SQL Analysis and Tuning for the Application Express
Developer & DBA
Chaitanya Koratamaddi, Principal Product Manager
Oracle Application Express
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The Typical APEX Environment

- Developers don’t really understand the database
- DBA’s are tasked with correcting APEX applications

“All problems are Oracle Application Express problems until proven otherwise”
The Application Express Taxonomy

- Instance
- Workspaces
- Schemas
- Applications
An APEX Request

Browser → APEX Listener ← Browser

APEX Listener → Session Pool → APEX Listener

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Parsing of SQL

- Physical connection from pool established as APEX_PUBLIC_USER
  - Minimally privileged database user

- An APEX workspace is mapped to one or more database users (schemas)

- These DB users parse the SQL of APEX applications

- SYS.DBMS_SYS_SQL enables the APEX engine to parse SQL as another user
DEMONSTRATION

APEX / SQL Commands

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The “slow” SQL of APEX

\[ f(p \Rightarrow :p) \]

- Top-level entry point of the Application Express engine
- Correlates to the URL: <server:port>/apex/f?p=123

- The Slow SQL reported by Oracle shows in the top-level calls
  - In this case, a page view
The “slow” SQL of APEX

```sql
declare
    rc__ number;
    simple_list__ owa_util.vc_arr;
    complex_list__ owa_util.vc_arr;
begin
    owa.init_cgi_env(:n__, :nm__, :v__);
    htp.HTBUF_LEN := 63;
    null; null;
    simple_list__(1) := 'sys.%';
    simple_list__(2) := 'dbms\%';
    simple_list__(3) := 'util\%';
    simple_list__(4) := 'owa\%';
    simple_list__(5) := 'owa.%';
    simple_list__(6) := 'htf\%';
    simple_list__(7) := 'wpg_docload.%';
    simple_list__(8) := 'ctxsys.%';
    simple_list__(9) := 'mdsys.%';
    if ((owa_match.match_pattern(p_string => 'f' /* */ , p_simple_pattern => simple_list__, p_complex_pattern => <
        rc__ := 2;
    else
        null; null; f(p=>:p);
    if (wpg_docload.is_file_download) then
        rc__ := 1;
        wpg_docload.get_download_file(:doc_info);
        null; null; null;
        commit;
    else
        rc__ := 0; null; null; null; commit;
    end if;
end if;
end;
```
APEX Populates V$SESSION

<table>
<thead>
<tr>
<th>Client</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OS User</td>
<td>oradev2</td>
</tr>
<tr>
<td>Machine</td>
<td>adc6160784</td>
</tr>
<tr>
<td>Terminal</td>
<td>unknown</td>
</tr>
<tr>
<td>Client Information</td>
<td>JOEL:10</td>
</tr>
<tr>
<td>Client Identifier</td>
<td>JOEL:6223639235228</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>SELECT</td>
</tr>
<tr>
<td>Last Call Elapsed Time</td>
<td>0</td>
</tr>
<tr>
<td>Program</td>
<td>JDBC Thin Client</td>
</tr>
<tr>
<td>Module</td>
<td>APEX_040200/APEX:APP 4500:550</td>
</tr>
<tr>
<td>Action</td>
<td>Processes - point: BEFORE_BOX_BO</td>
</tr>
</tbody>
</table>

- Module:  Parsing DB User/APEX:APP Application ID:Page ID
- Client Info:  Authenticated Username:Workspace ID
- Client ID:  Authenticated Username:Session ID

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Find the Resource Hog
apex.oracle.com

- 1,800,919 rows in SYS.DBA_OBJECTS
- 14,075 rows in SYS.DBA_USERS
- 13,419 APEX workspaces
A Slow Application

Display 15 Go

report error:
ORA-00040: active time limit exceeded - call aborted
Tracing

- Tracing must be enabled at instance level (APEX)

![Monitoring](image)

- Debug must be enabled at the APEX application level to trace a page view.
- Run a page view with &p_trace=YES
Tracing

• TKPROF is an Oracle utility that formats SQL trace files
• No graphical interface for TKPROF
• Look in the user dump destination directory on the database server file system.
  - On OFA compliant systems this will be $ORACLE_BASE/admin/$ORACLE_SID/udump

<TraceDemo>
Tracing

- Pay attention to the parsing user_id in tkprof output
- Most APEX tables are named with a WWV_ prefix
- “Bind Peeking” and Adaptive Cursor Sharing:
  - Are available for the SQL of the APEX engine
  - Are not available for user SQL (your application SQL)
Database Time (DB Time)

- Total time in database calls by foreground sessions
- Includes CPU time, IO time and non-idle wait time
- DB Time <> response time

*Database time is total time spent by user processes either actively working or actively waiting in a database call.*
- Active Sessions by wait class over time
- Colored area = amount of DB time
Where to find DB Time?

- **V$SYS_TIME_MODEL, V$SESS_TIME_MODEL**
  - STAT_NAME = ‘DB time’
  - Cumulative database processing time

- **V$SYSMETRIC_HISTORY**
  - “Database Time Per Second”, “CPU Usage Per Sec”
  - 10g units = centi-secs/sec (100xAvg. Active Sessions)
  - 11g new metric “Average Active Sessions”

- **V$SQL**
  - ELAPSED_TIME and CPU_TIME
  - Wait class times:
    APPLICATION, CONCURRENCY, CLUSTER, USER_IO

- **V$ACTIVE_SESSION_HISTORY**
Active Session History (ASH)

• All ‘Active’ sessions captured every second
  – Foregrounds and backgrounds are sampled
  – Active foregrounds contribute to DB Time

• In-memory: V$ACTIVE_SESSION_HISTORY
  – Sampling interval = 1 second

• On-disk: DBA_HIST_ACTIVE_SESS_HISTORY
  – Sampling interval = 10 second

• ASH is a system-wide record of database activity
Active Session History
Automatic Workload Repository

- Collects performance statistics
  - By default, every hour and retained for 7 days
- Active Sessions
- Resource Intensive SQL Statements
- Wait events
- Can establish baseline and compare with current.
Automatic Workload Repository

- DBA_HIST_SNAPSHOT
- Shows top-level numbers about all snapshots in the Workload Repository
DEM O N S T R A T I O N

Active Workload Repository
APEX Views

- The database catalog of everything APEX
- Application definitions, workspaces, logs
- Display all views and columns
  - `select * from apex_dictionary`
- Display all view names
  - `select distinct apex_view_name from apex_dictionary`
- Can be queried via SQL*Plus, SQL Developer or other command-line tools
- Granted APEX_ADMINISTRATOR_ROLE role, can view across entire instance
APEX Views

- APEX_WORKSPACES – all workspaces defined on the instance
- APEX_APPLICATIONS – all APEX applications
- APEX_WORKSPACE_ACTIVITY_LOG – all logged page views
- APEX_WORKSPACE_APEX_USERS – all developers, administrators and end users of a workspace
- APEX_APPLICATION_PAGE_REGIONS – HTML regions, class SQL reports

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APEX Views

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Simple Plan

1. Identify time window
2. Isolate largest consumers of DB Time (sql_id, module)
3. Identify APEX workspaces, applications
4. Correlate SQL with specific location in an APEX application by querying the APEX views
Conclusion

- 98% of the time, the developer-authored SQL & PL/SQL is the culprit
- 1% of the time, the problem is APEX – and it’s a bug
- 1% of the time, it’s something else
- AWR provides a wealth of information about database performance
- Easy to correlate APEX applications to performance issues
Questions & Answers