



Why is my Oracle10g Database SLOWER than my Oracle9i Database?

Dan Hotka Author/Speaker/Oracle Expert





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DAN HOTKA Oracle Expert and Trainer





Agenda

- Index Monitoring

 Introduced in Oracle9i
- Things I've Heard...
- Index Clustering Factor
 - Relationship between index and table data blocks
- Oracle10g New Tablespace Features
 - Automatic Space Management
- Case Study





Indexes





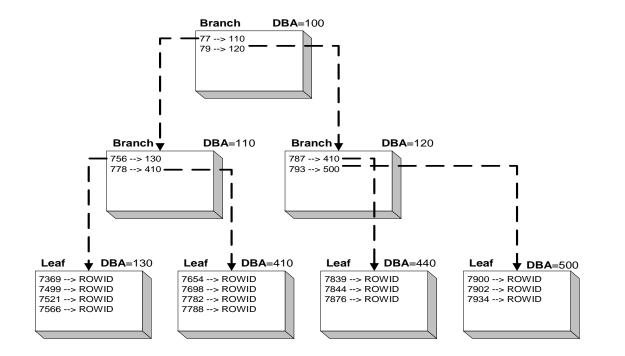
Indexes

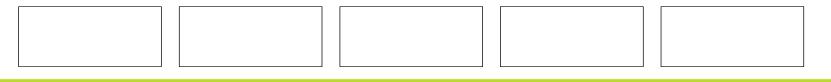
- Indexes:
 - Fast path to rows
 - Insures uniqueness
 - Oracle can use them when processing an Order By
 - NOT always the fastest method
 - Not used with any Oracle function
 - Coding style definitely affects Index usage





B*Tree Index Structure

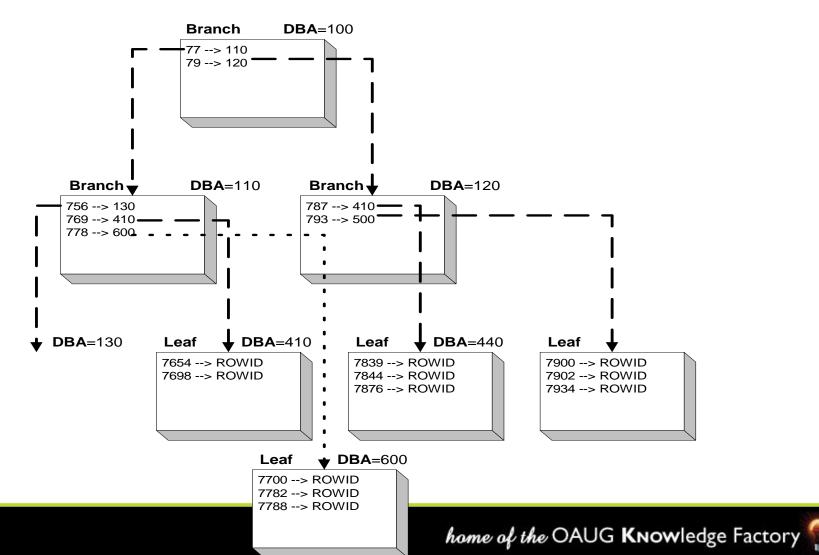








B*Tree Index Split









B*Tree Index

- Reorganize Indexes
 - Fills leaf blocks to PCTFREE
 - Performance of fast full scans and range scans increases







Index Monitoring

- Oracle9+ can monitor Index Usage
 - SQL> alter index <index name> MONITORING USAGE
 - SQL> alter index <index name> NOMONITORING USAGE

| 💐 View: SYS.V\$0BJECT_USAGE | | | | | | | | | |
|--|---|-------|--------------------------------------|---------------------------------------|----|--|--|--|--|
| Created: 5/12/2002 4:23:35 | Created: 5/12/2002 4:23:35 PM Updated: 5/12/2002 4:23:35 PM | | | | | | | | |
| Columns Script Data Grants Deps (Uses) Deps (Used by) Triggers | | | | | | | | | |
| The second secon | | | | | | | | | |
| Column | Data Type | Null? | Updatable | Comments | ΠI | | | | |
| INDEX_NAME | VARCHAR2 (30) | N | | Name of the index | | | | | |
| TABLE_NAME | VARCHAR2 (30) | N | Name of the table upon which the inc | | | | | | |
| MONITORING | VARCHAR2 (3) | Y | | Whether the monitoring feature is on | | | | | |
| USED | VARCHAR2 (3) | Y | | Whether the index has been accessed | | | | | |
| START_MONITORING | VARCHAR2 (19) | Y | | When the monitoring feature is turned | | | | | |
| END_MONITORING | VARCHAR2 (19) | Y | | When the monitoring feature is turned | | | | | |





