

IV Jornada Técnica de DB2 LUW (19 Noviembre, 2009)



Information Management

DB2 Access Plans

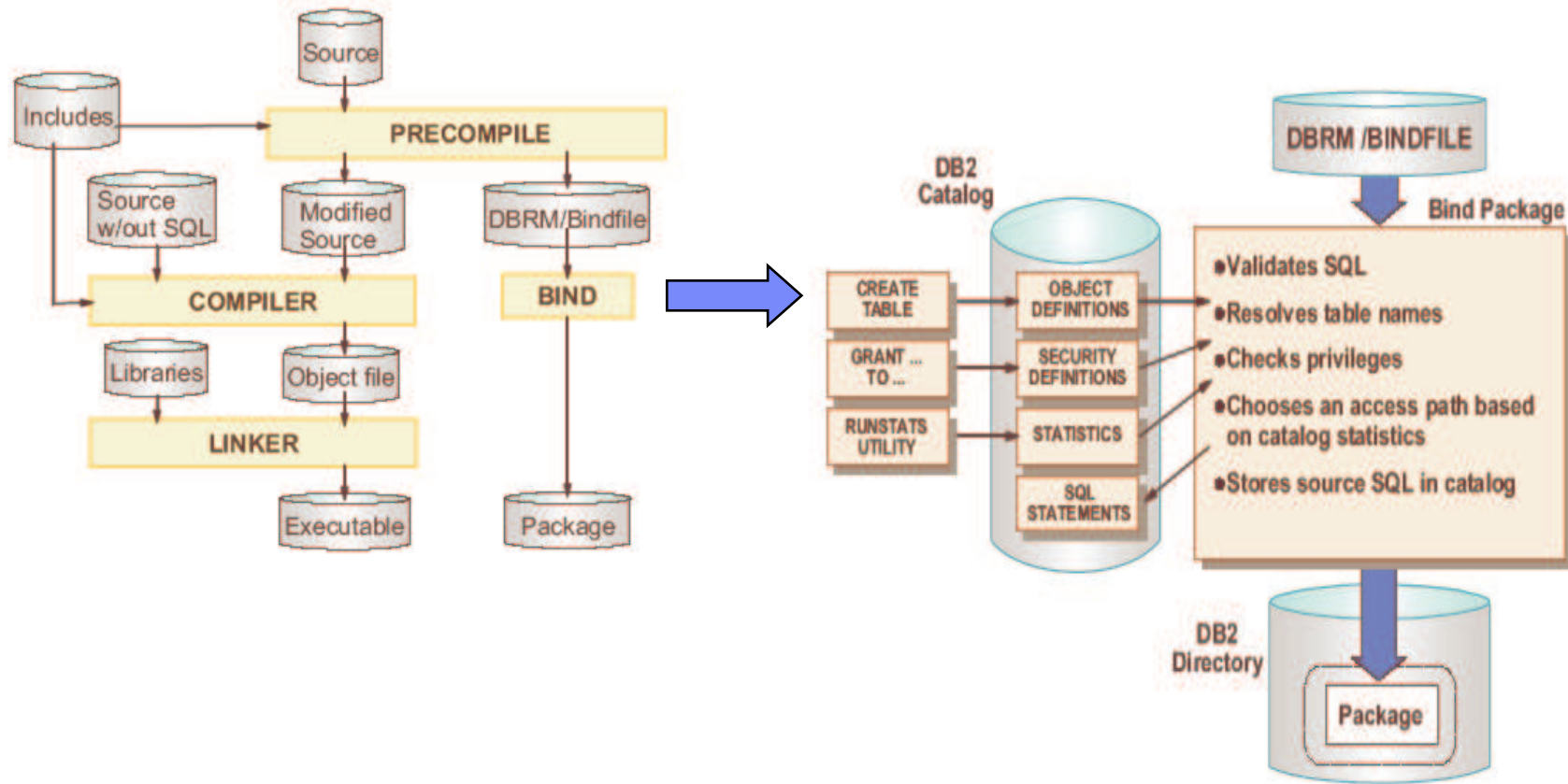


