Parallel Execution Plans
A critical sound-bite

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Sample Query

```
select
        count(t1.small_vc),     count(t2.small_vc),
        count(t3.small_vc),     count(t4.small_vc)
from
        t4,             -- big table
        t1,             -- small table
        t2,             --      "
        t3              --      "
where
        t1.id = t4.id1
and     t2.id = t4.id2
and     t3.id = t4.id3
and     t1.small_vc in (1,2,3)          -- 3 rows out of 70
and     t2.small_vc in (1,2,3)          --         "
and     t3.small_vc in (1,2,3)          --         "
;
```

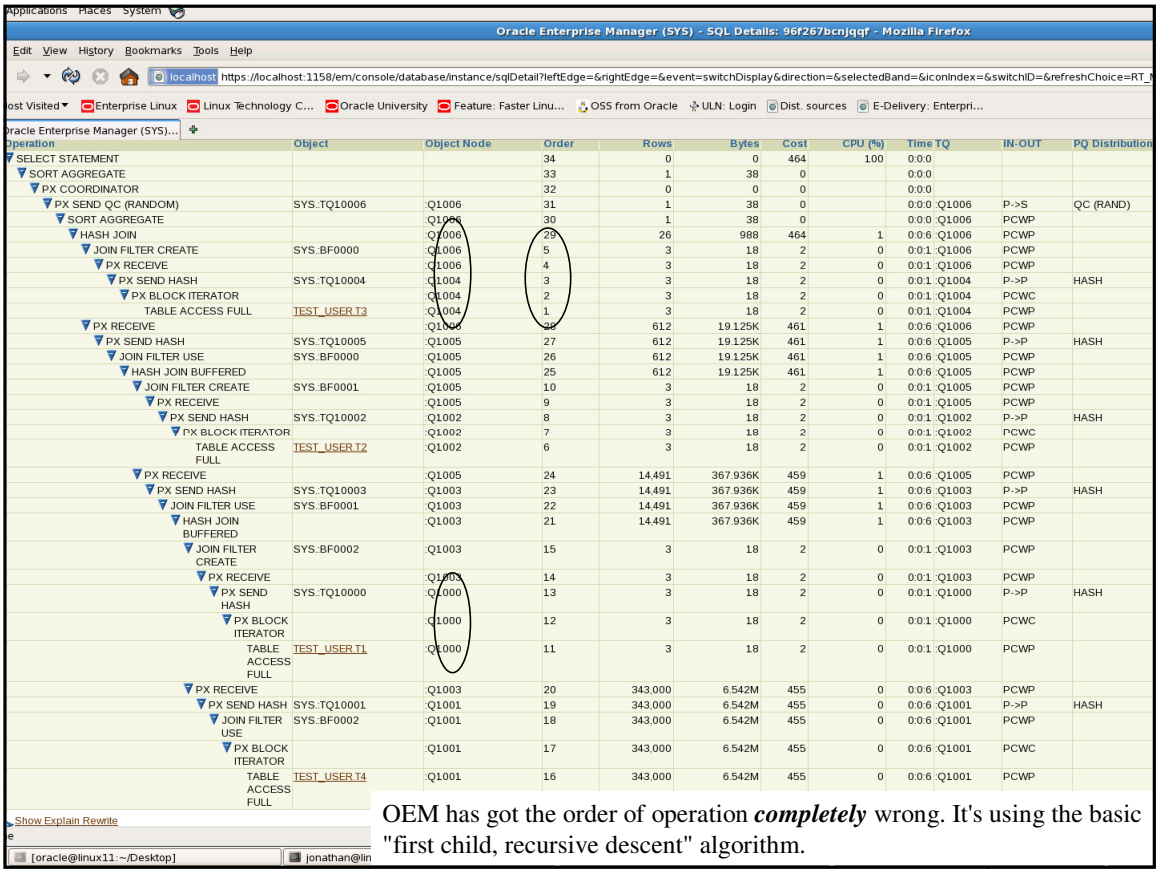
Sample Query (serial plan)

select * from table(dbms_xplan.display_cursor);

