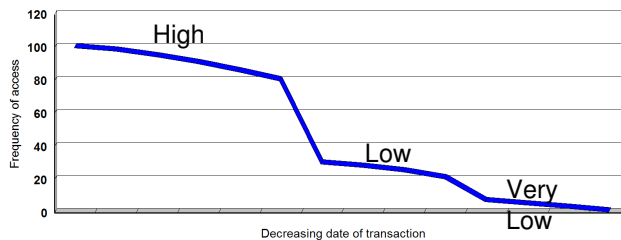
▪ Archive

–To both (table and then file)!

• Multi-tier archive:



Data Access





What does DB2 Data Archive Expert for z/OS do?

- **Retrieve**
 - To temporary table or source
 - Usually on demand -- could be programmatically controlled
 - Selective from
 - Single archive
 - Multiple archives

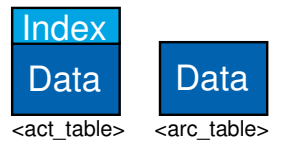
- **Keeps track of the archives (metadata)**
 - When (timestamp)
 - Who (userid)
 - What (What was archived)
 - SQL WHERE clause
 - Definitions (DDL)
 - Where (Location of the archived data)
 - Why (Scheduled, periodic, or manual)
 - How (via DB2 Unload)



What does DB2 Data Archive Expert for z/OS do?

- **By allowing data to be archived to tables, apps can access the archive**
 - Limitations apply; not for everyone
 - Uses UNION in VIEW function in DB2 for z/OS Version 7

Application still reads from <table_name>



- ☞ Application reads need to supply a date_col predicate to avoid access to <arc_table>
 - ☞ Updates need to point to the act_table
 - ☞ Prevent updates to arc_table
- ```

CREATE VIEW <table_name> AS
SELECT * FROM <act_table>
WHERE DATE_COL >= (CURRENT_DATE-365 DAYS)
UNION ALL
SELECT * FROM <arc_table>
WHERE DATE_COL < (CURRENT_DATE-365 DAYS)

```





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## Archiving Scenario

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## Archive Unit



### PROJECT

| PROJNO | PROJNAME            | DEPTNO | PRENDATE  |
|--------|---------------------|--------|-----------|
| IP2000 | USER EDUCATION      | C01    | 21/11/983 |
| MA2110 | W L PROGRAMMING     | D11    | 21/11/983 |
| MA2111 | W L PROGRAM DESIGN  | D11    | 12/11/982 |
| MA2112 | W L ROBOT DESIGN    | D11    | 12/11/982 |
| MA2113 | W L PROD CONT PROGS | D11    | 12/11/982 |
| OP1010 | OPERATION           | E11    | 21/11/983 |

starting point table: PROJECT

connection keys:

DEPARTMENT.DEPTNO = PROJECT.DEPTNO

DEPARTMENT.DEPTNO = EMPLOYEE.WORKDEPT

related tables: DEPARTMENT & EMPLOYEE

### DEPARTMENT

| DEPTNO | DEPTNAME               |
|--------|------------------------|
| C01    | INFORMATION CENTER     |
| D11    | MANUFACTURING SYSTEMS  |
| D21    | ADMINISTRATION SYSTEMS |
| E11    | OPERATIONS             |

### EMPLOYEE

| EMPNO | LASTNAME  | WORKDEPT |
|-------|-----------|----------|
| 60    | STERN     | D11      |
| 130   | QUINTANA  | C01      |
| 150   | ADAMSON   | D11      |
| 160   | PIANKA    | D11      |
| 140   | NICHOLLS  | C01      |
| 170   | YOSHIMURA | D11      |
| 310   | SETRIGHT  | E11      |

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## Steps in Archiving

Create an archive specification. The archive specification contains all of the information that is required to copy data from the archive source to the archive target.

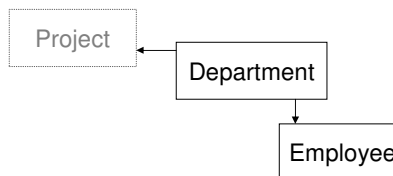
### 1. Select a starting point table.

- A starting point table designates the basis for the archive unit upon which a row filter is specified to determine the rows to be archived.

| PROJECT | DEPTNO              | EMPNO | PROJDATE  |
|---------|---------------------|-------|-----------|
| P2100   | DEPT001             | 001   | 22-FEB-90 |
| MA110   | W.L.PROGRAMMING     | 011   | 22-FEB-90 |
| MA111   | W.L.PROGRAM DESIGN  | 011   | 22-FEB-90 |
| MA112   | W.L.PROJECT DESIGN  | 011   | 22-FEB-90 |
| MA113   | W.L.PROJ.CONS.PROGS | 011   | 22-FEB-90 |
| DE110   | DEPT001             | 011   | 22-FEB-90 |

### 2. Find related tables.

- Archive data is copied as an archive unit. If the find related tables function is used, then the archive unit is presented, but can be modified.



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## Archive Specification Definition - Menu

```

HHXV11 ----- Archive Specification Definition -----
Command ==> _____

Archive specification:

Name==> _____ DB2 system . : DSNB
Creator==> SYS248
Description==> _____
Complete archive run (delete source data)? ==> N (Yes/No)
Perform orphan row/changed data detection? ==> Y (Yes/No)

Select an archive definition activity ==> _

1. Define archive unit (required)
2. Define table targets (active)
3. Define data set targets
4. Save archive specification

```

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### Archive Specification Definition - Naming a Specification

```

AHXV11 ----- Archive Specification Definition -----
Command ==> _____

Archive specification:

Name==> DEMO31HPROJ01 DB2 system . : DSNB
Creator==> SYS248
Description . . .==> PROJECT ARCHIVE DEMO
Complete archive run (delete source data)? ==> y (Yes/No)
Perform orphan row/changed data detection? ==> Y (Yes/No)

Select an archive definition activity ==> 1

1. Define archive unit (required)
2. Define table targets (active)
3. Define data set targets
4. Save archive specification

```

### Archive Specification Definition - Starting Point Tables

```

AHXV11 ----- Archive Specification Definition -----
Command ==> _____

Archive specification:

Name==> DEMO31HPROJ01 DB2 system . : DSNB
Creator==> _____ Specify Starting Point Table
Description . . .==> _____
Complete archive ru
Perform orphan row/
Provide table selection list? ==> Y (Y/N)

Select an archive def
1. Define archive
2. Define table t
3. Define data se
4. Save archive s

Table name . ==> %
Creator . . ==> DEMO31
Database . . ==> %
DB2 system . . : DSNB

(% or blank indicates all)

Command ==> _____

