Beginning Performance Tuning

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(and a beginner, always)

Agenda

- What this is about?
  - You noticed some degradation of performance
  - What should you do next?
  - Where to start
  - What tool to use
  - How to understand the root issue
- Tools
  - Nothing to buy
  - SQL*Plus and internal Oracle supplied utilities
    - May be extra-cost

Why Most Troubleshooting Fails

- Not systematic or methodical
- Not looking at the right places
- Confusing Symptoms with Causes

Principle #1

Measure your challenge

Three approaches

Time Accounting

What *happened*

e.g. a block was retrieved, 16 blocks were retrieved, no rows were returned, etc.

how much *time* was spent on each

Wait Accounting

What is the session *waiting* on

e.g. wait for a block to be available.

How much time it has waited already, or waited in the past

Resource Accounting

What types of resources were consumed

e.g. latches, logical I/Os, redo blocks, etc.

What's a Wait?

U Doing something useful

W Waiting for something it needs

I Waiting for work to be given

Wait Interface

- The information is available in V$SESSION
  - Was in V$SESSION_WAIT in pre-10g

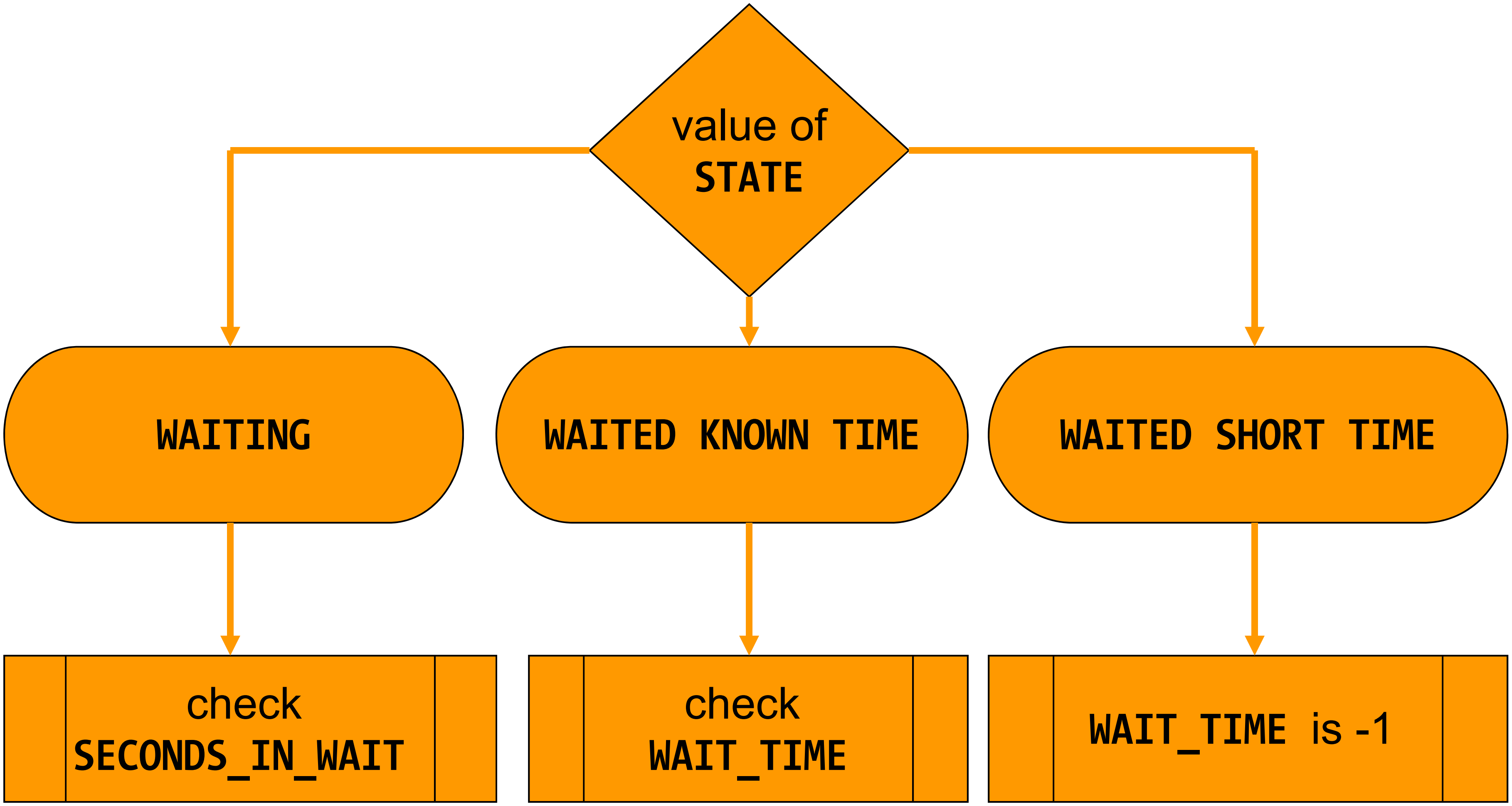
```
select sid, EVENT, state, wait_time,
seconds_in_wait
from v$session
```

