# A Day of Real-World Performance

Andrew Holdsworth, Tom Kyte, Graham Wood





# **Program Agenda**

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- Introductions
- OLTP
- Coffee



- Analyzing SQL
- Lunch



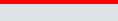
- Data Warehousing
- Coffee

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Star Schemas

Breaks at
 -10:30-11:00
 -12:30-13:30
 -15:00-15:30





# Introductions









# Introductions Andrew Holdsworth

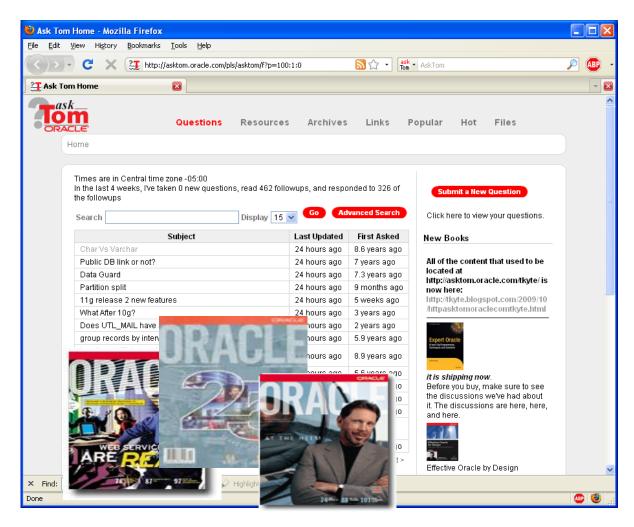
- 25 Years at Oracle
- Vice President Real World Performance
  - Good performance is rarely an accident
  - Most people get the systems they deserve
  - Good enough rarely is, aspire for excellence not good enough.







# Tom Kyte



- Been with Oracle since 1993
- User of Oracle since 1987
- The "Tom" behind AskTom in Oracle Magazine

www.oracle.com/oramag

- Expert Oracle Database Architecture
- Effective Oracle by Design
- Expert One on One Oracle
- Beginning Oracle

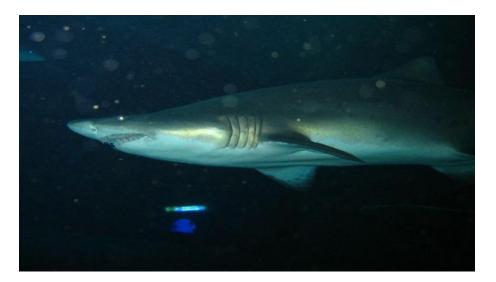




# Graham Wood Architect Server Technologies



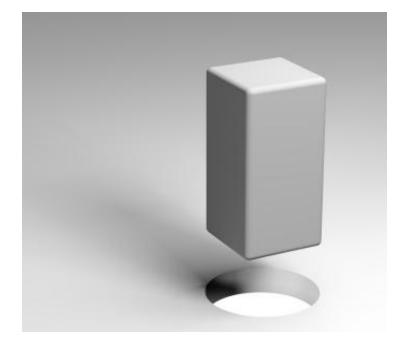








## **Real-World Performance Root Causes**



The database is not being used as it was designed to be used

The application architecture/code design is suboptimal



There is a sub optimal algorithm in the database





# To Fix Root Causes Requires CHANGE





# **CHANGE** is scary and somebody will always get upset





# Are you willing to be an agent of CHANGE ?





# How Does Your Organization Do Performance ?

- Conventional
  - Focus is on "Good Enough" or "What the Business Needs"
  - Process Orientated/Part of QA
  - Spends most the time on Platform Tuning Issues
  - Only changes things within limited scope
  - Bottom up tuning approach
  - Looking for incremental gains

## Real-World

- Focus on excellence and what the HW and SW can do
- Innovate excellent performance and add intellectual property to your code
- Everything is within scope
- Holistic top down approach
- Focus on orders of magnitude gains



# Real-World Performance OLTP





OUG

# Agenda

- **1** Computer Science Basics
- 2 Schema Types and Database Design
- 3 Database Interface
- 4 DB Deployment and Access Options
- 5 Application Algorithms
- 6 Resource Management





# Agenda

- **1** Computer Science Basics
- 2 Schema Types and Database Design
- <sup>3</sup> Database Interface
- A DB Deployment and Access Options
- 5 Application Algorithms
- Resource Management