```

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### Archive Specification Definition - Select a SP table

```

AHXV11 ----- Select Starting Point Table ----- Row 1 to 6 of 6

Archive specification: DEM031#PROJ01
DB2 system : DSNB

Line commands are:
S - Select table S* - Select all
D - Deselect table D* - Deselect all

Cmd * Table name Creator Database Table space

-- ACT DEM031 DEM031 DSN8S51P
-- DEPT DEM031 DEM031 DSN8S51D
-- EMP DEM031 DEM031 DSN8S51E
-- EMPPROJACT DEM031 DEM031 DSN8S51P
-- PROJ DEM031 DEM031 DSN8S51P
-- PROJACT DEM031 DEM031 DSN8S51P
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE

```

IBM 12/002

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### Archive Specification Definition - Find Related Tables

```

AHXV11 ----- Select Starting Point Table ----- Row 1 to 6 of 6

Archive specification: DEM031#PROJ01
DB2 system : DSNB

Line commands are:
S - Select table S*
D - Deselect table

Cmd * Table name Find related tables? ==> Y (Yes/No)

-- ACT
-- DEPT
-- EMP
-- EMPPROJACT
S PROJ
-- PROJACT

Starting point table: PROJ
Creator : DEM031
Database name : DEM031
DB2 system : DSNB

Command ==> _____

Command ==> _____ Scroll ==> PAGE

```

IBM 19/038

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## Archive Specification Definition - Select Related Tables

```

RHXV11 ----- Select Related Tables ----- Row 1 to 5 of 5

Archive Specification : DEMO31#PROJ01
Starting point table : PROJ
Creator : DEMO31
DB2 system : DSNB

Line commands are:
S - Select table for archive unit S* - Select all tables
D - Deselect table D* - Deselect all tables

Cmd * Table name Creator Database Table space

-- ACT DEMO31 DEMO31 DSN8S51P
-- DEPT DEMO31 DEMO31 DSN8S51D
-- EMP DEMO31 DEMO31 DSN8S51E
-- EMPPROJECT DEMO31 DEMO31 DSN8S51P
-- PROJECT DEMO31 DEMO31 DSN8S51P
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE
a 14/002

```

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## Steps in Archiving...

**3. Identify connection keys.**

- Connection keys are columns in the tables of the archive unit that provide relationships between the tables. If the find related tables function is used, these columns are presented, but can be modified.

**4. Specify junction tables.**

- A junction table is a table in the archive unit that contains connection keys to other tables in the unit, but is a table for which you do not want its data to be archived.

**PROJECT (starting point table)**

| PROJNO | PROJNAME            | DEPTNO | PRNDATE    |
|--------|---------------------|--------|------------|
| 1F2000 | USER EDUCATION      | C01    | 21/11/983  |
| MA2110 | W L PROGRAMMING     | D11    | 21/11/983  |
| MA2111 | W L PROGRAM DESIGN  | D11    | 12/11/1982 |
| MA2112 | W L ROBOT DESIGN    | D11    | 12/11/1982 |
| MA2113 | W L PROD CONT PROGS | D11    | 12/11/1982 |
| OP1010 | OPERATION           | E11    | 21/11/983  |

department.deptno = project.deptno

**DEPARTMENT (junction table)**

| DEPTNO | DEPTNAME               |
|--------|------------------------|
| C01    | INFORMATION CENTER     |
| D11    | MANUFACTURING SYSTEMS  |
| D21    | ADMINISTRATION SYSTEMS |
| E11    | OPERATIONS             |

department.deptno = employee.workdept

**EMPLOYEE**

| EMPNO | LASTNAME  | WORKDEPT |
|-------|-----------|----------|
| 60    | STERN     | D11      |
| 130   | QUINTANA  | C01      |
| 150   | ADAMSON   | D11      |
| 160   | PIANKA    | D11      |
| 140   | NICHOLLS  | C01      |
| 170   | YOSHIMURA | D11      |
| 310   | SETRIGHT  | E11      |

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### Archive Specification - Define Connection Keys

```

AHXV11 ----- Archive Unit Definition ----- Row 1 to 3 of 3

Archive specification:

Name . . . : DEM031#PROJ01 Starting point table: PROJ
Creator . . : SYS248 Creator : DEM031
DB2 system: DSNB Database name . . : DEM031

Line commands are:
A - Add C - Columns K - Connection keys D - Delete
R - Rules P - Starting point table U - Index cols W - Row filter

Cmd Table name Creator Database StP Jct Del Row filter

k PROJ DEM031 DEM031 SP N
= ENPPROJACT DEM031 DEM031
- PROJACT DEM031 DEM031
***** Bottom of data *****

Command ==>
Scroll ==> PAGE
17/003

```



### Archive Specification - Define Connection Keys

```

AHXV11 ----- Archive Unit Table Connections ----- Row 1 from 10

Archive specification : DEM031#PROJ01 DB2 system: DSNB
Archive unit table . . : PROJ
Creator : DEM031

Line commands are:
A - add column D - delete P - add parent connection
C - add child connection

Cmd Connection column Parent table Child table
=====
= PROJNO Name : PROJNO Name : PROJ
 CHAR Creator: DEM031 Creator: DEM031
 Column : PROJNO Column : MAJPROJ
=====
- MAJPROJ Name : PROJNO Name :
 CHAR Creator: DEM031 Creator:
 Column : PROJNO Column :
=====
- PROJNO Name : PROJNO Name : PROJACT
 CHAR Creator: DEM031 Creator: DEM031

Command ==>
Scroll ==> PAGE
13/003

```





### Archive Specification - Define Connection Keys

```

AHXVII ----- Archive Unit Table Connections ----- Row 1 from 8

Archive specification : DEMO31#PROJ01 DB2 system: DSNB
Archive unit table . : PROJ
Creator : DEMO31

Line commands are:
A - add column D - delete P - add parent connection
C - add child connection

Cmd Connection column Parent table Child table
=====
= PROJNO Name : Name : PROJACT
 CHAR Creator: DEMO31 Creator: DEMO31
 Column : Column : PROJNO
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE

```

### Archive Specification - Define Connection Keys

```

AHXVII ----- Archive Unit Table Connections ----- Row 2 from 8

Archive specification : DEMO31#PROJ01 DB2 system: DSNB
Archive unit table . : PROJACT
Creator : DEMO31

Line commands are:
A - add column D - delete P - add parent connection
C - add child connection

Cmd Connection column Parent table Child table
=====
- PROJNO Name : PROJ Name :
 CHAR Creator: DEMO31 Creator:
 Column : PROJNO Column :
=====
- ACSTDATE Name : Name : EMPPROJACT
 DATE Creator: DEMO31 Creator: DEMO31
 Column : Column : EMSTDATE
=====
- ACTNO Name : Name : EMPPROJACT
 SMALLINT Creator: Creator: DEMO31

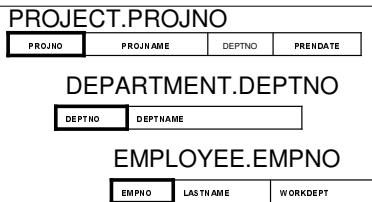
Command ==> _____ Scroll ==> PAGE

