The Self-managing Database: Proactive Space and Schema Object Management

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Agenda

- **Proactive Space Management**
  - Alerts
  - Size estimation and growth trending
  - Segment Advisor and Shrink

- **Proactive Undo Management**
  - Alerts
  - Auto-sizing
  - Auto-tuning
Oracle9i
- No external space fragmentations
  - Locally Managed Tablespace
- No space allocation contention
  - Automatic Segment Space Management
- No Rollback Segments
  - Automatic Undo Management
Oracle Database 10g – Self-Managing Database

- Application & SQL Management
- Storage Management
- Backup & Recovery Management
- System Resource Management
- Space Management
- Database Management

Intelligent Infrastructure

Database Control
10g: Always working for you

- Collects continuously
- Records periodically to disk
- Learns from historical data
- Adapts to changing workload
- Alerts DBA when problems occur
- Advises proactively on problems

- Integrated with the Enterprise Manager
Proactive Space Management
Proactive Space Management in 10g

Size Estimation

Planning

Actions

Shrink
Add file
Re-org/ rebuild
Resumable

Operations

Growth Trending

Segment Advisor

Tablespace Alerts

ORACLE
Object Size Estimation

Create Table

General | Constraints | Storage | Options | Partitions
------- | ----------- | ------- | ------- | --------
Name: Employee | Schema: HR | Tablespace: DEFAULT | Organization: Standard, Heap Organized

Columns

<table>
<thead>
<tr>
<th>Select Name</th>
<th>Data Type</th>
<th>Size</th>
<th>Scale</th>
<th>Not NULL</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emplname</td>
<td>VARCHAR2</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empid</td>
<td>NUMBER</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dept</td>
<td>NUMBER</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>NUMBER</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>VARCHAR2</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TIP Only the columns with a data type of BLOB, CLOB, NCLOB, and TableType have advanced attributes.
Tablespace Alerts

- Database Generated
- Warning, Critical
- Out of the box

- Tablespaces can be provisioned with more disk space before out-of-space conditions occur
Tablespace Thresholds

- **Locally Managed Tablespace**
  - 85% Warning
  - 97% Critical

- **Add Files**
- **Free up space**

- **Resolve Space Problem**
  - Alert
Alert Computation

- **Read only/Offline tablespaces**: Do not setup alerts.
- **Temporary tablespace**: Threshold corresponds to space currently used by sessions.
- **Undo tablespace**: Threshold corresponds to space used by active and unexpired extents.
- **AUTOEXTENSIBLE files**: Threshold is based on the maximum file size.
Threshold Alert Tracking

Instance1

File1
100MB 60MB ...
50MB 10MB ...
...
Filen

File Size
Allocated Space
Change SCN

Instance2

File1
100MB 60MB ...
50MB 10MB ...
...
Filen

Data aggregated through GV$

Tablespace Size: 150M Allocated: 70M
Setting Thresholds Using EM

- Changing database default thresholds
- Changing a particular tablespace thresholds
  - Directly in the context of the tablespace
  - From the Edit Metric Thresholds page
Receiving Alerts in EM
Growth Trend Report

- Based on Automatic Workload Repository Data
- Indicates past growth trend and predicts future growth pattern
Growth Trend Report

**Dependent Segments**

<table>
<thead>
<tr>
<th>Select Schema</th>
<th>Segment Name</th>
<th>Type</th>
<th>Tablespace</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>COUNTRIES</td>
<td>TABLE</td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>COUNTRY_C_ID_PK</td>
<td>INDEX</td>
<td>EXAMPLE</td>
</tr>
<tr>
<td>SH</td>
<td>COUNTRIES_PK</td>
<td>INDEX</td>
<td>EXAMPLE</td>
</tr>
</tbody>
</table>

**TIP** Select a segment and click the 'Refresh' button to see the Space Usage Trend.

**Space Usage Trend**


**TIP** Putting in a future date will generate a prediction for the space usage on that date. Getting the Space Usage Trend is a time consuming operation and could take a while.

**General  Constraints  Segments  Storage  Options  IOT Properties**
Segment Advisor

- Determines whether an object is a good candidate for a shrink operation
  - Based on unused space that can be released
  - Considers estimated future space requirements
- EM allows you to apply the recommended shrink
- Can be invoked at the segment or tablespace level
Segment Shrink

Online and In-place

Shrink Operation

Data

Unused Space

Unused Space

HWM

Reclaimed Space
Benefits

- Online & In-place
- Shrunk Segment
- Faster access
- Better space utilization
Candidate Segments

Auto Segment Space Managed Tablespace

- Tables
- LOBs
- IOTs
- Materialized Views
- Indexes

Row Movement Enabled
Dependency Maintenance

Indexes are maintained

Triggers are not fired

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How Can I Shrink Segments?

ALTER ... SHRINK SPACE [CASCADE]

- TABLE
- INDEX
- MATERIALIZED VIEW
- MATERIALIZED VIEW LOG

- MODIFY PARTITION
- MODIFY SUBPARTITION
- MODIFY LOB

1. ALTER TABLE employees ENABLE ROW MOVEMENT;
2. ALTER TABLE employees SHRINK SPACE CASCADE;
How Does it Work?

1. `ALTER TABLE employees SHRINK SPACE COMPACT;`

2. `ALTER TABLE employees SHRINK SPACE;`
EM Interface

Oracle Database: melly-pc1:1521:v90111 > Search Result

Search
Select an object type and optionally enter a schema name and an object name to filter the data that is displayed in your results set.

