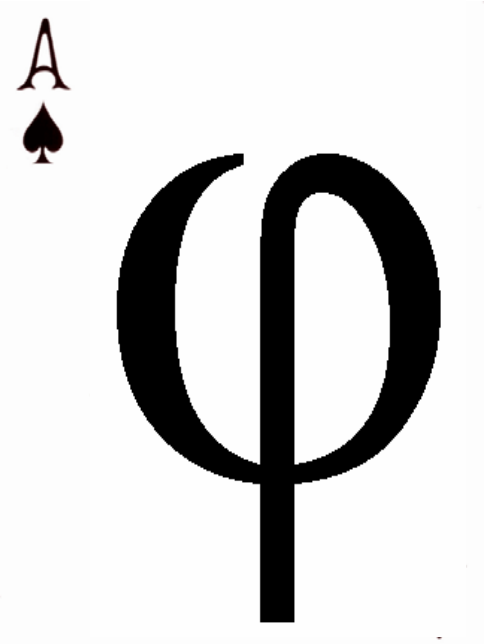
Still using Ratios

(But I think I know what I am doing)

Piet de Visser

The Simple Oracle DBA



Keywords: Ratios, Capacity, Performance, mostly OLTP.
Also: Simplicity.

Agenda (45 minutes)

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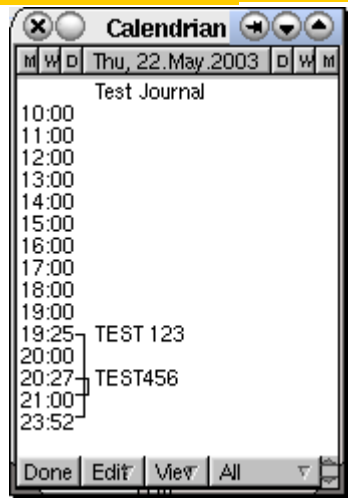
SOLUTIONS THAT MATTER



It is about Efficiency, OLTP (Hah …)

Efficiency, Concurrency, Scalability…

- **High Result per unit of work (a ratio...)**
- **Little effort per task (a ratio…)**

Some Numbers (Do try this at home)

- **Will go from detail to general.**

Discussion (Do Challenge!)

Background - Requirements

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- 40M “documents“, 500+ users
  - Can we process inside a month ?
  - Every month ? With less resources ?
- 1800 msgs/sec
  - Can it run on given hardware ?
  - Can it run on “Any hardware” ?
- 25M transactions per hr, in <4 hrs.
  - only on 1st Mondays (or exceptional days) - scary
  - (7000 t/sec => 7 t/ms @10ms/t that is 70 CPUs)

Background – the jargon…

- **Keywords:**
  - **Performance** (speedy response)
  - **Capacity** (do we have enough …)
  - **Concurrency** (can we run all … at once)
  - **Scalability** (what if workload triples …)
- **Can limited tests predict these…?**
- **Rarely, but we can try…**

Scalability = Efficiency and Concurrency. Capacity and performance are strongly related.
(ps: I have colleagues who "predict" with much more confidence!)

What not…. (old ratios from 1995)

- **BCHR - logical vs physical IO**
  - **<90% => need more cache**
- **Scan Ration - Index vs table-scans**
  - **> 1% => need more indexes**
- **Parse ratio – (dynamic) sql**
  - **>1% => increase shared_pool**
- **Sort Ratio (memory vs disk)**
  - **>10% => increase sort_area_size…**

- **Number, counters, mostly Since startup.**
- **Aggregates !**
- **No direct relation with one particular task/problem.**

Some of the old ones – Millsap, Lewis and others have explained at length why they don't work.
Note: a good BCHR on a test will not guarantee good, consistent behaviour in production.

AWR has some ratios ….