```

### Steps in Archiving...

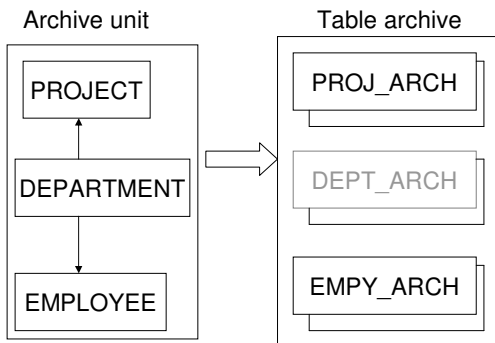
#### 5. Specify row uniqueness.

- In most cases DB2 Data Archive Expert requires row uniqueness. DB2 Data Archive Expert can locate any primary keys or unique columns that exists. If one does not exist, the user must then specify unique columns.



#### 6. Specify table archive targets.

- Specify one or more table spaces in which to place archive tables, or you may choose to use the DB2 Data Archive Expert default archive tables.



### Archive Specification - Target Selection

```

AHXV11 ----- Archive Specification Definition -----
Command ==> _____

Archive specification:

Name==> DEMO31#EMPPROJACT DB2 system . : DSNB
Creator==> SYS248
Description==> Running file archive in batch
Complete archive run (delete source data)? ==> N (Yes/No)
Perform orphan row/changed data detection? ==> Y (Yes/No)

Select an archive definition activity ==> 3

1. Define archive unit (completed)
2. Define table targets (active)
3. Define data set targets
4. Save archive specification (pending)

```



### Archive Specification - Archive Table Targets

```

RHXXV11 ----- Table Archive Targets ----- Row 1 to 2 of 3

Archive specification: DEMO31#PROJ01 DB2 system: DSNB
Creator : SYS248

Select an option for creating targets: 1

1. Default table/default table spaces (one table per table space)
2. Specify table/default table spaces (one table per table space)
3. Default tables/specify table space (all tables in one table space)
4. Specify tables/specify table space (all tables in one table space)
5. Default tables/specify table spaces (any combination)
6. Specify tables/specify table spaces (any combination)

Source table Target table Target table space
=====
Name : PROJ Name : Name :
Creator: DEMO31 Creator: Database: DSNDB04
=====
Name : EMPPROJACT Name : Name :
Creator: DEMO31 Creator: Database: DSNDB04
=====

Command ==> _____ Scroll ==> PAGE

```



### Archive Specification - Archive File Target

```

RHXXV11 ----- File Archive Targets ----- Row 1 to 1 of 1

Archive specification: DEMO31#EMPPROJACT DB2 system: DSNB
Creator : SYS248

Select an option for creating targets: 3 _

1. Default target data set generation with high-level qualifier.
 High-level qualifier ==> SYS248
2. Specify data set name for each source table.
3. Specify utility templates for each source table.

Source table Target data set
=====
Name : EMPPROJACT
Creator: DEMO31
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE

```



## Steps in Archiving ...

### 7. Specify a row filter

- A row filter is the criteria applied to the starting point table that selects the rows to be archived.

WHERE PROJECT.PRENDATE = '12/1/1982'

PROJECT

| PROJNO  | PROJNAME             | DEPTNO | PRENDATE  |
|---------|----------------------|--------|-----------|
| F 2000  | USER EDUCATION       | CO1    | 2/1/1983  |
| NA2100  | WELD LINE AUTOMATION | DO1    | 2/1/1983  |
| MA2110  | W/L PROGRAMMING      | D11    | 2/1/1983  |
| MA2111  | W/L PROGRAM DESIGN   | D11    | 12/1/1982 |
| MA2112  | W/L ROBOT DESIGN     | D11    | 12/1/1982 |
| MA2113  | W/L PROD CONT PROGS  | D11    | 12/1/1982 |
| OP 1000 | OPERATION SUPPORT    | EO1    | 2/1/1983  |
| OP 1010 | OPERATION            | E11    | 2/1/1983  |

DEPARTMENT

| DEPTNO | DEPTNAME              |
|--------|-----------------------|
| C01    | INFORMATION CENTER    |
| D01    | MANUFACTURING SYSTEMS |
| D11    | ADMINISTRATOR SYSTEMS |
| E01    | OPERATIONS            |

EMPLOYEE

| EMPNO | LASTNAME  | WORKDEPT |
|-------|-----------|----------|
| 11    | STEEN     | D11      |
| 12    | QUARTANA  | C01      |
| 13    | ADAMS ON  | D11      |
| 14    | PLANKA    | D11      |
| 15    | NEHRHALLS | C01      |
| 16    | YOSHIMURA | D11      |
| 17    | SETTSUOT  | E11      |

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## Archive Specification - Row filter declaration

```

AHXV11 ----- Starting Point Table Row Filter ----- Row 12 from 19
Archive specification : DEMO31#PROJ01 DB2 system: DSNB
Starting point table: PROJ
Creator : DEMO31

Row filter ==> _____

Columns Num Type Length Scale

PROJNO 1 CHAR 6 0
PROJNAME 2 VARCHAR 24 0
DEPTNO 3 CHAR 3 0
RESPEMP 4 CHAR 6 0
PRSTAFF 5 DECIMAL 5 2
PRSTDATE 6 DATE 4 0
PRENDATE 7 DATE 4 0
MAJPROJ 8 CHAR 6 0
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE
 24/014

```

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### Archive Specification - Row filter specification

```

AHXV11 ----- Starting Point Table Row Filter ----- Row 12 from 19

Archive specification : DEMO31#PROJ01 DB2 system: DSNB
Starting point table: PROJ
Creator : DEMO31

Row filter ==> PROJNO = 'AD3111'

Columns Num Type Length Scale

PROJNO 1 CHAR 6 0
PROJNAME 2 VARCHAR 24 0
DEPTNO 3 CHAR 3 0
RESPEMP 4 CHAR 6 0
PRSTAFF 5 DECIMAL 5 2
PRSTDATE 6 DATE 4 0
PRENDATE 7 DATE 4 0
MAJPROJ 8 CHAR 6 0
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE
a 24/014

```

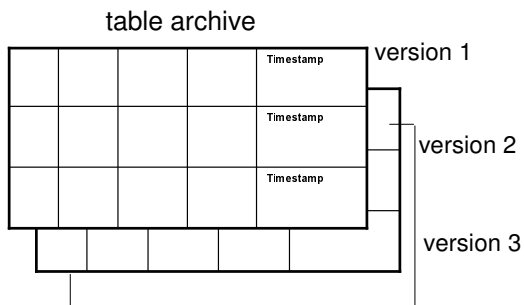


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### Steps in Archiving...