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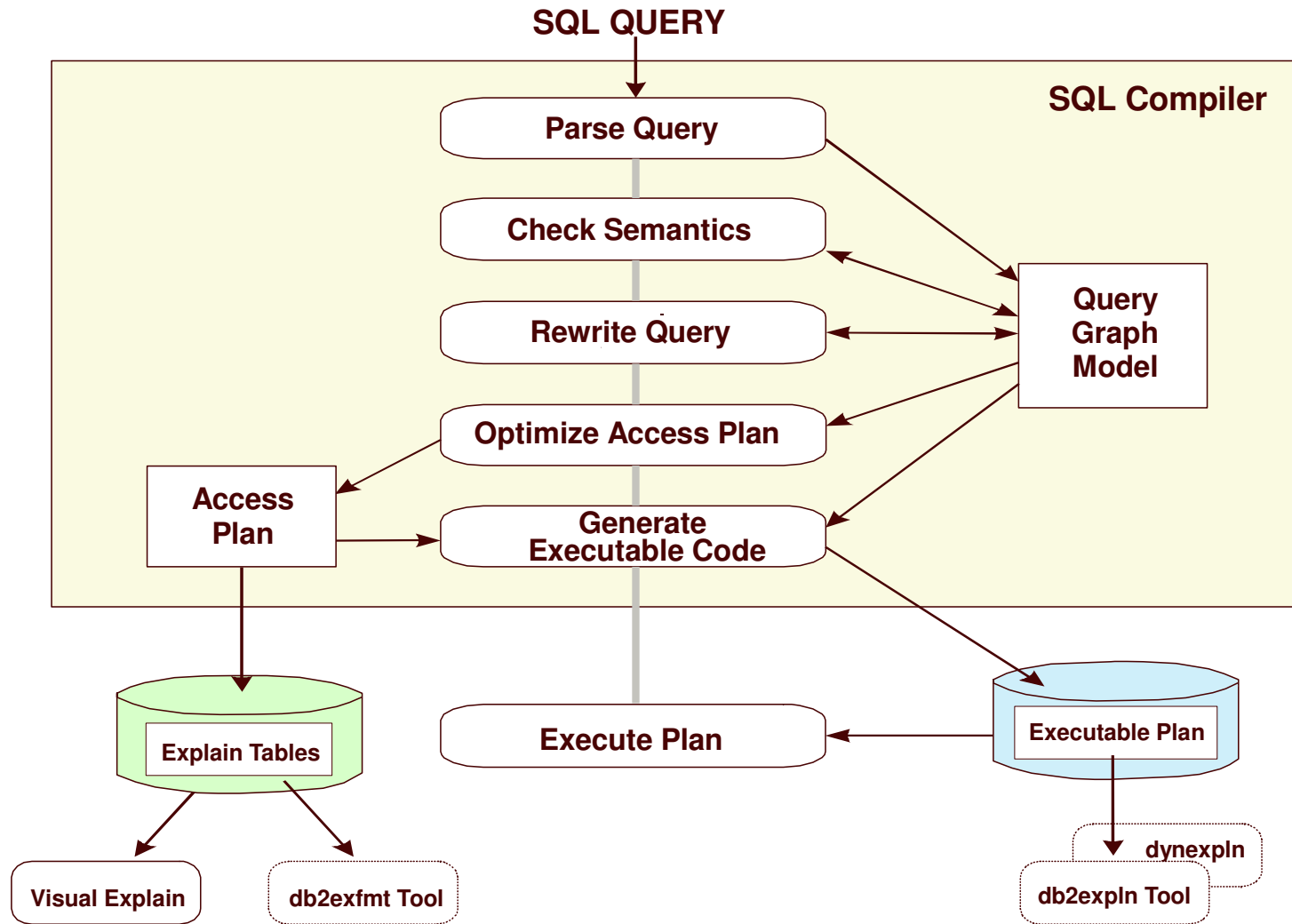
11/25/2009