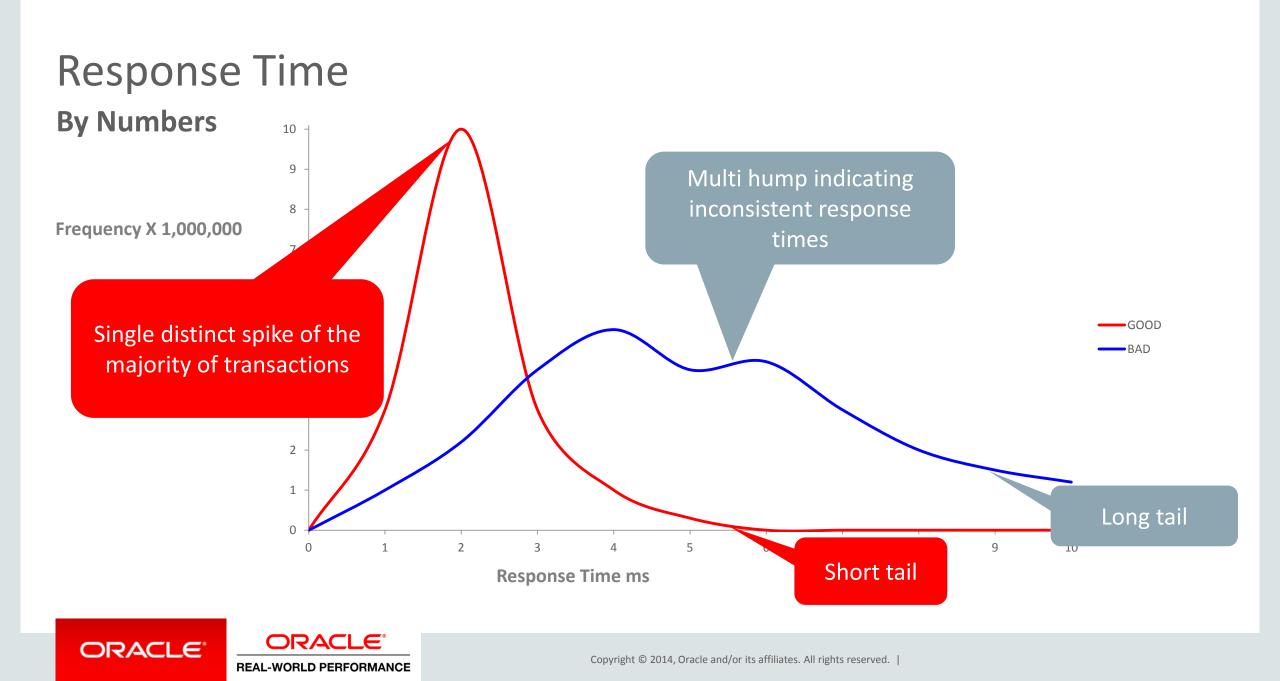




# Response Time What it means

- Response time defines your users (customers) experience
- Response time is a measure of performance quality
- Consistency of response time is an equally important measure of performance quality
- If response time is not consistent, bad things happen !





# Response Time - Demo Observations

- Users experiencing poor response time
- Low overall system throughput
- Wait events observed in the database
- Culture of blame:
  - Blame the database for all performance issues
  - Development blames the DBA
  - The DBA blames the SW/HW or system administrators





## Response Time Performance Data





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## Response Time Application Server Performance Data





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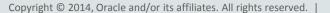
## Response Time Resolution

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## Response Time Application Server Bottleneck

- Data analysis shows:
  - Small proportion of the actual response time is in the database
  - Majority of response time spent in application logic
  - CPU is overloaded on the application servers
  - Potential root cause:
    - Capacity planning mistake ?
    - Application code change last week ?



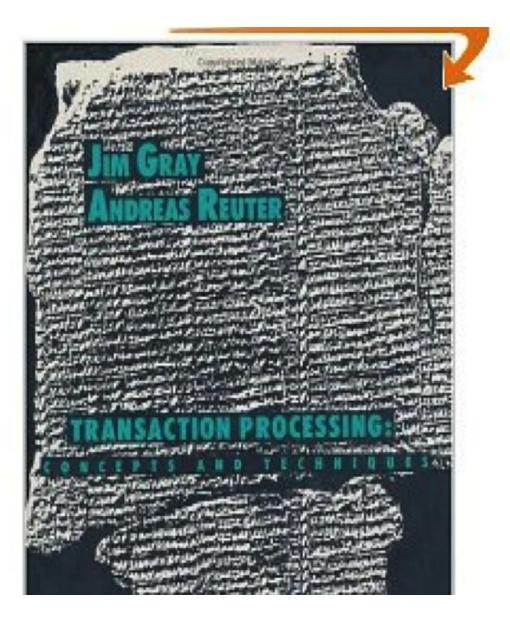
# High Performance Applications The Challenge