8. Running an archive specification.

- Each time that an archive specification is run, a new set of archive data is created. This new set is called an archive data version. Many versions of archived data can exist.
- Different row filters can be used for each run of the archive specification.



## Archive Specification - List

AHXV11 ----- Archive Specifications List ----- Row 1 to 9 of 12

Primary commands are: DB2 system : DSNB  
 FI - Filter archive specification list User ID . . : SYS248  
 RE - Refresh archive specification list Time . . . : 08:15

Line commands are:  
 N - New C - Copy D - Delete R - Run B - Browse details E - Edit  
 H - History of runs I - Info summary F - Table archive to file  
 T - Define retrieve specification L - List retrieve specifications

| Cmd      | Name          | Description          | Creator | Updated    | State | Type |
|----------|---------------|----------------------|---------|------------|-------|------|
| <u>R</u> | DEMO31#PROJ01 | PROJECT ARCHIVE DEMO | SYS248  | 2003-12-16 | DEF   | TABL |
| =        | DEMO30#PROJ6  |                      | SYS248  | 2003-12-16 | PCOM  | TABL |
| -        | DEMO30#PROJ5  |                      | SYS248  | 2003-12-12 | COM   | TABL |
| -        | DEMO30#PROJ4  |                      | SYS248  | 2003-12-11 | COM   | TABL |
| -        | DEMO30#PROJ3  |                      | SYS248  | 2003-12-11 | COM   | TABL |
| -        | DEMO30#PROJ   |                      | SYS248  | 2003-12-11 | COM   | TABL |
| -        | DEMO#PROJ3    |                      | SYS248  | 2003-12-09 | PCOM  | TABL |
| -        | DEMO30#PROJ2  |                      | SYS248  | 2003-12-09 | PCOM  | TABL |
| -        | DEMO30#PROJ1  | 1                    | SYS248  | 2003-12-09 | COM   | TABL |

Command ==> \_\_\_\_\_ Scroll ==> PAGE

## Archive Specification - Run

AHXV11 ----- Run Archive Specification -----

Command ==&gt; \_\_\_\_\_

Primary commands are:  
 R - Run the archive specification

Confirm the row filter and run the archive specification. Change the row filter if desired, then run archive specification.

Specification name: DEMO31#PROJ01 DB2 system . . . DSNB  
 Creator . . . . . SYS248 User ID. . . . . SYS248  
 Description: PROJECT ARCHIVE DEMO

Archive will be immediately completed during archive.

Row filter ==> PROJNO = 'AD3111'

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## Archive Specification - Run Statistics

```

AHXU11 ----- Archive Run Statistics----- Archive run successful

Archive specification : DEMO31#PROJ01 DB2 system . : DSNB
Creator : SYS248
Description : PROJECT ARCHIVE DEMO
Row filter : PROJNO = 'AD3111'

=====
Run: 1 Source table: EMPPROJACT Creator: DEMO31 Del: 7
Act: R Target table: AHXA_000280001002 Creator: ARCHIVED Ins: 7
=====
Run: 1 Source table: PROJ Creator: DEMO31 Del: 0
Act: R Target table: AHXA_000280001001 Creator: ARCHIVED Ins: 1
=====
Run: 1 Source table: PROJACT Creator: DEMO31 Del: 7
Act: R Target table: AHXA_000280001003 Creator: ARCHIVED Ins: 7
=====
***** Bottom of data *****

Command ==> _____ Scroll ==> PAGE
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```

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## Archive Specification - List

```

Session A - [24 x 80]
AHXU11 ----- Archive Specifications List ----- Row 3 to 10 of 10
Command ==> _____ Scroll ==> CSR

Primary commands are:
FI - Filter archive specification list
RE - Refresh archive specification list
DB2 system : DSNB
User ID . : DNET018
Time . . . : 16:47

Line commands are:
N - New C - Copy D - Delete R - Run B - Browse details E - Edit
H - History of runs I - Info summary F - Table archive to file
T - Define retrieve specification L - List retrieve specifications

Cmd Name Description Creator Updated State Type

h ARCEMPPROJACT EMPPROJACT,PROJACT,AC DNET018 2004-04-13 COM TABL
_ ARCEMPRJACFILTMPL ARCH GDG TEMPLATE DNET018 2004-04-13 COM FILE
_ ARCEMPRJACTIBLFL ARCH FROM ARCTBL TO A DNET018 2004-04-13 COM FILE
_ ARCEMPPROJACTFILE EMPRJACT,PRJACT,ACT F DNET018 2004-04-13 COM FILE
_ ARCTBLDEPT83 ARCHIVE DNET0183.DEPT DNET018 2004-04-05 DEF TABL
_ archtblprt ARCHIVE DNET0183.DEPT DNET018 2004-04-05 DEF TABL
_ ARCHTBLFLEMP TABLE ARCHIVE TO FILE DNET018 2004-04-05 COM FILE
_ archive1 archive emp DNET018 2004-04-05 COM TABL
***** Bottom of data *****

MA a 05/046

```

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### Archive Specification - History

```

Session A - [24 x 80]
AHXU11 ----- Archive Specification History ----- Row 1 to 4 of 4
Command ==> _____ Scroll ==> CSR

Specification name: ARCEMPPROJECT Creator: DNET018
Description: EMPPROJECT,PROJACT,ACT ARCHIVE

Line commands are:
S - Show statistics

Cmd Run State Run by Date Row filter

- 0 Defined
- 1 Complete DNET018 2004-04-13-04.11.28 ACTNO=10
- 2 Complete DNET018 2004-04-13-04.15.06 ACTNO=70
- 3 Complete DNET018 2004-04-13-15.40.45 ACTNO=70
***** Bottom of data *****

```

09/033

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### Archive Specification - Run Statistics

```

Session A - [24 x 80]
AHXU11 ----- Archive Run Statistics----- Row 1 to 3 of 3
Command ==> _____ Scroll ==> CSR

Archive specification : ARCEMPPROJECT DB2 system . : DSNB
Creator : DNET018
Description : EMPPROJECT,PROJACT,ACT ARCHIVE
Row filter : ACTNO=70