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Fases de Compilación



Generación Info de explain



Centro de Control – Explain Gráfico

Centro de control - DB2

Centro de control Selecciónada Editar Ver Herramientas Ayuda

Mandatos Resultados de consulta Plan de acceso

PC-CALEJANDRO - DB2 - SAMPLE
 Paquete: NULLID.SYSSH200 Número de sección: 65
 Fecha y hora de explicación: 11/12/2006 13:47:55 Paralelismo: Ninguna
 Coste total (timers): 22,7802276611

```

SELECT B.DEPTNO,B.DEPTNAME,A.SEX,AVG(A.SALARY)
FROM EMPLOYEE A, DEPARTMENT B
WHERE A.WORKDEPT=B.DEPTNO
GROUP BY DEPTNO,DEPTNAME,SEX;
    
```

Mandatos entrados

```

connect to SAMPLE ;
connect to SAMPLE
    
```

Carácter de terminación de sentencia ;

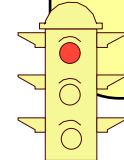
Visión general

The diagram shows an execution plan for the query. The root node is RETURN(1) with a cost of 22.7802276611. It is connected to HSJOIN(3) with a cost of 22.7777271271. HSJOIN(3) branches into GRPBY(5) with a cost of 15.1876621246 and TBSCAN(13) with a cost of 7.5852684975. GRPBY(5) is connected to TBSCAN(7) with a cost of 15.1862573624. TBSCAN(7) is connected to SORT(9) with a cost of 15.1844263077. SORT(9) is connected to TBSCAN(11) with a cost of 15.1655082703. TBSCAN(11) is connected to CARLOS.EMPLOYEE. TBSCAN(13) is connected to CARLOS.DEPARTMENT.

Generación Explain

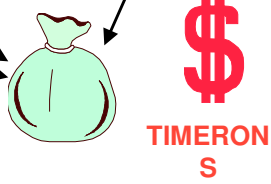
explain all with snapshot for
select a.empno, b.deptname
from employee a,department b
where a.workdept=b.deptno;
! db2exfmt -d sample -w -1 -n % -s % -# 0 -o exfmt.out;
set current explain snapshot no;

TABLAS de EXPLAIN



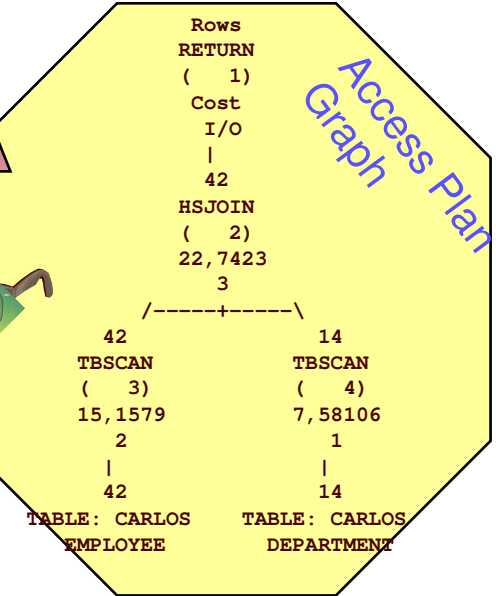
Tablespace name: USERSPACE1
 Tablespace overhead: 7,500000
 Tablespace transfer rate: 0,060000

Parallelism: None
 CPU Speed: 2,755341e-007
 Comm Speed: 100
 Buffer Pool size: 250
 Sort Heap size: 256
 Database Heap size: 600
 Lock List size: 50
 Maximum Lock List: 22
 Average Applications: 1
 Locks Available: 935



SQL Type: Dynamic
 Optimization Level: 5
 Blocking: Block All Cursors
 Isolation Level: Cursor Stability