- The impact of how application code impacts system performance should never be underestimated
  - This fact has been known for a long time
  - It has been ignored for almost as long
- Education of developers on the correct way to write code is a continuous, repeating activity
  - New developers graduate every year!
- Poor coding techniques combined with classic programmer bugs can render investments in the system worthless





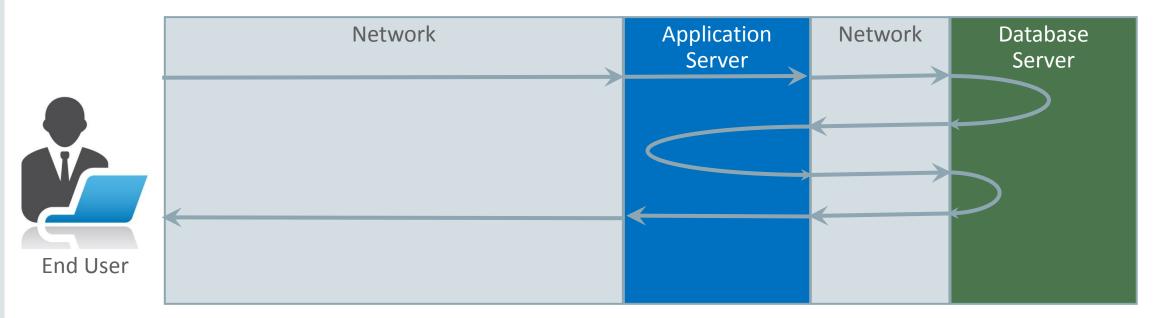
# Some Computer Science Basics

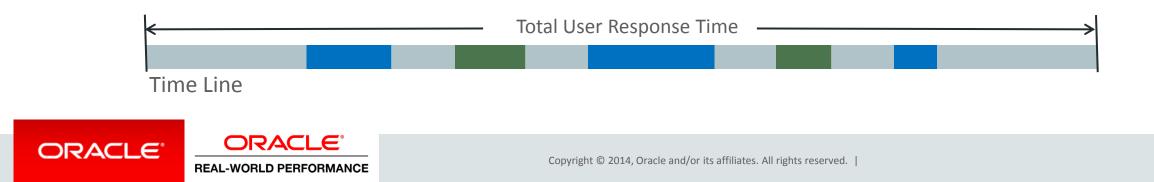






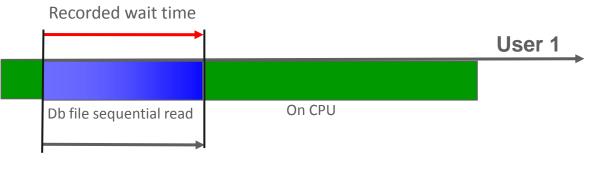
# Response Time v DB Time v Latency





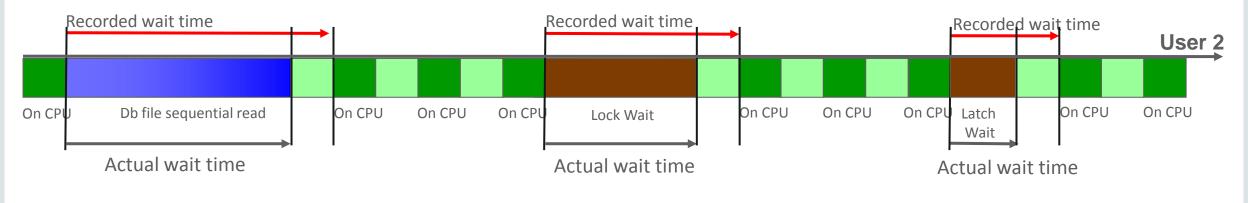
# Database Time – Total time spent in database

#### ON IDLE SYSTEM



Actual wait time

#### ON DEGRADED SYSTEM





# Latency - Some Important Numbers Best Block Access Speeds

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Access Time
~ 1 nano sec ( 10 <sup>-9</sup> )
~ 1 micro sec ( 10 <sup>-6</sup> )
~ 10 micro sec ( 10 <sup>-6</sup> )
~ 0.01 milli sec ( 10 <sup>-3</sup> )
~ 0.1 milli sec ( 10 <sup>-3</sup> )
~ 1-10 milli sec ( 10 <sup>-3</sup> )

# Database Performance Core Principles

- The Oracle database is a process based architecture and to perform efficiently each process requires:
  - To be efficiently scheduled by the O/S until the process completes the SQL statement, or blocks on an operation required to complete the SQL statement e.g. Disk I/O
  - If the process has to fight to get scheduled, or needs to be scheduled for an over extended period of time due to SQL inefficiencies, or any blocking operation takes a long time, then database performance will be poor
- Database performance engineers spend most of their time looking for CPUconsuming processes and eliminating blocking events