=====
Run: 3 Source table: ACT Creator: DNET0183 Del: 0
Act: Target table: ACT_ARC Creator: DNET0183 Ins: 1
=====
Run: 3 Source table: EMPPROJECT Creator: DNET0183 Del: 0
Act: Target table: EMPPROJECT_ARC Creator: DNET0183 Ins: 12
=====
Run: 3 Source table: PROJACT Creator: DNET0183 Del: 0
Act: Target table: PROJACT_ARC Creator: DNET0183 Ins: 12
***** Bottom of data *****

```

02/014





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## Retrieving Scenario

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### Retrieve Specification Definition – Archive Selection

```

Session A - [24 x 80]
AHXU11 ----- Define a New Retrieve Specification -----
Command ==> _____ Scroll ==> CSR

DB2 system: DSNB
User ID : DNET018
Time : 17:21

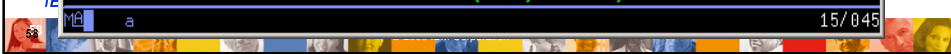
Retrieve specification:
Name _____
Description _____

For Archive specification:
Name _____
Type _____ (TABL,FILE)
Description
More details? (Yes)

Select a retrieve definition activity ==> 1_

1. Select an archive specification to retrieve . . . : (required or enter name)
2. Select archived source tables to retrieve data . . . : (optional)
3. Select archived data versions to be retrieved . . . : (optional)
4. Add a row filter to retrieve subset of rows . . . : (optional)
5. Specify target tables for retrieve : (optional)
6. Specify target table spaces for retrieve : (optional)
7. Save definition of new retrieve : (required)
8. Cancel definition of new retrieve (exit, no save)

```



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### Retrieve Specification Definition – Filter for Archive Selection

```

Session A - [24 x 80]
AHXU11 ----- Define a New Retrieve Specification -----
Command ==> _____ Scroll ==> CSR_

DB2 system: DSNB
User ID : DNET018
 : 7:21

Retrie Name AHXU11 ----- Filter for Archives List -----
Desc Command ==> _____ Scroll ==> CSR_
For Ar Name
Type Specify criteria for listing known archive specifications,
Desc press Enter. Some criteria is case sensitive.
More (% or blank indicates all)

Select Archive name . . . % _____
 Creator . . . DNET018
 Type . . . % (TABL,FILE)
1. Se Source table . . . % _____
2. Se Creator . . . % _____
3. Se
4. Ad
5. Sp
6. Sp
7. Save definition of new retrieve : (required)
8. Cancel definition of new retrieve (exit, no save)

a 15/028

```

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### Retrieve Specification Definition – Archive Specification List

```

Session A - [24 x 80]
AHXU11 ----- Archive Spec List for Retrieve ----- Row 1 to 8 of 8
Command ==> _____ Scroll ==> CSR_

Filter of list complete
Primary commands are:
FI - Filter archive specification list
RE - Refresh archive specification list

Line commands are:
S - Select for retrieve B - Browse details I - Info summary
H - History of runs

DB2 system: DSNB
User ID : DNET018
Time : 17:23

Cmd Name Description Creator Updated State Type

- ARACPREMPRACTBLNDL ARCH ACT AS SP & RI TO TB DNET018 2004-04-15 PCOM TABL
- arcemprjacttbl del arch to table & del from DNET018 2004-04-13 COM TABL
- ARCEMP PROJACT EMPPROJACT, PROJACT, ACT AR DNET018 2004-04-13 COM TABL
- ARCEMPR JACFILTMPL ARCH GDG TEMPLATE DNET018 2004-04-13 COM FILE
- ARCEMPR JACTBLFL ARCH FROM ARCTBL TO ARCFI DNET018 2004-04-13 COM FILE
- ARCEMP PROJACTFILE EMPPROJACT, PROJACT, ACT FILE DNET018 2004-04-13 COM FILE
- ARCTBLTFLEMP TABLE ARCHIVE TO FILE DNET018 2004-04-05 COM FILE
- archive1 archive emp DNET018 2004-04-05 COM TABL
***** Bottom of data *****

a 16/006

```

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### Retrieve Specification Definition – Target Tables

```

!Session A - [24 x 80]
AHXU11 ----- Define a New Retrieve Specification -----
Command ==> _____ Scroll ==> CSR
Archive info copied
DB2 system: DSMB
User ID : DNET018
Time : 17:24

Retrieve specification:
Name _____
Description _____
For Archive specification:
Name ARCEMPPROJACT
Type TABL (TABL,FILE)
Description . . : EMPPROJACT,PROJACT,ACT ARCHIVE
More details? . . ___ (Yes)

Select a retrieve definition activity ==> 5_

1. Select an archive specification to retrieve . . : (completed)
2. Select archived source tables to retrieve data : (optional)
3. Select archived data versions to be retrieved . : (optional)
4. Add a row filter to retrieve subset of rows . . : (optional)
5. Specify target tables for retrieve : (optional)
6. Specify target table spaces for retrieve . . . : (optional)
7. Save definition of new retrieve : (required)
8. Cancel definition of new retrieve (exit, no save)

```

IBM 15/045

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### Retrieve Specification Definition – Target Tables

```

!Session A - [24 x 80]
AHXU11 ----- Specify Target Tables for Retrieve ----- Row 1 to 3 of 3
Command ==> _____ Scroll ==> CSR
All tables will be retr
Primary command is: DB2 system: DSMB
C - Clear current table mappings User ID : DNET018
Time : 17:26

Specify names and owners of target tables below.
If you specify names, for each run of the retrieve
spec new rows will be appended to pre-existing
target tables. Press End when you are done.