Total Cost: 22,7423
 Query Degree: 1



Database Context

Query Context

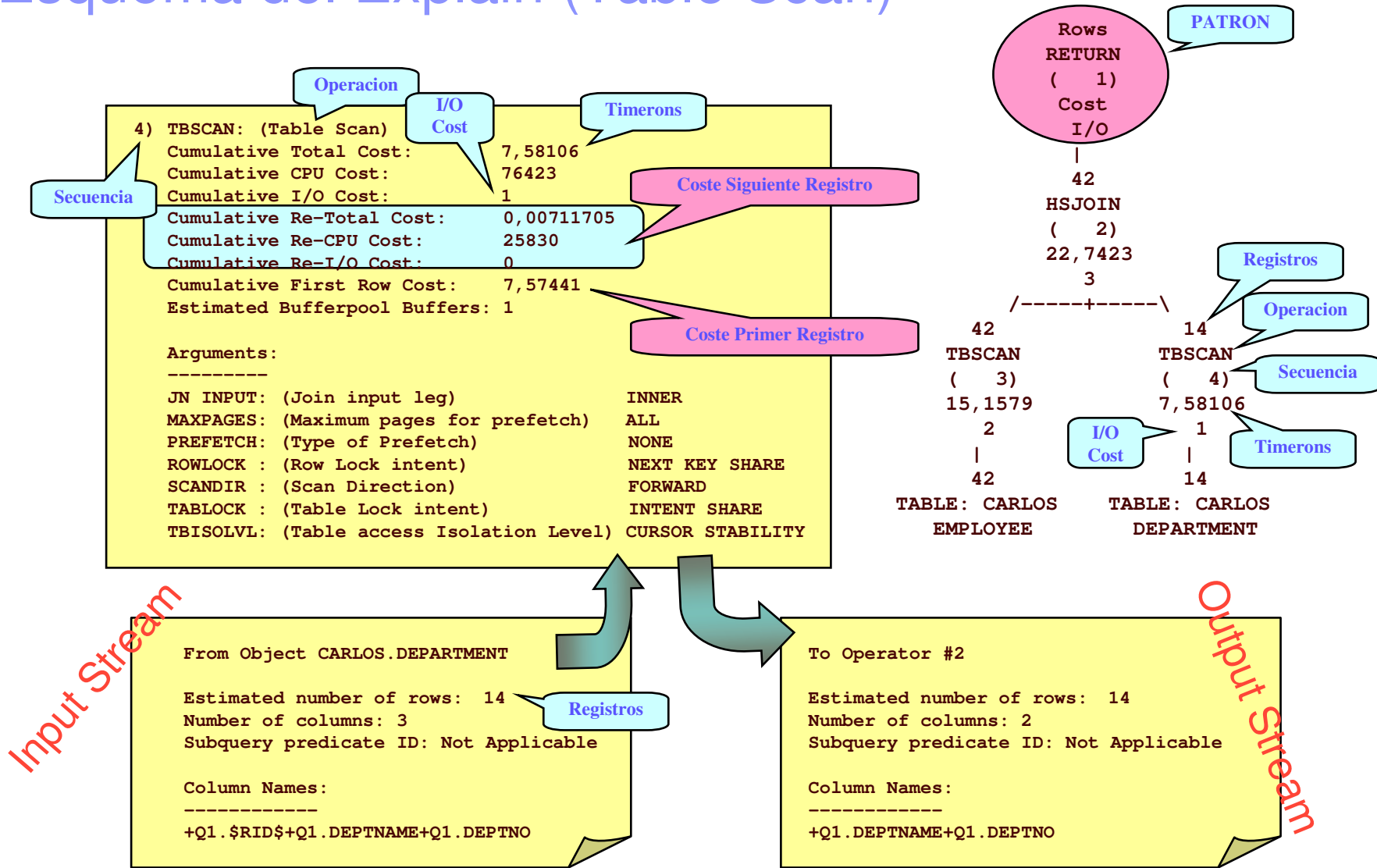
Nivel de Optimización



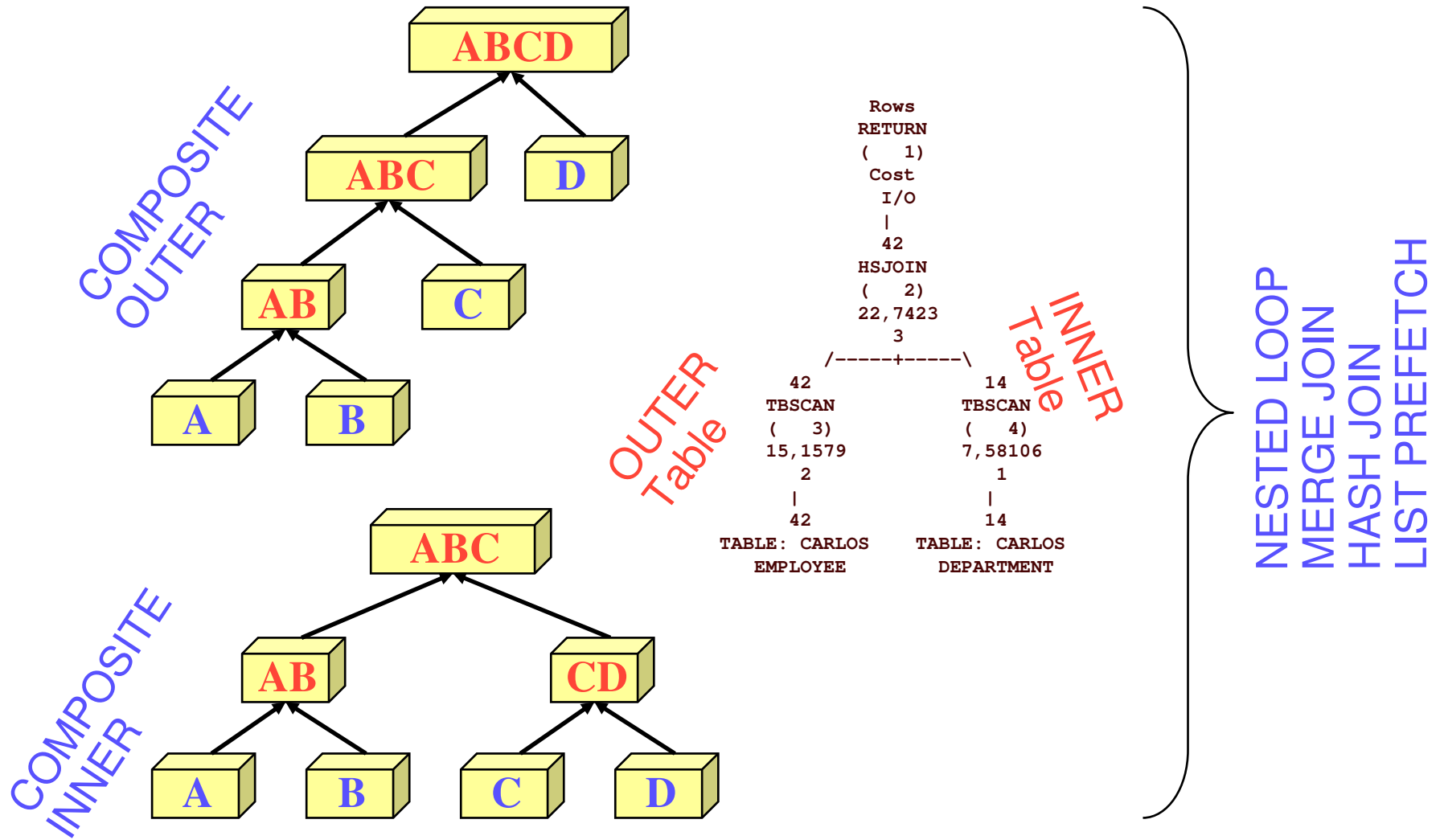
	0	1	2	3	5	7	9
non-uniform distribution statistics: - most frequent values - quantiles	N	N	Y	most frequent values quantiles-No	Y		
Rewrite Rules	basic	subset	- all, except comp. intensive rules	- most sub-query-to-join transform.	- all, except computationally intensive rules		all
complex dynamic SQL queries	Greedy join				reduced depend on machine size and number of predicates.	not reduced	
Search Strategies for Selecting Optimal Join					Dynamic programming join		
Join Concepts	NLJoin Index Scan	MSJoin NLJoin		Index scan Table scan			
Star Join Strategy	N		Y				
List Prefetch	N		Y				
Index ANDing	N			Y			
Appropriate to use with:	OLTP		OLAP/DSS		for queries with four or more joins.		