- **event** shows the event being waited on
  - However, it's not really only for "waits"
  - It's also for activities such as CPU

Wait Times

- SECONDS_IN_WAIT shows the waits right now
- WAIT_TIME shows the last wait time
- STATE shows what is the session doing now
  - WAITING – the session is waiting on that event *right* now
    - The amount of time it has been waiting so far is shown under SECONDS_IN_WAIT
    - The column WAIT_TIME is not relevant
  - WAITED KNOWN TIME – the session waited for some time on that event, but not just now
    - The amount of time it had waited is shown under WAIT_TIME
  - WAITED SHORT TIME – the session waited for some time on that event, but it was too short to be recorded
    - WAIT_TIME shows -1

Wait Time Accounting



Common Waits

- `db file sequential read`
  - Session waiting for an I/O to be complete
- `enq: TX - row lock contention`
  - Session wants a lock held by a different session
- `log file sync`
  - Session waiting for log buffer to be flushed to redo log file
- `latch free`
  - Session is waiting for some latch
- `SQL*Net message from client`
  - Session waiting for work to be given

```
select sid, state, event,
       seconds_in_wait  waiting,
       wait_time/100    waited
from v$session
where event not in
(
  'SQL*Net message from client',
  'SQL*Net message to client',
  'rdbms ipc message'
)
and state = 'WAITING'
and username not in ('SYS','SYSTEM','SYSMAN','DBSNMP')
```

wait1.sql

Locking Waits

- Find out which session is locking this record

```
select
   blocking_session, blocking_instance,
   seconds_in_wait
from v$session
where sid = <sid>
```

- Find out who is holding the lock

block1.sql

V$SESSION Columns

- SID – the SID
- SERIAL# - Serial# of the session
- MACHINE – the client that created the session
- TERMINAL – terminal of the client
- PROGRAM – the client program, e.g. TOAD.EXE
- STATUS – Active/Inactive
- SQL_ID – the SQL_ID
- PREV_SQL_ID – the previous SQL

sess1.sql

Getting the SQL

- You can get the SQL from V$SQL

```
select sql_text, sql_fulltext
from v$sql
where sql_id = <sqlid>
and child_number = <child#>
```

- Full Text

```
select SQL_TEXT
from v$sqltext
where sql_id = <sqlid>
order by piece
```

sql1.sql

Row Information

- Information on exact row locked

```
select
   object_type,
   owner||'.'||object_name||':'||
      nvl(subobject_name,'-') obj_name,
   dbms_rowid.rowid_create (
           1,
           row_wait_obj#,
           row_wait_file#,
           row_wait_block#,
           row_wait_row#
   ) row_id
from v$session s, dba_objects o
where sid = &sid
and o.data_object_id = s.row_wait_obj#
```

lock1.sql
row1.sql

High CPU

- From OS `top` or similar commands find out the process ID
- Find out the session for that process

```
select sid, s.username, status, machine, state,
  seconds_in_wait, sql_id
from v$session s, v$process p
where p.spid = &spid
and s.paddr = p.addr;
```