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	Per Second	
Redo size:	629,039.51	663.37
Logical reads:	120,99	,474.09
Block changes:		43.47

Top 5 Timed Events

Event	Waits	Ti	Call Time	Wait Class
CPU time			58.9	
db file sequential read			18.7	User I/O
log file sync		6	18.7	Commit
log file para		3	17.3	System I/O
db file		12	5.8	System I/O

Tra	82.08

And … Is your Customer Happy ?

Does it relate to relevant work ?

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The numbers at the top will give some impression, but will generally not pinpoint the problems yet. Serious Performance nowadays is about measuring time and resources, the top-5 AWR and the MilliSeconds….!

Basics: what do we need to do….

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- Requirements (and not all system are “Xtreme”)
- Database (Tables & Indexes)
  - ACID
  - 12 + 1 rules of Codd and Date
- Application (someone will dream up code...)
- SQL: Store, Retrieve, Manipulate DATA ….
  - Fast enough to serve customer requirement.
  - Within reasonable hardware (and licen$$$)

My hobbyhorse: Fast - and Scaleable

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- **Individual actions; must be efficient**
  - **C reate / Insert (1x)**
  - **R ead / Queries (Nx, which fields, why?)**
  - **U pdate (Nx, which fields ?)**
  - **D elete (1x, bulk/del old data?)**
  - **…. Efficient ? … SQL and Indexes !**

- **Concurrent actions; must remain efficient**
  - **Limit locks (no blocking of others)**
  - **No unusable indexes (exhange part..!)**
  - **No hot-blocks (buffer busy waits).**

Start at detail: SQL – how much work…

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- What generates my (DB) workload ?
  - SQL, the statements that tell the DB what to do!
  - Do you recognize the qries in the awrrpt ?
  - (e.g. are you looking at the right report)

- From Statspack / AWR / V_$SQL / Traces
  - What Time (ela, cpu) does a stmnt take (aggregated!)
  - How much Work does a stmnt do (gets, rows-processed)
  - What job, what Unit of work was done ?
  - Is that Reasonable … ? (fast? scaleable?)

- (Expected) Frequency and “workload” for a qry ?

Most, if not all DB activity stems from SQL statements. So that is where I start.
And statspack, AWR, V_$SQL or 10046 are all excellent instruments.

Details: AWR, V$SQL or WRH$

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SQL ordered by Gets

- Resources reported for PL/SQL code includ
- Total Buffer Gets: 32,612,884
- Captured SQL account for 91.2% of Total

Buffer Gets	Executions	Gets per Exec	%
32,570,957	1,363	23,896.52	
1,851,387	1,765	1,048.94	
1,828,401	1,765	1,035.92	
1,764,845	1,765	999.91	
1,648,859	1,765	934.20	
1,352,149	1,765	766.09	
1,245,977	1,765	705.94	

SQL ordered by Executions

- Total Executions: 548,950
- Captured SQL account for 54.7% of Total

Executions	Rows Processed	Rows per Exec	Cl
77,294	77,294	1.00	
72,676	0	0.00	
60,498	60,498	1.00	
28,658	28,658	1.00	
10,330	10,330	1.00	
1,765	1,765	1.00	
1,765	1,765	1.00	
1,765	1,765	1.00	
1,765	1,765	1.00	
1,765	1,765	1.00	

```
SQL > Select buffer_gets, executions, rows_processed
From V$SQL where … order by … ;
```

Ratios per Statement (just mine…)

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- **Gets / Row** **<10**
  - **Realistically, any data is accessed via Index!**
- **Gets / Execute :** **<100**
  - **How much work (CPU, IO) will it take.**
  - **For a million rows, allow some more work…**
  - **But: be careful if executed at high-frequency.**
- **Gets / Transaction** **<1000**
  - **Why? Efficiency! And Limit the time of locking.**
  - **Problem: more difficult to measure in detail.**

Ratio to find Locking…

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- **Special case: TX-enqueue waits.**
  - **Table / Segment can be found from segment-stats**
  - **Which Stmnt ?… use a ratio!**