# Database Performance Core Principles

- To determine acceptable CPU utilization take a probabilistic approach to the subject.
  - If a CPU is 50% busy the chance of getting scheduled is 1 in 2
  - If a CPU is 66% busy the chance of getting scheduled is 1 in 3
  - If a CPU is 80% busy the chance of getting scheduled is 1 in 5
  - If a CPU is 90% busy the chance of getting scheduled is 1 in10
- If the probabilities are used as indicator of the predictability of user response time, then the variance in user response time becomes noticeable at about 60-65%
- This has been observed in production and laboratory conditions for many years.

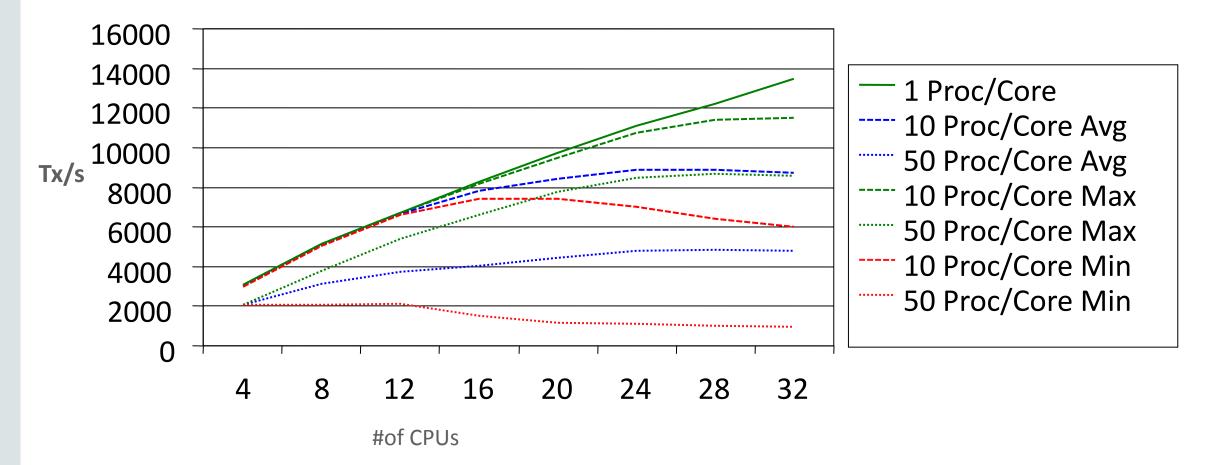




## Database Core Principles Impact of Too Many Processes

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# **Connection Pooling**

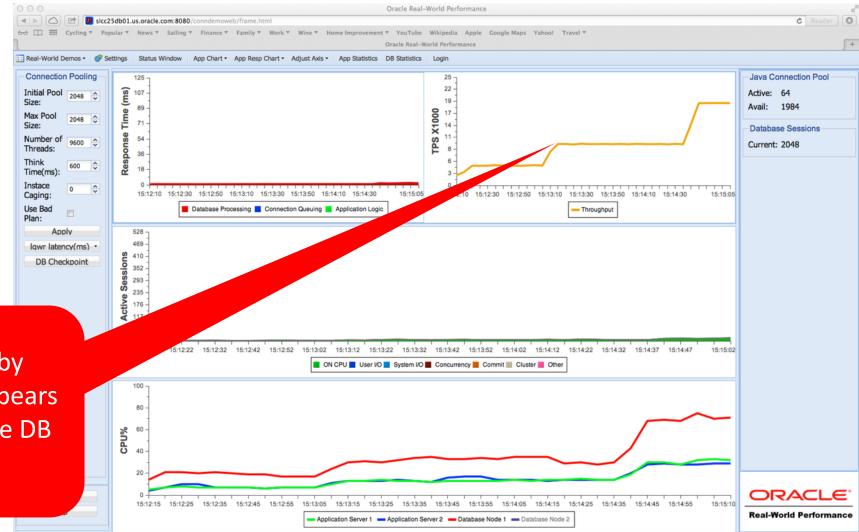












The workload is increased by doubling the load. System appears scalable up to 60% CPU on the DB server.