Id	Operation	Name	Starts	**E-Rows**	**A-Rows**
0	SELECT STATEMENT		1		1
1	SORT AGGREGATE		1	1	1
* 2	HASH JOIN		1	26	27
* 3	TABLE ACCESS FULL	T3	1	3	3
* 4	HASH JOIN		1	612	630
* 5	TABLE ACCESS FULL	T2	1	3	3
* 6	HASH JOIN		1	14491	14700
* 7	TABLE ACCESS FULL	T1	1	3	3
8	TABLE ACCESS FULL	T4	1	343K	343K

Parallel plan *(hash / hash)*

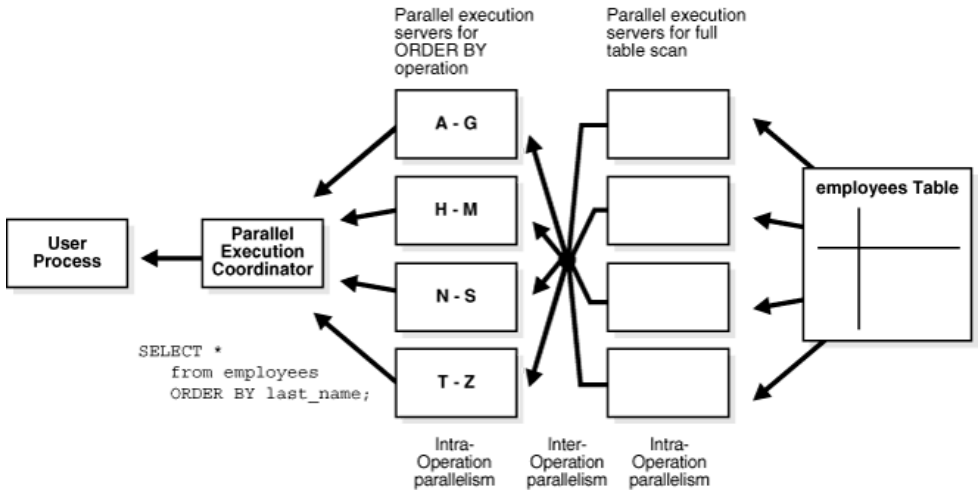
Id	Operation	Name	Rows	Time	TQ	IN-OUT	PQ Distrib
0	SELECT STATEMENT						
1	SORT AGGREGATE		1				
2	PX COORDINATOR						
3	PX SEND QC (RANDOM)	:TQ10006	1		Q1,06	P->S	QC (RAND)
4	SORT AGGREGATE		1		Q1,06	PCWP	
* 5	HASH JOIN		26	00:00:29	Q1,06	PCWP	
6	JOIN FILTER CREATE	:BF0000	3	00:00:01	Q1,06	PCWP	
7	PX RECEIVE		3	00:00:01	Q1,06	PCWP	
8	PX SEND HASH	:TQ10004	3	00:00:01	Q1,04	P->P	HASH
9	PX BLOCK ITERATOR		3	00:00:01	Q1,04	PCWC	
* 10	TABLE ACCESS FULL	T3	3	00:00:01	Q1,04	PCWP	
11	PX RECEIVE		612	00:00:29	Q1,06	PCWP	
12	PX SEND HASH	:TQ10005	612	00:00:29	Q1,05	P->P	HASH
13	JOIN FILTER USE	:BF0000	612	00:00:29	Q1,05	PCWP	
* 14	HASH JOIN BUFFERED		612	00:00:29	Q1,05	PCWP	
15	JOIN FILTER CREATE	:BF0001	3	00:00:01	Q1,05	PCWP	
16	PX RECEIVE		3	00:00:01	Q1,05	PCWP	
17	PX SEND HASH	:TQ10002	3	00:00:01	Q1,02	P->P	HASH
18	PX BLOCK ITERATOR		3	00:00:01	Q1,02	PCWC	
* 19	TABLE ACCESS FULL	T2	3	00:00:01	Q1,02	PCWP	
20	PX RECEIVE		14491	00:00:29	Q1,05	PCWP	
21	PX SEND HASH	:TQ10003	14491	00:00:29	Q1,03	P->P	HASH
22	JOIN FILTER USE	:BF0001	14491	00:00:29	Q1,03	PCWP	
* 23	HASH JOIN BUFFERED		14491	00:00:29	Q1,03	PCWP	
24	JOIN FILTER CREATE	:BF0002	3	00:00:01	Q1,03	PCWP	
25	PX RECEIVE		3	00:00:01	Q1,03	PCWP	
26	PX SEND HASH	:TQ10000	3	00:00:01	Q1,00	P->P	HASH
27	PX BLOCK ITERATOR		3	00:00:01	Q1,00	PCWC	
* 28	TABLE ACCESS FULL	T1	3	00:00:01	Q1,00	PCWP	
29	PX RECEIVE		343K	00:00:29	Q1,03	PCWP	
30	PX SEND HASH	:TQ10001	343K	00:00:29	Q1,01	P->P	HASH
31	JOIN FILTER USE	:BF0002	343K	00:00:29	Q1,01	PCWP	
32	PX BLOCK ITERATOR		343K	00:00:29	Q1,01	PCWC	
* 33	TABLE ACCESS FULL	T4	343K	00:00:29	Q1,01	PCWP	