Index Monitoring

set headings off

```
spool index_monitoring.sql
```

select 'alter index ' || index_name || ' monitoring usage;'
from user_indexes;

spool off

start index_monitoring

```
select count(*) from v$object_usage where used = 'YES';
select count(*) from v$object_usage where used is null;
select count(*) from v$object_usage;
select count(*) from user_tables;
```





Index Monitoring

Ask me for this script:
 DHOTKA@EARTHLINK.NET







Things I've Heard

- Things I've Heard...
 - SQL with Histograms not working correctly
 - SQL with Different Explain Plans for no apparent reason
 - Try COMPATIBLE setting
 - Set to 9.2.0.0.0
 - ALTER SESSION SET COMPATIBLE = 9.2.0.0.0
 - INIT.ora sessing

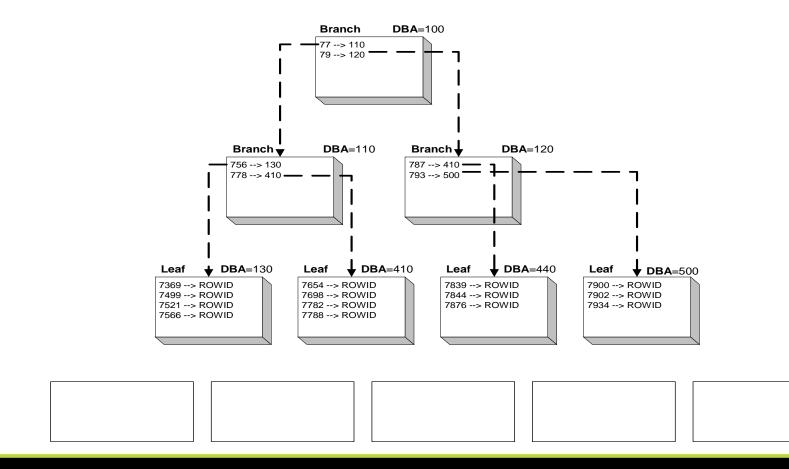




- The relationship of how many data blocks each leaf block points to
- Collected by CBO
- Lower the clustering factor more the data is in order by indexed column
- Design indexes/data order around most-used queries/most important queries