- **CPU-time / Elapsed time (percentage) >50 %**
  - **Notably: looking for Concurrency or IO problems**
  - **Also : if it waits for anything but CPU**
  - **(buff-busy, log-file-sync, log-file-par-wrt)**

- **To fix locks: often means talking to Arch and Dev…**
  - **Start transaction at latest possible moment.**
  - **Avoid running totals and similar constructs if possible.**

Fixes, if needed…

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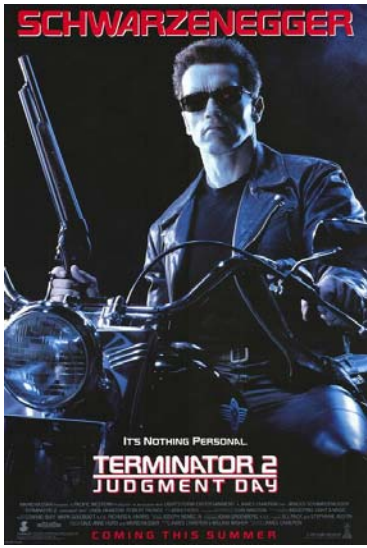
- "Elimination": don't run the stmnt.
  - Best option!
- "Optimization": make it faster.
  - Realistic option (hopefully)
- "Containment" : run the stmnt less frequent.
  - (= Worst option; It Will Be Back!
- Do-Nothing:
  - If you are confident about workload and hardware….



If and How to fix will depend on your situation, but you basically have those options.
And nowadays, a lot of problems get "killed by Iron". Capacity is becoming cheaper all the time.

Before we Continue…

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- Warning : Ratios are Still BAD
- In All Cases, PLEASE understand the LIMITATIONS.
- Most ratios are Aggregates – not Individuals
- Skew
- What if 1 execute cause the average to go Off the Scale ?
  - "…where status=:1" using c_archived;

- Mitigation:
  - Know your system and your Data!
  - Small intervals (avg over small N).
  - Careful (re)testing.

Zoom out… : why all that SQL again ?

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- System processes “units” - find the unit.
  - Documents, Messages, Services, SOA…,
  - Orders, Clearings, Bookings
  - whatever (there will be an app for that…)

- Run “unit tests” of 1, 10, 100, … n “units”
- How much does 1 “unit” take ?
- How many units we need (per second? per hr? per day?)

- Anecdote:
  - Required: 1800 msg/sec, 9 very basic msgs, <2 sec/msg.
  - Tested: 17 msg/sec, 2 node RAC, 8 cores each – CPUs @ 85+%

Zoom out… : does my app scale ?

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- Dig in: how much “Work” is done per unit:
  - Executes / unit (what SQL, at what frequency)
  - Gets / unit (how much LIO, PIO)
  - Round-trips / unit (network and conn-pool sizing!)

- SNAP$, WRH$, 10046, even V_$SQLwill tell you
  - “snap” the stmnts on a unit-test or volume-test.
  - (and verify they are “from the unit”)
- Determine if workload will “realistically scale”
- Proposed Fix: don’t do 300 SQLs (round-trips!) per msg.

Zoom out… : my numbers (YMMV)

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- **Round-trips / unit (how to count ?) <1**
  - **RT: Expensive & risky, too many components**
- **Executes / unit <100**
  - **Minimize stmnts per "unit"**
- **Gets / unit <1000**
  - **LIO(and PIO) take up CPU- and Cache-capacity**

- **Yours will be Higher, but "knowing" will help you Think!**
- **(and on some system you can just add Iron…)**

Sumary, Advice.. (hardest slides) 1/3

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- Know the limitations of “ratios” !

- When diving into details:
  - Ratios ~ load per statement, per transacti

- Gets / Row <10
- Gets / Exe <100
- Gets / Transaction <1000

Sumary, Advice… 2/3

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- At higher level:
  - Ratio ~ Load per Unit (per msg, per screen, …)

- Round Trips / Unit <=1
- Executes / Unit <100
- Gets / Unit <1000

- (did I mention the Limitations…?)