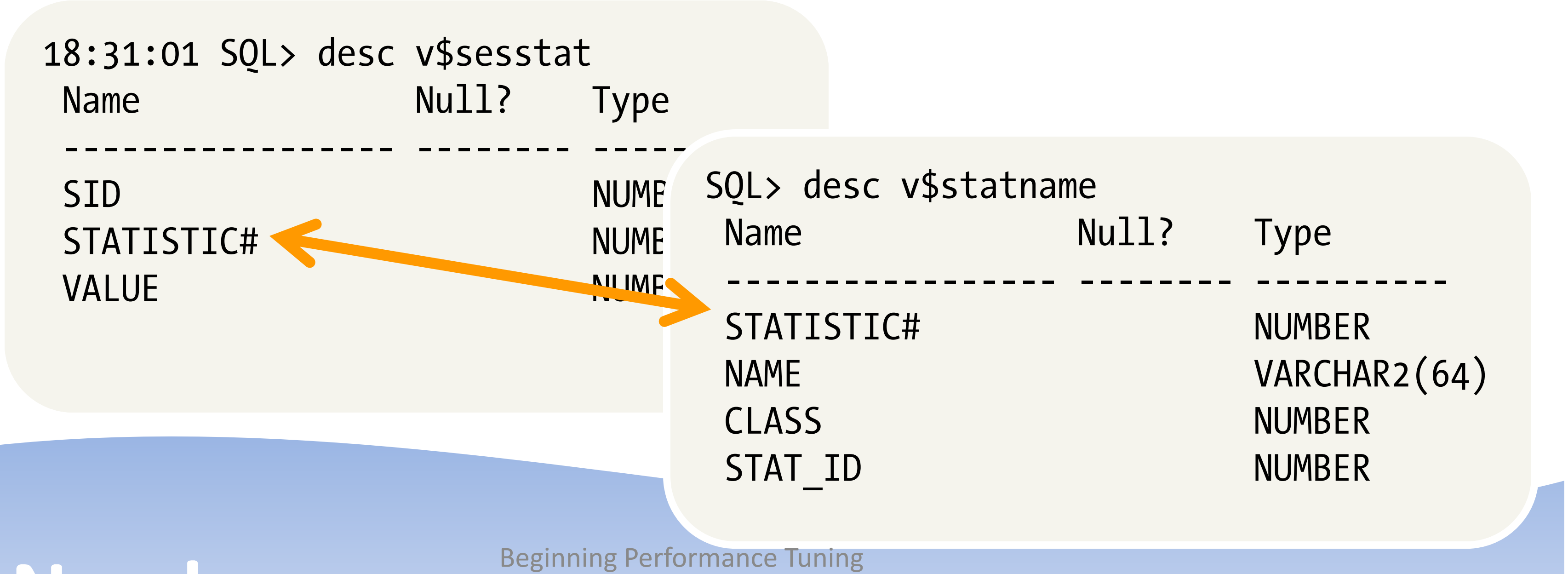
spid1.sql

Stats of a Session

- How much CPU the session has consumed
- How much of the came from the session
- View: V$SESSTAT

Understanding Statistics

- V$SESSTAT shows the information except the name, which is shown in V$STATNAME
- V$MYSTAT shows the stats for the current session only



```
18:31:01 SQL> desc v$sesstat
 Name                     Null?    Type
 ------------------------ -------- -----
 SID                               NUMB
 STATISTIC#                        NUMB
 VALUE                             NUMB
```

```
SQL> desc v$statname
 Name                     Null?    Type
 ------------------------ -------- ----------
 STATISTIC#                        NUMBER
 NAME                              VARCHAR2(64)
 CLASS                             NUMBER
 STAT_ID                           NUMBER
```

Use of Session Stats

- Find out how much CPU was consumed already

```
select name, value
from v$sesstat s, v$statname n
where s.statistic# = n.statistic#
and upper(name) like '%CPU%'
and sid = <SID>;
```

- Some stats:

```
session logical reads
CPU used by this session
parse time cpu
```

stat1.sql
stat2.sql

Other Session Times

- LAST_CALL_ET – when the last SQL call was issued
- Check

```
select state, status, seconds_in_wait, wait_time*100
last_wait, last_call_et
from v$session
where sid = 368
```