Operation	Object	Object Node	Order	Rows	Bytes	Cost	CPU (%)	Time	TQ	IN-OUT	PQ Distribution
SELECT STATEMENT			34	0	0	464	100	0:0:0			
SORT AGGREGATE			33	1	38	0		0:0:0			
PX COORDINATOR			32	0	0	0		0:0:0			
PX SEND QC (RANDOM)	SYS.:TQ10006	Q1006	31	1	38	0		0:0:0	Q1006	P->S	QC (RAND)
SORT AGGREGATE		Q1006	30	1	38	0		0:0:0	Q1006	PCWP	
HASH JOIN		Q1006	29	26	988	464	1	0:0:6	Q1006	PCWP	
JOIN FILTER CREATE	SYS.:BF0000	Q1006	5	3	18	2	0	0:0:1	Q1006	PCWP	
PX RECEIVE		Q1006	4	3	18	2	0	0:0:1	Q1006	PCWP	
PX SEND HASH	SYS.:TQ10004	Q1004	3	3	18	2	0	0:0:1	Q1004	P->P	HASH
PX BLOCK ITERATOR		Q1004	2	3	18	2	0	0:0:1	Q1004	PCWC	
TABLE ACCESS FULL	TEST_USER.T3	Q1004	1	3	18	2	0	0:0:1	Q1004	PCWP	
PX RECEIVE		Q1006	28	612	19.125K	461	1	0:0:6	Q1006	PCWP	
PX SEND HASH	SYS.:TQ10005	Q1005	27	612	19.125K	461	1	0:0:6	Q1005	P->P	HASH
JOIN FILTER USE	SYS.:BF0000	Q1005	26	612	19.125K	461	1	0:0:6	Q1005	PCWP	
HASH JOIN BUFFERED		Q1005	25	612	19.125K	461	1	0:0:6	Q1005	PCWP	
JOIN FILTER CREATE	SYS.:BF0001	Q1005	10	3	18	2	0	0:0:1	Q1005	PCWP	
PX RECEIVE		Q1005	9	3	18	2	0	0:0:1	Q1005	PCWP	
PX SEND HASH	SYS.:TQ10002	Q1002	8	3	18	2	0	0:0:1	Q1002	P->P	HASH
PX BLOCK ITERATOR		Q1002	7	3	18	2	0	0:0:1	Q1002	PCWC	
TABLE ACCESS FULL	TEST_USER.T2	Q1002	6	3	18	2	0	0:0:1	Q1002	PCWP	
PX RECEIVE		Q1005	24	14.491	367.936K	459	1	0:0:6	Q1005	PCWP	
PX SEND HASH	SYS.:TQ10003	Q1003	23	14.491	367.936K	459	1	0:0:6	Q1003	P->P	HASH
JOIN FILTER USE	SYS.:BF0001	Q1003	22	14.491	367.936K	459	1	0:0:6	Q1003	PCWP	
HASH JOIN BUFFERED		Q1003	21	14.491	367.936K	459	1	0:0:6	Q1003	PCWP	
JOIN FILTER CREATE	SYS.:BF0002	Q1003	15	3	18	2	0	0:0:1	Q1003	PCWP	
PX RECEIVE		Q1003	14	3	18	2	0	0:0:1	Q1003	PCWP	
PX SEND HASH	SYS.:TQ10000	Q1000	13	3	18	2	0	0:0:1	Q1000	P->P	HASH
PX BLOCK ITERATOR		Q1000	12	3	18	2	0	0:0:1	Q1000	PCWC	
TABLE ACCESS FULL	TEST_USER.T1	Q1000	11	3	18	2	0	0:0:1	Q1000	PCWP	
PX RECEIVE		Q1003	20	343.000	6.542M	455	0	0:0:6	Q1003	PCWP	
PX SEND HASH	SYS.:TQ10001	Q1001	19	343.000	6.542M	455	0	0:0:6	Q1001	P->P	HASH
JOIN FILTER USE	SYS.:BF0002	Q1001	18	343.000	6.542M	455	0	0:0:6	Q1001	PCWP	
PX BLOCK ITERATOR		Q1001	17	343.000	6.542M	455	0	0:0:6	Q1001	PCWC	
TABLE ACCESS FULL	TEST_USER.T4	Q1001	16	343.000	6.542M	455	0	0:0:6	Q1001	PCWP	