Next Examples with Permission from Jonathan Lewis

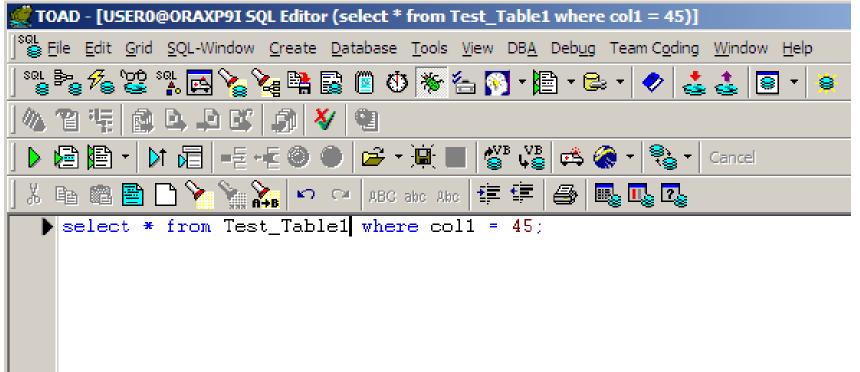




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| ▶ sele | ct * from Test_Table1 where col1 = 45; | ► Se | t * from Test_Table | 2 where col1 = 45; | |
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| 45 | 680 | | 45 | | |
| 45 | 681 | | 045 | | |
| 45 | 682 | | 245 | | |
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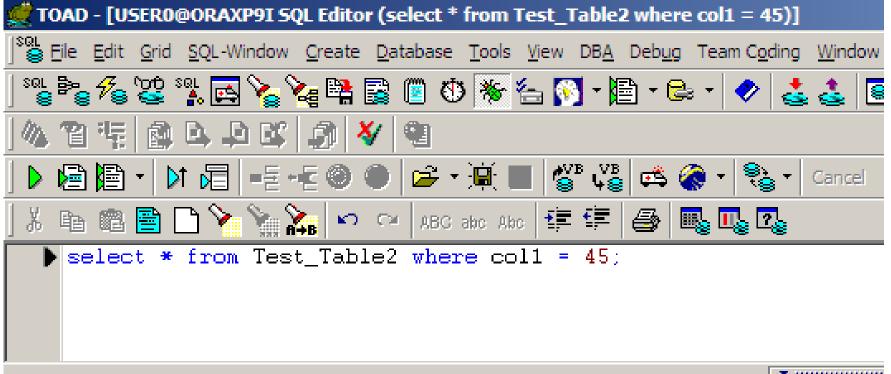


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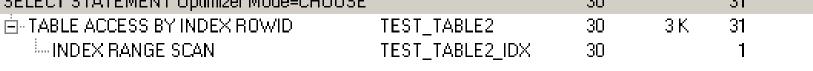
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| | TABLE ACCESS | S FULL | | TEST_TABLE2 | 2 30 | 3 | 3K 11 | |







| 👹 TOAD - [USER0@ORAXP9I SQL Editor (Part1_ | _SQL5.sql)] |
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| select /*+ index(test_table2) |) */ * from Test_Table2 where col1 = |
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| Data Explain Plan Auto Trace DBMS Output 0 | Code Statistics Script Output |
| Operation | Object Name Rows Bytes Cost Object |
| SELECT STATEMENT Optimizer Mode=CHOOSE | 30 31 |









| Table: USER0.TEST_TABLE1 | Table: USER0.TEST_TABLE2 |
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| TEST_TABLE1: Created: 9/17/2003 5:02:37 PM Last DDL: 9/17/2003 ! | TEST_TABLE2: Created: 9/17/2003 5:02:39 PM Last DDL: 9/17/2003 ! |
| Partitions Subpartitions Stats/Size Referential Used By | Partitions Subpartitions Stats/Size Referential Used By |
| Columns Indexes Constraints Triggers Data Scripts Grants | Columns Indexes Constraints Triggers Data Scripts Grants |
| 📑 🔹 🔐 🖓 🖨 <no key="" primary=""></no> | 📑 🔹 🔐 🖓 🎒 «NO PRIMARY KEY» |
| Column Name Col ID Pk Data Type Null? | Column Name Col ID Pk Data Type Null? |
| COL1 1 NUMBER Y VAL1 2 VARCHAR2 (100) Y | COL1 1 NUMBER Y VAL1 2 VARCHAR2 (100) Y |
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| Table: USER0.TEST_TABLE1 | Table: USER0.TEST_TABLE2 |
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| Index Name Unique? Column | Index Name Unique? Column |
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| Parameter Value | Parameter Value |
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| Table: USER0.TEST_TABLE1 | | × | Table: USER0.TEST_TABLE2 | × |
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| Columns Indexes Constraints Trig | gers Data Scripts Gra | ants | Columns Indexes Constraints Trig | gers Data Scripts Grants |
| Partitions Subpartitions Stats/S | | | Partitions Subpartitions Stats/S | |
| Show Stats 🔽 Show Size/E> | tents | ĺ | Show Stats 🔽 Show Size/Es | xtents |
| Parameter | Value | | Parameter | Value |
| NUM_ROWS | 6000 | | NUM_ROWS | 6000 |
| BLOCKS | 101 | | BLOCKS | 101 |
| EMPTY_BLOCKS | 3 | | EMPTY_BLOCKS | 3 |
| AVG_SPACE | 889 | | AVG_SPACE | 905 |
| CHAIN_CNT | 0 | | CHAIN_CNT | 0 |
| AVG_ROW_LEN | 108 | | AVG_ROW_LEN | 107 |
| AVG_SPACE_FREELIST_BLOCKS | 0 | | AVG_SPACE_FREELIST_BLOCKS | 0 |
| NUM_FREELIST_BLOCKS | 1 | | NUM_FREELIST_BLOCKS | 1 |
| INSTANCES | 1 | | INSTANCES | |
| CACHE | I N | | CACHE | N |
| TABLE LOCK | ENABLED | | TABLE LOCK | ENABLED |
| SAMPLE_SIZE | 6000 | | SAMPLE_SIZE | 6000 |
| LAST_ANALYZED | 9/17/2003 5:02:39 | | LAST_ANALYZED | 9/17/2003 5:02:40 |
| | | | | |
| Parameter | Value | | Parameter | Value |
| Size in MB | 0.81 | Ţ | Size in MB | 0.81 |
| | -12 | 12 | | |
| | | | | |
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Index_Info.sql