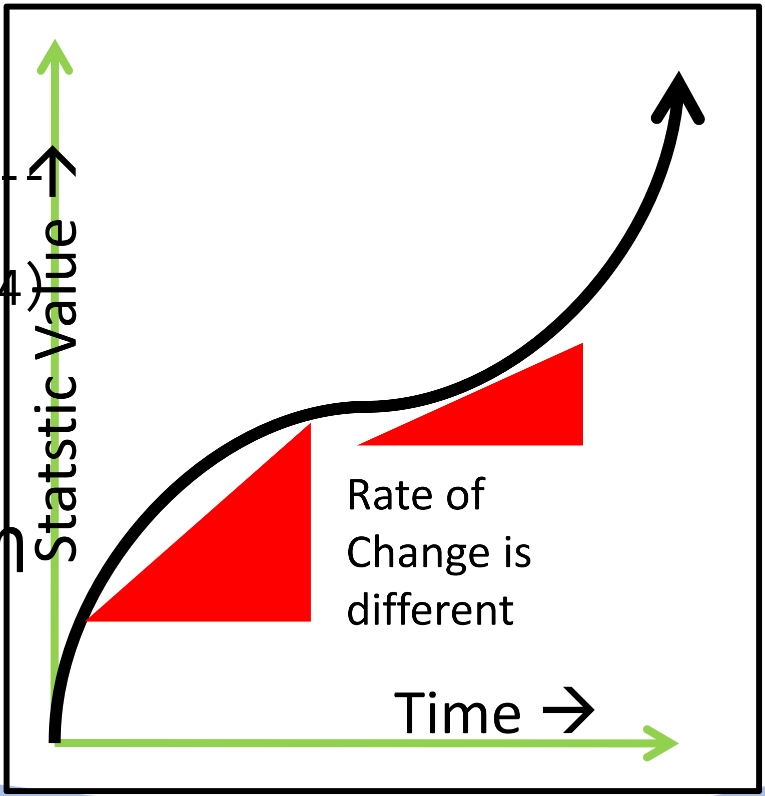
last1.sql

System Statistics

- Similar to events, there is also another view for system level stats - V$SYSSTAT

```
SQL> desc v$sysstat
 Name              Null?    Type
 ----------------- -------- ------------
 STATISTIC#                 NUMBER
 NAME                       VARCHAR2(64)
 CLASS                      NUMBER
 VALUE                      NUMBER
 STAT_ID                    NUMBER
```

- Note there is a NAME column
- This is a cumulative value



Session Events

- What waits the session *has encountered* so far?
- View V$SESSION_EVENT

V$EVENT_NAME has the event details joined on EVENT# column

```
SQL> desc v$session_event
 Name                  Null?    Type
 ----------------- -------- ------------
 SID                        NUMBER       → Session ID
 EVENT                      VARCHAR2(64) → The wait event, e.g. “library cache lock”
 TOTAL_WAITS                NUMBER       → total number of times this session has waited
 TOTAL_TIMEOUTS             NUMBER       → total no. of times timeouts occurred for this
 TIME_WAITED                NUMBER       → the total time (in 100th of sec) waited
 AVERAGE_WAIT               NUMBER       → the average wait per wait
 MAX_WAIT                   NUMBER       → the maximum for that event
 TIME_WAITED_MICRO          NUMBER       → same as time_waited; but in micro seconds
 EVENT_ID                   NUMBER       → the event ID of the event
 WAIT_CLASS_ID              NUMBER       → the class of the waits
 WAIT_CLASS#                NUMBER
 WAIT_CLASS                 VARCHAR2(64)
```

event1.sql

Session Event

- Query

```
select event, total_waits, total_timeouts,
 10*time_waited, 10*average_wait, 10*max_wait
from v$session_event where sid = <SID>
```

- Result

```
EVENT                          TOTAL_WAITS TOTAL_TIMEOUTS 10*TIME_WAITED 10*AVERAGE_WAIT 10*MAX_WAIT
------------------------------ ----------- -------------- -------------- --------------- -----------
db file sequential read                  5              0             30             5.9          10
gc cr grant 2-way                        2              0              0             1.3           0
row cache lock                           1              0              0             1.3           0
library cache pin                        5              0             10             1.2           0
library cache lock                      23              0             20              .8           0
SQL*Net message to client               46              0              0               0           0
SQL*Net more data to client              3              0              0               0           0
SQL*Net message from client             45              0         325100          7224.3       83050
```

- 10 was multiplied to convert the times to milliseconds

System Event

- The V$SYSTEM_EVENT view shows the same waits for the entire instance

```
select event, total_waits, total_timeouts, 10*time_waited, 10*average_wait
from v$system_event
where event like 'gc%‘
```

```
EVENT                                    TOTAL_WAITS TOTAL_TIMEOUTS 10*TIME_WAITED 10*AVERAGE_WAIT
---------------------------------------- ----------- -------------- -------------- ---------------
gcs remote message                        3744149220     3391378512     1.2595E+10             3.4
gc buffer busy                               2832149          14048       23739030             8.4
gc cr multi block request                   62607541         120749       32769490              .5
gc current multi block request               2434606             57         775560              .3
gc cr block 2-way                          128246261          19168       77706850              .6
gc cr block 3-way                          126605477          22339      124231140               1
….
```

Last 10 Waits

- View V$SESSION_WAIT_HISTORY
- Shows last 10 waits for active sessions

Active Session History

- Captures the state of all active sessions in memory
- Visible through V$ACTIVE_SESSION_HISTORY
  - Part of diagnostic and tuning pack. extra cost
- Held for 30 minutes
- Then stored in AWR: DBA_HIST_ACTIVE_SESSION_HIST

Tracing

- DBMS_MONITOR

```
begin
    dbms_monitor.session_trace_enable(
        session_id => &sid,
        serial_num => &serial,
        waits => TRUE,
        binds => TRUE
    );
end;
```

Analyze Tracefile

- TKPROF is the tool

```
$ tkprof u/p <inputfile> <outputfile>
```

<*Outputfile*> is a text file

Summary

- Find out what is the immediate symptom – CPU, I/O running high or a specific session is slow
- Find out who is consuming the most of the resource
- If a specific session is slow, find out what it is waiting on
- Get more information on the session
  - what all the session has been waiting on, what resources it has consumed so far, etc
- Trace to get a timeline of events.

Thank You!

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