Archived Table Name Owner Retr Retrieve
 StPt Target Table Name Owner

ACT DNET0183 _____ RETRIEVE
EMPPROJACT DNET0183 SP _____ RETRIEVE
PROJACT DNET0183 _____ RETRIEVE
***** Bottom of data *****

```

IBM 02/015

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### Retrieve Specification - List

Session A - [24 x 80]

AHXU11 ----- Retrieve Specifications List ----- Row 1 to 7 of 7  
 Command ==> Scroll ==> CSR

Primary Commands are: DB2 system: DSNB  
 FI - Filter retrieve specification list User ID : DNET018  
 RE - Refresh retrieve specification list Time : 17:03

Line Commands are:  
 N - New E - Edit C - Copy D - Delete B - Browse details I - Info summary  
 R - Run H - History of runs

| Cmd Name           | Description               | Creator | Updated    | State | Type |
|--------------------|---------------------------|---------|------------|-------|------|
| RTREMPRJACTDELSTG  | RTRV ARCH TBL TO STAGING  | DNET018 | 2004-04-13 | COM   | TABL |
| RTREMPRJACTARTBSRC | RTRV ARCH TBL TO SRC TBL  | DNET018 | 2004-04-13 | DEF   | TABL |
| RTREMPRJACTTBSRC   | RTR EMPRJACT TBL-SRC ACTI | DNET018 | 2004-04-13 | COM   | TABL |
| RTREMPRJACTFLTGTB  | RTRV EMPRJACT FL-TBL FILE | DNET018 | 2004-04-13 | COM   | FILE |
| RTREMPROJACTFLSRC  | RTRV EMPRJACT FL-SRC TBL  | DNET018 | 2004-04-13 | DEF   | FILE |
| RTREMPROJACT       | RETRIEVE EMPRPOJACT AND R | DNET018 | 2004-04-13 | COM   | TABL |
| RETRIEVE1          |                           | DNET018 | 2004-04-05 | COM   | TABL |

\*\*\*\*\* Bottom of data \*\*\*\*\*

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### Retrieve Specification - History

Session A - [24 x 80]

AHXU11 ---- History of Runs for Retrieved Data Versions ---- Row 1 to 3 of 3  
 Command ==> Scroll ==> CSR

Line commands are: DB2 system: DSNB  
 S - Show run statistics User ID : DNET018  
 T - Show target retrieve info W - Show row filter Time : 17:07

| Cmd | User | Retrieve Timestamp | Row filter used to retrieve rows             |
|-----|------|--------------------|----------------------------------------------|
| 0   |      | NOT RUN YET        | Retrieve all rows from selected archive runs |
| 1   |      | 2004-04-13-04.26.0 | Retrieve all rows from selected archive runs |
| 2   |      | 2004-04-13-04.28.3 | Retrieve all rows from selected archive runs |

\*\*\*\*\* Bottom of data \*\*\*\*\*

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### Retrieve Specification Definition – Run Statistics

```

!Session A - [24 x 80]
AHXU11 ----- Retrieve Run Statistics ----- Row 1 to 2 of 3
Command ==> _____ Scroll ==> CSR

DB2 system: DSNB
Userid ID : DNET018
Time : 17:09

Retrieve specification:
Name : RTREMPROJACT
Description . . . : RETRIEVE EMRPROJACT AND RI TABLES
Defined by . . . : DNET018
Run version . . . : 1
run by . . . : DNET018
run on . . . : 2004-04-13-04.26.01.059000

Archived table : ACT Creator: DNET0183
Target retrieve table : ACT_RTR Creator: DNET0183
Rows retrieved: 1

Archived table : EMPPROJACT Creator: DNET0183
Target retrieve table : EMPPROJACT_RTR Creator: DNET0183
Rows retrieved: 12

```

02/015

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### Retrieve Specification - List

```

!Session A - [24 x 80]
AHXU11 ----- Retrieve Specifications List ----- Row 1 to 7 of 7
Command ==> _____ Scroll ==> CSR

Primary Commands are:
FI - Filter retrieve specification list
RE - Refresh retrieve specification list

DB2 system: DSNB
User ID : DNET018
Time : 17:11

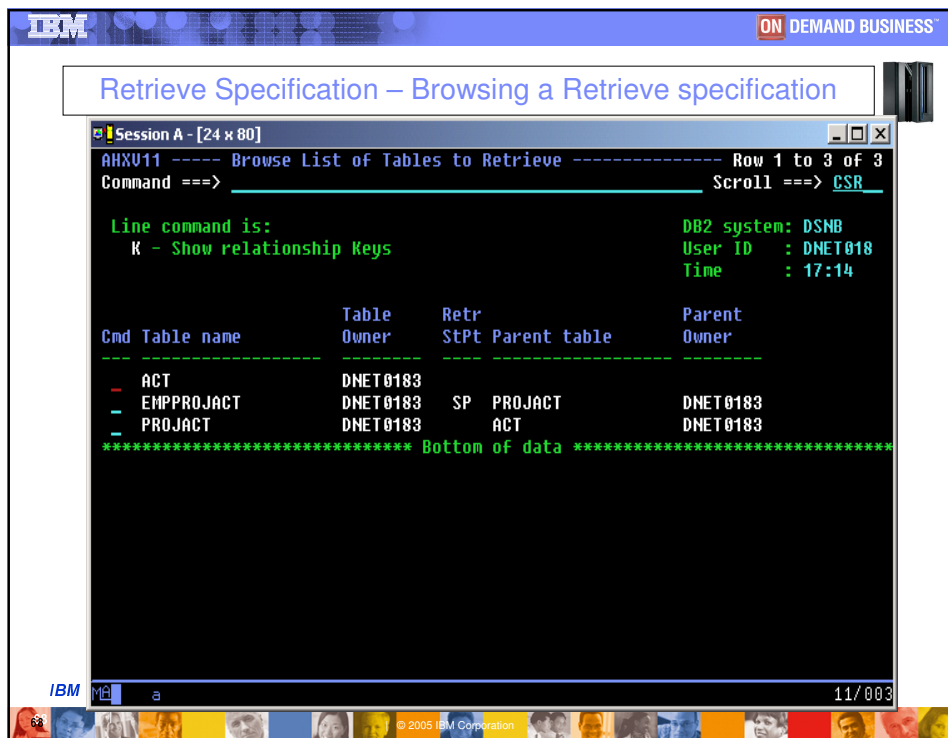
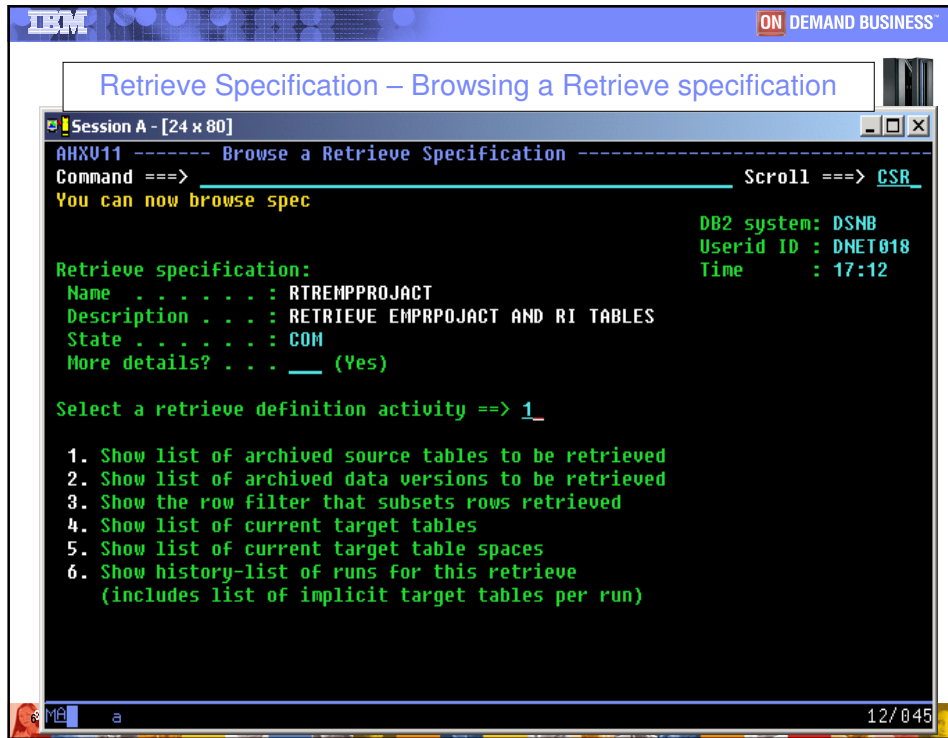
Line Commands are:
N - New E - Edit C - Copy D - Delete B - Browse details I - Info summary
R - Run H - History of runs