SELECT i.table_name, i.index_name, t.num_rows, t.blocks, i.avg_data_blocks_per_key, i.avg_leaf_blocks_per_key,i.clustering_factor, o.created from user_indexes i, user_objects o, user_tables t where i.index_name = o.object_name and i.table_name = t.table_name;

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|------------|------------------------------|-----------------------------------|-----------------|--------|----------|----------|------------|
| Dat | a 🛛 Explain Plan 🗍 Auto Trac | ce DBMS Output Code Statistic | s Script Output | | | | |
| \Diamond | TABLE_NAME | INDEX_NAME | NUM_ROWS | BLOCKS | AVG_DATA | AVG_LEAF | CLUSTERING |
| ► | A | A_STATUS_IDX | 1000 | 8 | 3 | 3 | 3 |
| | В | B_STATUS_IDX | 100 | 4 | 1 | 1 | 1 |
| | С | C_B_ID_IDX | 1000 | 8 | 3 | 1 | 300 |
| | DEPT_CHAR | DEPT_CHAR_PRIMARY_ | | | | | |
| | DEPT | DEPT_PRIMARY_KEY | | | | | |
| | MASTER | MASTER_LASTNAME | | | | | |
| | В | PK_B_ID | 100 | 4 | 1 | 1 | 1 |
| | TEAMS | TEAMS_PK | | | | | |
| | TEST_TABLE1 | TEST_TABLE1_IDX | 6000 | 101 | 1 | 1 | 92 |
| | TEST_TABLE2 | TEST_TABLE2_IDX | 6000 | 101 | 30 | 1 | 6000 |
| | TOAD_PLAN_TABLE | TPTBL_IDX | | | | | |
| | | | | | | | |





Index Info

Ask me for this script:
 DHOTKA@EARTHLINK.NET







| Ø1 | able: U | SER0.TEST_TABLE1 | Table: USER0.TEST_TABLE2 |
|------------|-----------|---|--|
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| TES | T_TABLE | E1: Created: 9/17/2003 5:02:37 PM Last DDL: 9/17/2003 ! | ! TEST_TABLE2: Created: 9/17/2003 5:02:39 PM Last DDL: 9/17/2003 |
| Pa | irtitions | Subpartitions Stats/Size Referential Used By | Partitions Subpartitions Stats/Size Referential Used By |
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| 4 | T I | 🗠 🗠 🕨 🛨 🗕 🛷 💥 🤁 🗖 Sort by Primary K | 🖞 📥 🕁 📧 <> 🕨 + 🗕 🛷 🛠 🖱 🗖 Sort by Primary R |
| \bigcirc | COL1 | VAL1 | COL1 VAL1 |
| ► | 0 | 1 | |
| | 0 | 2 | 2 2 |
| | 0 | 3 | 3 3 |
| | 0 | 4 | 4 4 |
| | 0 | 5 | 5 5 |
| | 0 | 6 | 6 6 |
| | 0 | 7 | 7 7 |
| | 0 | 8 | 8 8 |
| | 0 | 9 | 99 |
| | 0 | 10 | 10 10 |
| | 0 | 11 | 11 11 |
| | 0 | 12 | 12 12 |
| • | | | |
| | | lu lu | |





- Replaces Free lists and free list groups
- Ignores PCTUSED
- Uses a bitmap in the segment header to track available space

- Holds less extent pointers (chains more quickly)





- Only available with Locally-Managed TS – Oracle9v2+
 - AUTO uses Automatic Space Storage Mngt
 - Manual uses freelists (existing technology)

CREATE TABLESPACE my_tablespace DATAFILE '/oracle/data/myts01.dbf' SIZE 500M EXTENT MANAGEMENT LOCAL SEGMENT SPACE MANAGEMENT AUTO;





- Different Segment Header Info
 - No changes in Cache Layer, Map Header
 - Extent Table holds these limits:
 - 2K 151 Extents (down from 121...)
 - 8K 307 Extents (down from 496)
 - Etc
 - Low/High Water Marks
 - Low HWM all blocks below are formatted
 - High HWM all blocks above are unformatted
 - Between: Oracle checks block status bitmap flag