OEM has got the order of operation ***completely*** wrong. It's using the basic "first child, recursive descent" algorithm.

Parallel Images



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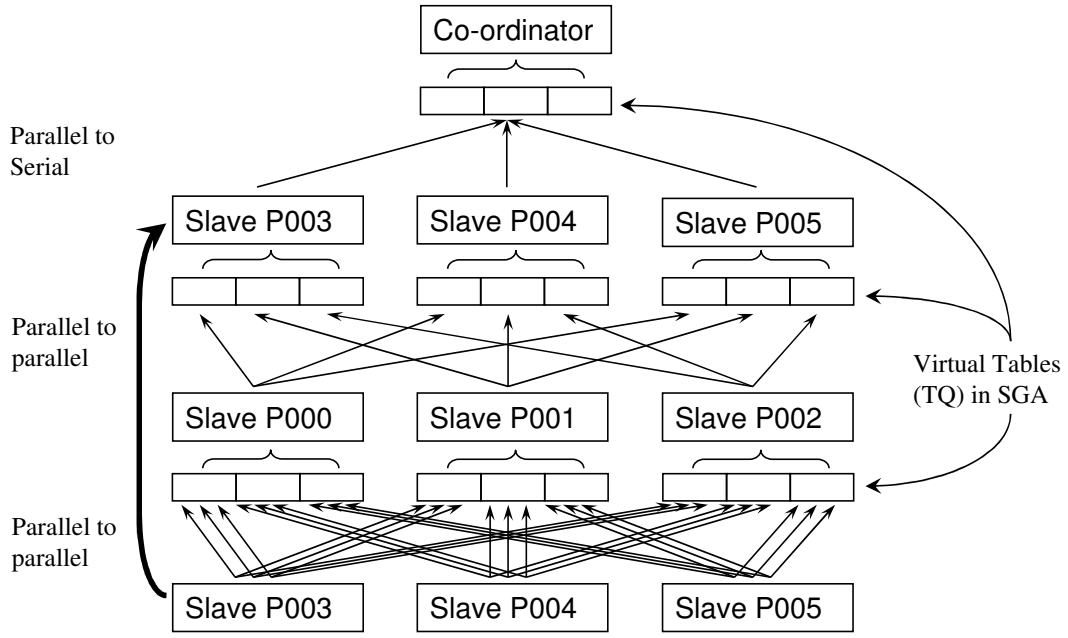
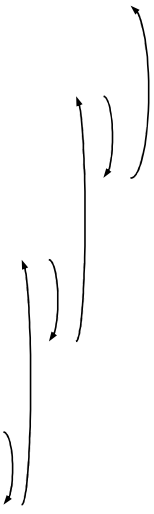
Parallel Execution - visual