Esquema del Explain (Table Scan)



Uniones entre Tablas



Operadores



*SELECT Employee, Dept, Deptname
FROM Employee a, Department b
WHERE a.Dept = b.Dept*

NESTED LOOP

EMPLOYEE	DEPT
CHRISTINE HAAS	A00
MICHAEL THOMPSON	B01
VINCENZO LUCCHESI	A00
JOHN GEYER	E01
IRVING STERN	D11
EVA PULASKI	D21
EILEEN HENDERSON	E11
THEODORE SPENSER	E21
SALLY KWAN	C01
SEAN O'CONNELL	A00
DELORES QUINTANA	C01

Outer Table

Inner Table

DEPT	DEPTName
✓ ↓ ✓	A00 SPIFFY COMPUTER SERVICE DIV.
↓ ↓ ↓	B01 PLANNING
↓ ↓ ↓	C01 INFORMATION CENTER
✓ ↓ ✓	A00 SPIFFY COMPUTER SERVICE DIV.
↓ ↓ ↓	D21 ADMINISTRATION SYSTEMS
↓ ↓ ↓	E01 SUPPORT SERVICES
✓ ↓ ✓	A00 SPIFFY COMPUTER SERVICE DIV.
↓ ↓ ↓	B01 PLANNING

- No existe índices
- No existe índice apropiado en Inner
- Puede utilizar índice en Outer

MERGE SCAN

EMPLOYEE	DEPT
CHRISTINE HAAS	A00
SEAN O'CONNELL	A00
MICHAEL THOMPSON	B01
DELORES QUINTANA	C01
SALLY KWAN	C01
IRVING STERN	D11
EVA PULASKI	D21
JOHN GEYER	E01
EILEEN HENDERSON	E11
THEODORE SPENSER	E21

Inner Table

DEPT	DEPTName
✓	A00 SPIFFY COMPUTER SERVICE DIV.
✓	A00 SPIFFY COMPUTER SERVICE DIV.
↓	B01 PLANNING
↓	C01 INFORMATION CENTER
↓	D11 MANUFACTURING SYSTEMS

- Inner y Outer ordenados por unión
- Existe índice sobre columna unión
- Tablas Grandes

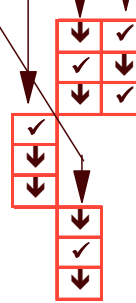
Puede decidir crear **INDICE online**

Outer Table

HASH JOIN

EMPLOYEE	DEPT
CHRISTINE HAAS	A00
JOHN GEYER	E01
MICHAEL THOMPSON	B01
DELORES QUINTANA	G22
SALLY KWAN	C01
IRVING STERN	D11
EVA PULASKI	D21
JOHN GEYER	E01
EILEEN HENDERSON	E11
THEODORE SPENSER	E21

ONLINE



Inner Table

DEPT	DEPTName	Bucket
A00	SPIFFY COMPUTER SERVICE DIV.	Bucket #1
B01	PLANNING	
A00	SPIFFY COMPUTER SERVICE DIV.	
E01	SUPPORT SERVICES	Bucket #2
C01	INFORMATION CENTER	
E21	SOFTWARE SUPPORT	
F22	BRANCH OFFICE F2	Bucket #3
G22	BRANCH OFFICE G2	
G25	BRANCH OFFICE G5	