- Bitmap Blocks
 - Stored in separate blocks as part of the segment header
 - Tracks PCTFREE and formatted/unformatted blocks
 - Tracks total free space in the block (not just what is available for inserts)



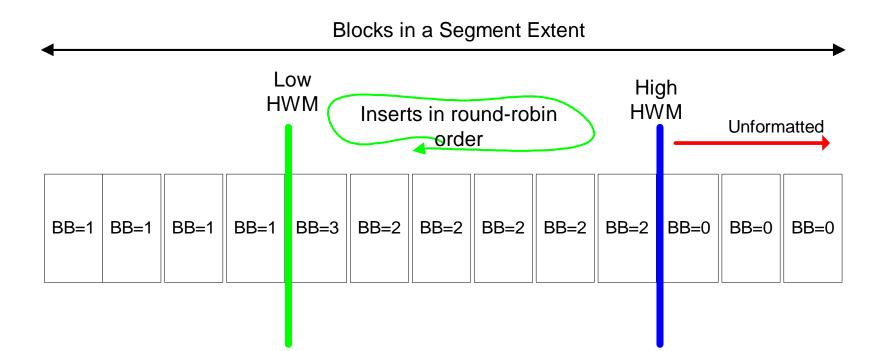


- 1 nibble (bit) per data block in the segment
 - -0 = unformatted
 - -1 = Full (met PCTFREE)
 - -2 = 0 25% free
 - -3 = 25 50% free
 - -4 = 50 75% free
 - -5 = 75 100% free
- Updated as blocks cross thresholds





• How it works:







- What it is good for:
 - Apps with lots of concurrent inserts
 - RAC (intended use)
 - Other 10g features

- What it is NOT good for:
 - Space not well used
 - Space can be come lost
 - Needs DBA Attention/monitoring
 - FIX_SEGMENT_STATUS
 - Redo generation is high
 - Can give indexes a high clustering factor!





Index_Info.sql

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|---|------|-------------------|--|--|--|--|--|
| <pre>SELECT i.table_name, i.index_name, t.num_rows, t.blocks, i.avg_data_blocks_per_ke i.avg_leaf_blocks_per_key,i.clustering_factor, to_char(o.created,'MM/DD/YYYY HH24:MI:SSSSS') Created from user_indexes i, user_objects o, user_tables t where i.index_name = o.object_name and i.table_name = t.table_name</pre> | ey, | | | | | | |
| 7 crder by 1; | | | | | | | |
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| Data Grid | | | | | | | |
| 🔝 Data Grid DBMS Output (disabled) 🖹 Query Viewer 🛸 CodeXpert 🖾 Explain Plan 🖹 Script Output | | | | | | | |
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| TABLE_NAME INDEX_NAME NUM_ROWS BLOCKS AVG_DATA_BLOCKS_PER_KEY AVG_LEAF_BLOCKS_PER | _KEY | CLUSTERING_FACTOR | | | | | |
| TEST_TABLE1 TEST_TABLE1_IDX 6000 101 1 | 1 | 1022 | | | | | |







Case Study

- Large ERP Application
 - 4 CPU IBM P Series
 - 12GB Memory
 - SGA set at 3GB
 - Shared Pool 300MB
 - AIX 5.2 64bit OS
 - Major performance problems when migrating their ERP from 9.2.0.5 to 10.2.0.2
 - JD Edwards One World No changes/upgrades just rehosting





Case Study

- Large ERP Application
 - Metalink & 2 Consultants of little help
 - Weeks worth of stats pack reports
 - I/O and explain plans the same
 - Histograms changed
 - "No one could tell me anything..."





Case Study

- Solution
 - Upped the memory
 - Added 12DB Memory
 - SGA to 10GB
 - Shared Pool to 1.8GB
 - Adding 4 more CPUs solved the problem
 - It appears our machine could not handle the same I/O as it did with Oracle9i
 - Oracle finally said after the problem was solved that the 10g kernal code had grown enough that our 4 CPU system could not handle it





What have we learned?

- Index Monitoring
 - Introduced in Oracle9i
- Index Clustering Factor
 - Relationship between index and table data blocks
- Things I've Heard...
- Oracle10g New Tablespace Features
 - Automatic Space Management
- Case Study
 - ERP Application
- Lets do the book draw!!!