Cmd Name Description Creator Updated State Type

- RTREMPRJACTDELSTG RTRU ARCH TBL TO STAGING DNET018 2004-04-13 COM TABL
- RTREMPRJACTARTBSRC RTRU ARCH TBL TO SRC TBL DNET018 2004-04-13 DEF TABL
- RTREMPRJACTTBSLRC RTR EMRPROJACT TBL-SRC ACTI DNET018 2004-04-13 COM TABL
- RTREMPRJACTFLTGTB RTRU EMRPROJACT FL-TBL FILE DNET018 2004-04-13 COM FILE
- RTREMPPROJACTFLSRC RTRU EMRPROJACT FL-SRC TBL DNET018 2004-04-13 DEF FILE
- RTREMPPROJACT RETRIEVE EMRPROJACT AND R DNET018 2004-04-13 COM TABL
- RETRIEVE1 DNET018 2004-04-05 COM TABL
***** Bottom of data *****

```

19/006



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### Retrieve Specification – Browsing a Retrieve specification

```

!Session A - [24 x 80]
AHXU11 ----- Browse a Retrieve Specification -----
Command ==> _____ Scroll ==> CSR

 DB2 system: DSNB
 Userid ID : DNET018
 Time : 17:15

Retrieve specification:
Name : RTREMPROJACT
Description . . . : RETRIEVE EMRPROJACT AND RI TABLES
State : COM
More details? . . . ___ (Yes)

Select a retrieve definition activity => 2_

1. Show list of archived source tables to be retrieved
2. Show list of archived data versions to be retrieved
3. Show the row filter that subsets rows retrieved
4. Show list of current target tables
5. Show list of current target table spaces
6. Show history-list of runs for this retrieve
 (includes list of implicit target tables per run)

```

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### Retrieve Specification – Browsing a Retrieve specification

```

!Session A - [24 x 80]
AHXU11 ----- Browse Data Versions to be Retrieved ----- Row 1 to 2 of 2
Command ==> _____ Scroll ==> CSR

Line command is: DB2 system: DSNB
W - Show row filter User ID : DNET018
 Time : 17:16