If time, my wishlist: 1) Redo per stmnt, redo-per-unit, would be nice to get redo from statspack and 2) roundtrips. Some easy way to count round-trips (from statspack).

Sumary, Advice… 3/3

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- **Troubleshooting:**
  - **Find the heavy units (and fix)**
- **Testing:**
  - **Guesstimate workload**
  - **Decide if “accaptable”, or how to fix**
- **Planning:**
  - **Assess capacity (and keep some slack)**
- **Try it! - and Tell us about it.**

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Remember the fixes: “Eliminate”, “Optimize”, “Contain” or “Ignore”
… or get more hardware (and did I mention the limitation of “ratios” ?)

Don’t Take my word for it…

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Tahiti.oracle.com: start with concept-guides

Technet (but be critical)

Oracle-L : real world stuff

www . Bloggingaboutoracle . org (company ramblings)

SimpleOracleDba . Blogspot . com (my ramblings)

Do some testing yourself …

Goethe (simplicity, limitations…)

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Quick Q & A (3 min ;-) 3 .. 2 .. 1 .. Zero

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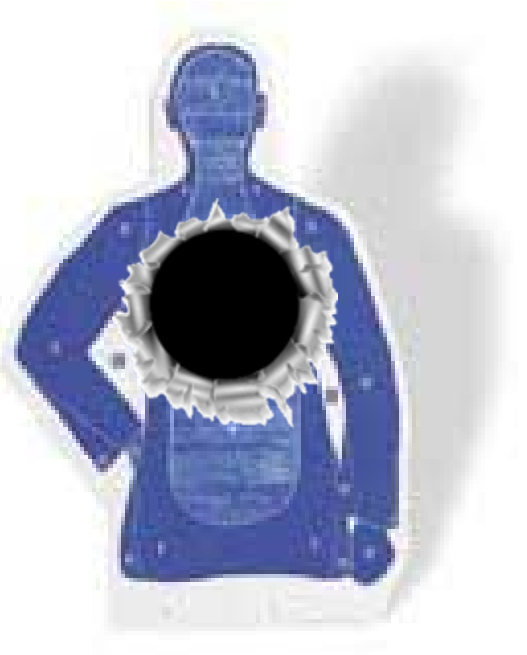
- **Questions ?**
- **Reactions ?**
- **Experiences from the audience ?**



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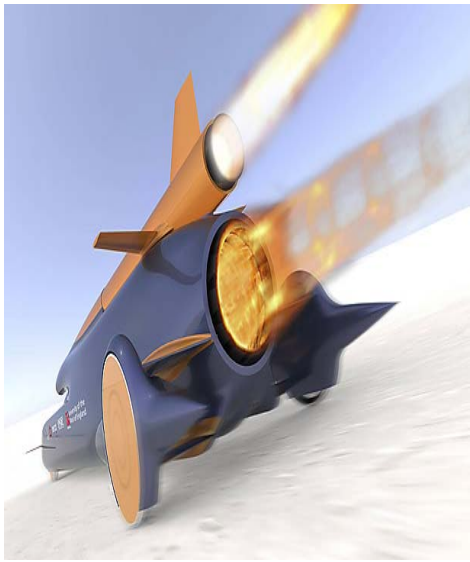
Here…

- **Placeholder slide to indicate ….**

Clusters often seem promising, but the “size” estimate requires predictable data.
Willing to learn on this one! Someone do a ppt on this next Conference ? (demo_sthc.sql if time)

But… As soon as the where-clause gets out of the “comfort zone”,
The STHC reverts to conventional behaviour, or worse.

Storage-wise, and STHC resembles a HEAP, but it is not supposed to “grow”
And why would I need the PK…



Inconclusive. Modern hardware has moved the bottleneck from CPU to Disk.
Check the system stats on old versus new systems: CPUs are sooo much faster, IO can hardly keep up.