- Inner subdividido en buckets mediante hash de la clave de unión.
- Outer hash por la clave de unión y nested loop contra el bucket de la Inner
- Inner bucket cabe en memoria, normalmente overflow a disco

LIST PREFETCH

Indice Employee		
EMPLOYEE	DEPT	RID
CHRISTINE HAAS	A00	(1,1)
JOHN GEYER	E01	(2,1)
MICHAEL THOMPSON	B01	(1,2)
DELORES QUINTANA	G22	(3,2)
SALLY KWAN	C01	(2,2)
IRVING STERN	D11	(4,3)
EVA PULASKI	D21	(4,1)
JOHN GEYER	E01	(3,1)
EILEEN	E11	(4,2)
THOMAS	E21	(3,3)

Outer Table

I/O Random con respecto a Inner Table

Página

RID = (10 , 3)

Nº Registro

Convertir un índice NO clusterizada en CLUSTER de Tabla Inner!

ONLINE

Inner Table

IndiceCluster	
DEPT	RID
A00	(1,1)
B01	(1,2)
E01	(2,1)
C01	(2,2)
E01	(2,1)
G22	(3,2)
E21	(3,3)
D21	(4,1)
D11	(4,2)
E11	(4,3)

IO Secuencial

DEPT	DEPTName	Página
A00	SPIFFY COMPUTER SERVICE DIV.	#1
B01	PLANNING	
A02	SPIFFY COMPUTER DIV.	#2
E01	SUPPORT SERVICES	
C01	INFORMATION CENTER	
E21	SOFTWARE SUPPORT	#3
F22	BRANCH OFFICE F2	
G22	BRANCH OFFICE G2	
G25	BRANCH OFFICE G5	

- Ordena clave de unión por row id.
- Acceso secuencial al Inner con prefetch activado.

List Prefetch



*select a.empno,a.workdept
from employee a
where a.empno = '100340';*

Schema: CARLOS
Name: EMPNO
Type: Index

Number of columns:	1
Number of rows:	2828
Number of buffer pool pages:	64
Distinct row values:	No
Prefetch page count:	32
Container extent page count:	32
Index clustering statistic:	0,332489
Index leaf pages:	9
Index tree levels:	2
Index full key cardinality:	202
Index first key cardinality:	202
Index RID count:	2828
Index empty leaf pages:	0

1 valor distinto de 202 valores =

$1/202 = 0,0049 = 0,005$ (Factor de filtro)

$0,005 * 2828 = 14,14$ registros

Index Scan
Cardinality

List Prefetch
Cardinality

```

      Rows
      RETURN
      ( 1)
      Cost
      I/O
      |
      14,14
      FETCH
      ( 2)
      39,5495
      32,7356
      /-----\
      14,14          2828
      RIDSCAN      TABLE: CARLOS
      ( 3)          EMPLOYEE
      7,58463
      1
      |
      14,14
      SORT
      ( 4)
      7,58427
      1
      |
      14,14
      IXSCAN
      ( 5)
      7,58261
      1
      |
      2828
      INDEX: CARLOS
      EMPNO
    
```

Schema: CARLOS
Name: EMPLOYEE
Type: Table

Number of columns:	14
Number of rows:	2828
Number of buffer pool pages:	64
Distinct row values:	No
Prefetch page count:	32
Container extent page count:	32
Table overflow record count:	0

Start Key Predicate
Comparison Operator: Equal (=)
Filter Factor: 0,005

Predicate Text:

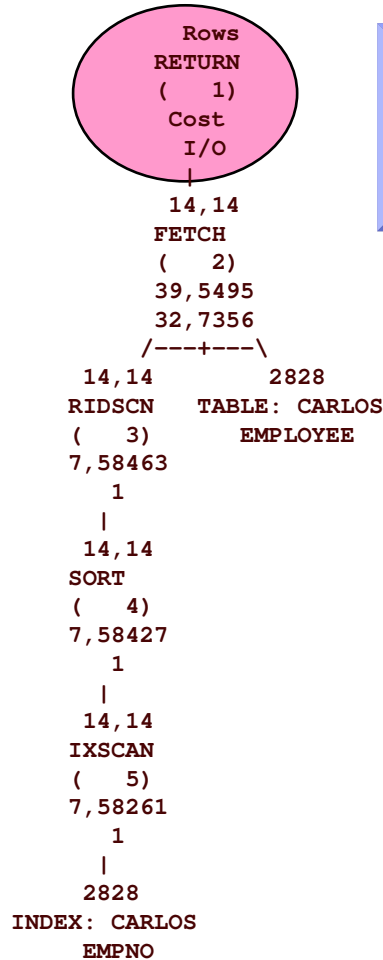
(Q1.EMPNO = '100340')

Stop Key Predicate
Comparison Operator: Equal (=)
Filter Factor: 0,005

Predicate Text:

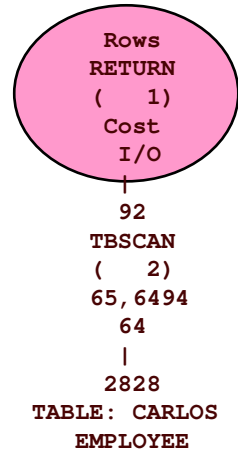
(Q1.EMPNO = '100340')

Total Cost: 39,5495



db2 runstats on table carlos.employee
with distribution on all columns
and detailed indexes all

Total Cost: 65,6494



92 valores distintos de 2828 registros =
92/2828 = 0,0325 (Factor de filtro)

SYSCAT.COLDIST

COLVALUE	VALCOUNT
'100340'	92

Start Key Predicate
Comparison Operator: Equal (=)
Filter Factor: 0,0325

Predicate Text:

(Q1.EMPNO = '100340')

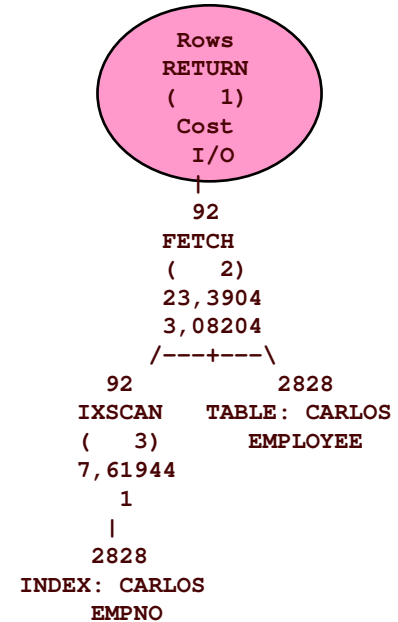
Stop Key Predicate
Comparison Operator: Equal (=)
Filter Factor: 0,0325

Predicate Text:

(Q1.EMPNO = '100340')

db2 reorg table carlos.employee
index carlos.empno
db2 runstats on table carlos.employee
with distribution on all columns
and detailed indexes all

Total Cost: 23,3904

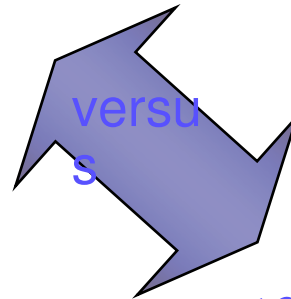


Proximamente ...

- **Constraints**
- **Informational Constraints**
- **Tablas Volatiles**

CURVA de I/O
por Bufferpool size
para INDEXSCAN

Uniform Data Distribution



Non - Uniform Data Distribution

Tratamiento de
Correlated
Columns

- **Estadísticas FRECUENCIA**
- **Estadísticas QUANTILES**
- **Estadísticas Multi-column
GROUP**
- **Statistical Views**



QUEDA MUCHO POR VER

!!!