Cmd Uer Archive Timestamp Row filter used to archive data rows

 1 2004-04-13-04.11.28 ACTNO=10
 2 2004-04-13-04.15.06 ACTNO=70
***** Bottom of data *****

```

IBM 10/003



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### DB2 Grouper

A common component of DB2 product tools  
DB2 and IMS Tools

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### Problem Statement

- There are many relationships between the various DB2 objects, such as tables, in a business application. Some of these relationships can be discovered easily, while others cannot be easily found.
- As the complexity of data relationships increases, it becomes increasingly difficult to discover and keep track of this information.
- These relationships can be “dynamic” or “transient”, causing difficulties in managing business applications efficiently.
- Finding these relationships can be critical to treating portions of application data in a coherent manner.

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## Problem Statement (Cont'd.)

- It can be difficult to understand all of these relationships, even though the information is useful to have.
  
- The information can be used for various kinds of administration activities, such as:
  - Planning effective backup and recovery strategies
  - Archiving and Relocation of data
  - Replicating data
  - Planning capacity and analyzing performance
  
- The objective of Grouper is to enable the location, augmentation, and management of this information as the basis for consistent data management activities.

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## The Solution - Grouper

- Grouper is a component for discovering, recording, and managing groups of related objects (tables) that comprise a business application.
- Grouper has the flexibility to augment and edit the information stored within it to support business needs.
- Grouper is autonomic at a predictive level; when users input a table to Grouper, it returns all of the tables that are related to it. Users can then choose either all or a subset of the tables returned for the operation being performed.

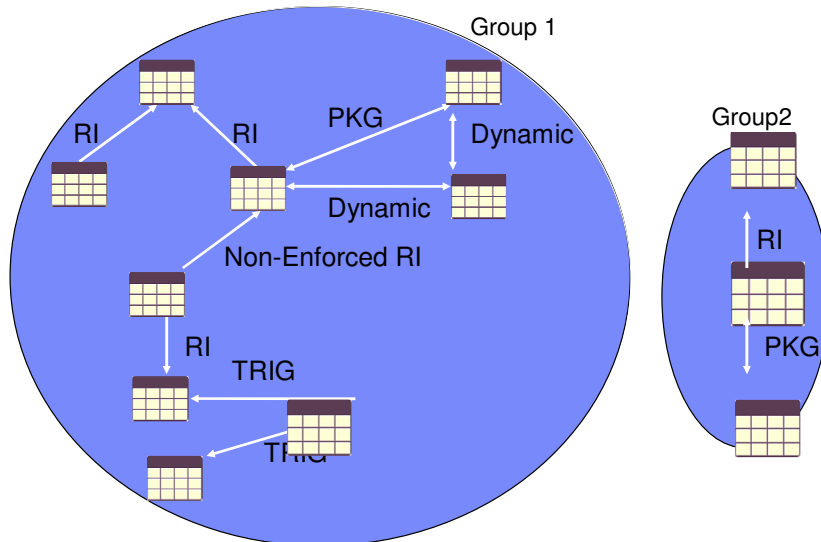
### Grouper is reusable:

- Groups of related tables can be defined for multiple uses
- The Grouper component can be integrated with various DB2 tools

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## Example of a data grouping problem



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## Types of Table Relationships

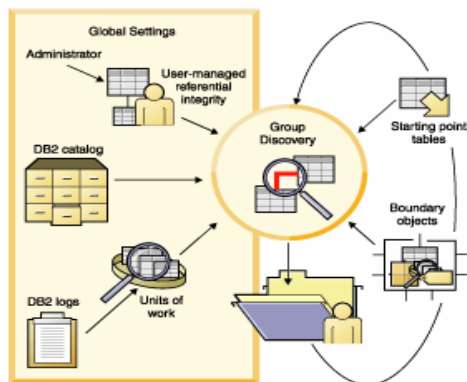
- **Referential Constraints (RI)**
  - DB2 System-enforced
  - Non-enforced by DB2
  - Can consider RI constraints only for grouping purposes (such as archiving)
- **Trigger**
- **Packages (tables in an application that contains static SQL)**
- **LOBs**
- **Tables within the same commit scope (dynamic SQL)**
- **Additional specified relationships based on knowledge about the system**

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## Grouper Administration (GUI)

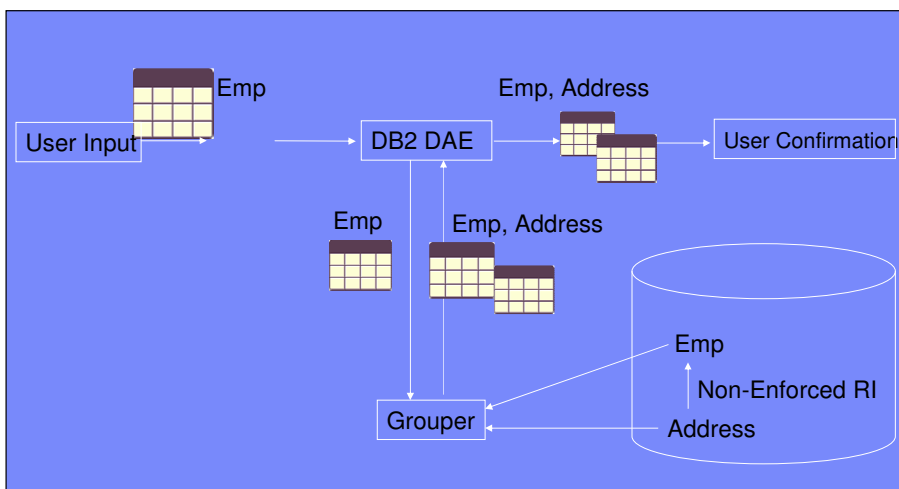
- Maintain sets of groupings
- Specify global relationships (non-enforced RI)
- Kick off dynamic (UOW) relationship discoveries
- Specify input values to the group discovery process
  - Group discovery scope (starting points)
  - Boundary objects
  - Additional relationships
- Launch the group discovery process
- Browse through the groupings
- Edit the groups



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## Example Use of Grouper by DB2 Data Archive Expert



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## Grouper usage examples

- Data Archiving:
  - As the volumes of data increases, performance deteriorates, and managing the data becomes difficult. To avoid this problem, inactive data is archived. However, there is still a need to archive referentially intact units.
  - Grouper component aids in determining the set of data to be archived simultaneously.
  - Specify a starting point table within DAE ISPF panels. DAE calls the Grouper component directly.
  - Using the Grouper client, define referential constraints not enforced by DB2.



## Other Considerations



## Performance Considerations

- Logging Overhead
- Locking and Concurrency
- Dynamic SQL Performance
- WLM policy definition
- Additional resources



## Logging Overhead

- Logging occurs
  - On table archive as SQL inserts occur into the target archive table.
  - On file archive as SQL inserts occur into the "transient" table
  - Whenever an archive is "completed" with table rule of "delete".
  - On table retrieve when executing LOAD LOG YES
- Conclusion is that logging overhead is the same with either table or file archives. Also be aware that depending on number of indexes, amount of enforced RI, and size of archive unit, significant logging overhead could be observed.



## Locking and concurrency

- **Locking occurs**
  - On table archive as SQL inserts occur into the target archive table.
  - On file archive as SQL inserts occur into the “transient” table
  - Whenever an archive is “completed” with table rule of “delete” as SQL deletes are executed.
- **Commit frequency is controlled with the DAE profile setting “COMMITTS” - Default setting is 1000.**
- **The DAE commit frequency only influences the commits performed during inserts. Deletes of the source table row (completed archive specifications with delete rules) are performed as a single unit of work.**
- **Conclusion is that completing a archive specification with a large result set should be scheduled and managed as any other long running uncommitted unit of work application.**



## Locking and concurrency - Continued

- **Drains**
  - Table or file based retrieves uses the DB2 LOAD Utility to insert into the target table.
  - If this is the original “production” table, you need to be aware of the drain that DB2 LOAD RESUME will take on the table. Again, this restriction will require that careful attention be taken when retrieving back into the original tables.

## Dynamic SQL tuning

- **Significantly high percentage of SQL used by DAE are dynamic.**
  - Dynamic statement cache usage should be monitored
  - Possibility exists for performance influenced by additional indexes
- **Refer to the redbook *Squeezing the Most out of Dynamic SQL with DB2 for z/OS and OS/390 - SG24-6418* for more information.**

## WLM Policy definitions

- **Be aware of the WLM service policy associated with the DB2 DAE and DB2 Grouper stored procedure environments.**
- **You might want to consider different WLM environments for archive and retrieve stored procedures.**
- **Ensure that you are assigned an appropriate WLM service policy**
- **More information about WLM definition and JAVA stored procedure performance can be found in the redbook *DB2 Java Stored Procedures - Learning by Example - SG24-5945-00***



## How does DB2 Data Archive Expert for z/OS help?

- **By improving**
  - Performance
  - Manageability
  - Hardware and storage costs
- and thus **reducing IT costs**
- **By freeing up developers from writing customized archiving software**
- **By providing an SQL callable interface for ease in scheduling**
- **By discovering related tables using the DB2 Grouper component**
- **By allowing the data to be removed/deleted from the source independently from the copy to the archive**
- **By working with data hardware compression**
- **By capturing all pertinent information about the archive**
- **By providing a choice of archiving strategies**
  - To table
  - To file
  - To both (multi-tier)

Unique product capability

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## Additional Resources - Other Publications

- **Other publications that might help with DAE performance, implementation, and management**
  - DB2 for z/OS and OS/390: Ready for JAVA - SG24-6435-00
  - DB2 for z/OS Stored Procedures: Through the CALL and beyond - SG24-7083
  - Cross Platform DB2 Stored Procedures: Building and Debugging - SG24-5485-01
  - *DB2 Java Stored Procedures - Learning by Example*, SG24-5945
  - DB2 Data Archive Expert for z/OS: Put Your Data in Its Place - SG24-7070-00



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## Additional Resources - URLs

### ▪ Using UNION in VIEW

– *Zero Latency Enterprise Data Store Techniques for DB2 for OS/390 and z/OS*

• <http://www.idug.org/idug/member/journal/Sept01/articl06.cfm>

– *SQL Techniques to Solve Design Challenges*

• <http://www.idug.org/idug/member/journal/aug02/sqltech.cfm>

### ▪ Other Information can be found on following url:

– [www.ibm.com/software/data/db2imstools](http://www.ibm.com/software/data/db2imstools)

– [www.ibm.com/redbooks](http://www.ibm.com/redbooks)