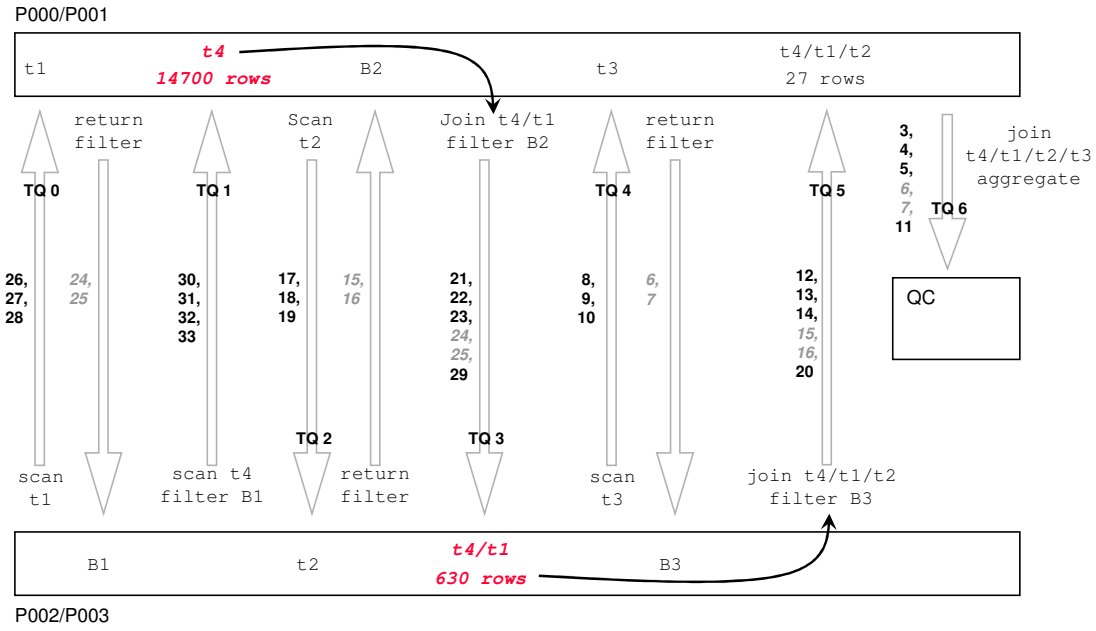
Execution plan (hash / hash)

```
| Id  | Operation                        | Name      | Rows  | Time      |     TQ  |IN-OUT| PQ Distrib |
|   0 | SELECT STATEMENT                 |           |       |           |         |      |            |
|   1 |  SORT AGGREGATE                  |           |     1 |           |         |      |            |
|   2 |   PX COORDINATOR                 |           |       |           |         |      |            |
|   3 |    PX SEND QC (RANDOM)           | :TQ10006  |     1 |           | Q1,06   | P->S | QC (RAND)  |
|   4 |     SORT AGGREGATE               |           |     1 |           | Q1,06   | PCWP |            |
|*  5 |      HASH JOIN                   |           |    26 | 00:00:29  | Q1,06   | PCWP |            |
|   6 |       JOIN FILTER CREATE         | :BF0000   |     3 | 00:00:01  | Q1,06   | PCWP |            |
|   7 |        PX RECEIVE                |           |     3 | 00:00:01  | Q1,06   | PCWP |            |
|   8 |         PX SEND HASH             | :TQ10004  |     3 | 00:00:01  | Q1,04   | P->P | HASH       |
|   9 |          PX BLOCK ITERATOR       |           |     3 | 00:00:01  | Q1,04   | PCWC |            |
|* 10 |           TABLE ACCESS FULL      | T3        |     3 | 00:00:01  | Q1,04   | PCWP |            |
|  11 |       PX RECEIVE                 |           |   612 | 00:00:29  | Q1,06   | PCWP |            |
|  12 |        PX SEND HASH              | :TQ10005  |   612 | 00:00:29  | Q1,05   | P->P | HASH       |
|  13 |         JOIN FILTER USE          | :BF0000   |   612 | 00:00:29  | Q1,05   | PCWP |            |
|* 14 |          HASH JOIN BUFFERED      |           |   612 | 00:00:29  | Q1,05   | PCWP |            |
|  15 |           JOIN FILTER CREATE     | :BF0001   |     3 | 00:00:01  | Q1,05   | PCWP |            |
|  16 |            PX RECEIVE            |           |     3 | 00:00:01  | Q1,05   | PCWP |            |
|  17 |             PX SEND HASH         | :TQ10002  |     3 | 00:00:01  | Q1,02   | P->P | HASH       |