Object Type: Table  |  Schema Name: SCOTT  |  Object Name: %

Table Search Results

Create Like | View Data | Show Dependencies | Generate DDL | Analyze | Reorganize | Create Index | Create Synonym | Create Trigger | Grant Privileges | Shrink Segments
SCOTT BONUS  | SYSTEM
SCOTT DEPT   | SYSTEM
SCOTT EMP    | SYSTEM
SCOTT PIZZA_TABLE | SYSTEM
SCOTT RAR_ABSTRACT_TEST | SYSTEM
Scenario: Reclaim Wasted Space

**Before**

- Check to see which objects in the tablespace have pockets of wasted space due to deletion:
  1. Create a script that looks at DBA_TABLES view to compare the total space allocated for each object (BLOCKS * DB_BLOCK_SIZE) in a tablespace to the estimated space used by the object (AVG_ROW_LEN * NUM_ROWS)
     (assumes objects have been analyzed)
  2. Review script output and identify target objects for reorganization
  3. Identify/Create “scratch” tablespace
  4. For each object to be reorganized, use the Enterprise Manager Reorg wizard to recreate each object along with its dependencies

**Oracle10G**

1. Launch Segment Advisor to advise on which object(s) to shrink
2. Accept the recommendations to shrink the objects online and in-place
Proactive Undo Management
Oracle Database 10g

- Auto-sizing Undo Tablespace
- Auto-tuning Undo Retention
- Proactive Monitoring
- Undo Advisor
Auto-sizing Undo Tablespace

- A self-learning system
  - Create Undo tablesapce with autoextensible files
  - Run your workload
    - Done!

(undo tablespace size adapts to the application)
Auto-tuning Undo Retention

Before

OLTP

DSS

Small RBS/UR = 15 min

Large RBS/UR = 5 hrs

Oracle 10g: Auto-tuning

Tuned UR, seconds

Time

0

2000

4000

6000

Tuned UR

Query Length
Proactive Monitoring: Alerts

- Out of Undo Space Alert
- Long query warning Alert
Undo Advisor

Automatically analyzes the undo usage to advice optimal:

- Undo tablespace size to support your longest running query
- Undo tablespace size for a given undo retention period to support Undo based Flashback toolset
Undo Home: Automatic Advice

Configuration
- Automatic Undo Retention: Enabled
- Undo Retention: Automatis
- Undo Retention Guarantee: No
- Undo Tablespace: undots
- Size (MB): Auto-Extensible: Yes

Recommendations
Choose the time period that best represents the system activity to get the recommendations for undo retention length and undo tablespace size.

- Analysis Time Period: Last Seven Days
- Selected Analysis Time Period: 8/5/03 1:00 PM - 6/12/03 1:00 PM

- Potential Problems: No Problem Found
- Recommendations: No Recommendation

System Activity and Tablespace Usage

- Longest Running Query (seconds): 588
- Average Undo Generation Rate (KB/minute): 0.0
- Maximum Undo Generation Rate (KB/minute): 0.0

Show Graph
Undo Advisor: What if?

Because Automatic Undo Retention is enabled, the undo retention is automatically set by the system. You can disable Automatic Undo Retention by setting an explicit New Undo Retention below and clicking Apply. Use this page to assess the impact of a new undo retention setting. You can change the Analysis Time Period to see different analytical results and recommendations based on system activity for that time period.

**Advisor**
- **New Undo Retention:** 50 minutes
- **Analysis Time Period:** Last Seven Days
- **Selected Analysis Time Period:** 6/5/03 1:00 PM - 6/12/03 1:00 PM

**Analysis**
- Required Tablespace Size for New Undo Retention (MB): 77
- Required Tablespace Size for Current Undo Retention (MB): 10
- Undo Retention to Prevent Snapshot Too Old Error (minutes): 22
- Maximum Undo Retention for Current Tablespace (minutes): 1405

**Recommendations**
- **Undo Retention (minutes):** No Recommendation
- **Required Tablespace Size (MB):** No Recommendation

**Required Tablespace Size by Undo Retention Length**

**Tip:** Clicking a point on the graph will update the New Undo Retention field.
Summary

• Self-management engineered into the core of Oracle Database 10g
• Self-management through:
  – Auto-sizing and size estimation
  – Built-in statistics gathering
  – Server-driven Alerts
  – Automatic Advisers
  – Auto-tuning to adapt to changing workload
  – Integration with the Enterprise Manager
Next Steps....

• **Recommended sessions**
  - The Self-Managing Database : Automatic Health Monitoring (Thursday, Sept. 11, 11 AM)
  - Enterprise Manager : Scalable Oracle Management (Thursday, Sept. 11, 1 PM)

• **Recommended demos and/or hands-on labs**
  - Oracle Database 10g : Manage the Oracle Environment Hands-On Lab

• **Relevant web sites to visit for more information**
Reminder: Please complete the OracleWorld online session survey

Session # 40170

Thank you.