|  18 |              PX BLOCK ITERATOR   |           |     3 | 00:00:01  | Q1,02   | PCWC |            |
|* 19 |               TABLE ACCESS FULL  | T2        |     3 | 00:00:01  | Q1,02   | PCWP |            |
|  20 |           PX RECEIVE             |           | 14491 | 00:00:29  | Q1,05   | PCWP |            |
|  21 |            PX SEND HASH          | :TQ10003  | 14491 | 00:00:29  | Q1,03   | P->P | HASH       |
|  22 |             JOIN FILTER USE      | :BF0001   | 14491 | 00:00:29  | Q1,03   | PCWP |            |
|* 23 |              HASH JOIN BUFFERED  |           | 14491 | 00:00:29  | Q1,03   | PCWP |            |
|  24 |               JOIN FILTER CREATE | :BF0002   |     3 | 00:00:01  | Q1,03   | PCWP |            |
|  25 |                PX RECEIVE        |           |     3 | 00:00:01  | Q1,03   | PCWP |            |
|  26 |                 PX SEND HASH     | :TQ10000  |     3 | 00:00:01  | Q1,00   | P->P | HASH       |
|  27 |                  PX BLOCK ITERATOR |      |     3 | 00:00:01  | Q1,00   | PCWC |            |
|* 28 |                   TABLE ACCESS FULL| T1   |     3 | 00:00:01  | Q1,00   | PCWP |            |
|  29 |               PX RECEIVE         |           |  343K | 00:00:29  | Q1,03   | PCWP |            |
|  30 |                PX SEND HASH      | :TQ10001  |  343K | 00:00:29  | Q1,01   | P->P | HASH       |
|  31 |                 JOIN FILTER USE  | :BF0002   |  343K | 00:00:29  | Q1,01   | PCWP |            |
|  32 |                  PX BLOCK ITERATOR |      |  343K | 00:00:29  | Q1,01   | PCWC |            |
|* 33 |                   TABLE ACCESS FULL| T4   |  343K | 00:00:29  | Q1,01   | PCWP |            |
```



We have seven table queues to follow. Notice how they don't follow a simple consecutive pattern up the plan, though.

Graphic (hash / hash)



Sound-bite

Follow the TQxxyyyy name order

"Name" = :TQxxyyy and "TQ" = Qxx,yyyy

"Buffered" is a threat

Broadcast plans don't need the buffering

Broadcast plans use Bloom filters sooner

Broadcast plans can be read using "first child first"