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#### **Performance Data**

B slcc25db01.us.oracle.com:8080/conndemoweb/frame.htm C Reader 0 6-0 1 W Cycling \* Popular \* News \* Sailing \* Finance \* Family \* Work \* Wine \* Home Improvement \* YouTube Wikipedia Apple Google Maps Yahoo! Travel Oracle Real-World Performance 😰 Real-World Demos 🗸 🧬 Settings 🛛 Status Window 🛛 App Chart 🗸 App Resp Chart 🗸 Adjust Axis 🗸 App Statistics DB Statistics Login Connection Pooling Java Connection Pool 134 25 22 Initial Pool Active: 1211 2048 Size: Avail: 837 **PS X1000** Max Pool 2048 Size: **Database Sessions** Number of 9600 Current: 2048 Threads: Think 550 Time(ms): Instace \$ 0 15:15:25 15:15:45 15:16:05 15:16:26 15:16:46 15:17:06 15:17:26 15:17:46 15:18:21 15:15:25 15:15:45 15:16:05 15:16:26 15:16:46 15:17:06 15:17:26 15:17:46 15:18:21 Caging: Use Bad Database Processing Connection Queuing Application Logic Throughput 0 Plan: Apply 528 469 lowr latency(ms) . **2** 410 Checkpoint sior 352 293 15:15:32 15:15:42 15:16:00 15:16:05 15:16:15 15:16:25 15:16:35 15:16:45 15:16:55 15:17:05 15:17:15 15:17:20 15:17:30 15:17:30 15:17:30 15:17:30 15:17:30 ON CPU 📕 User I/O 📕 System I/O 📕 Concurrency 📕 Commit 📗 Cluster 📕 Other 100 80 CPU% 60 20 ORACLE eset 15:15:30 15:15:40 15:15:50 15:16:00 15:16:10 15:16:20 15:16:30 15:16:40 15:16:50 15:17:00 15:17:10 15:17:20 15:17:30 15:17:40 15:17:50 15:18:00 15:18:10 15:18:25 Stop **Real-World Performance** Application Server 1 Application Server 2 Database Node 1 Database Node 2

Oracle Real-World Performance

A slight increase to the workload results in a disproportionate CPU increase and response time degrades. System monitoring tools become unreliable









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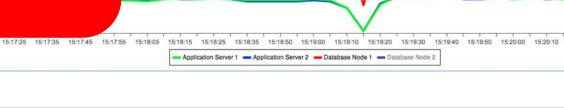
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15:20:25

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**Real-World Performance** 

Reducing the connection pool by 50% results in more application server queuing and less DB processes in a wait state. No observable improvement in response time or transaction rate (value or consistency)



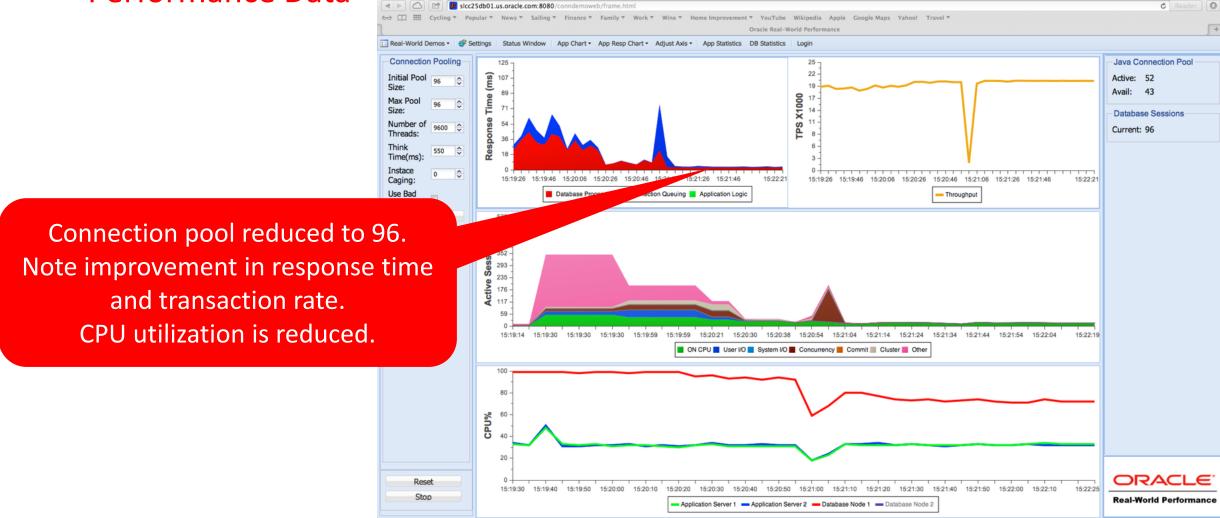
📕 ON CPU 📕 User I/O 📕 System I/O 📕 Concurrency 📕 Commit 📗 Cluster 📕 Other





Stop

#### **Performance Data**



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Oracle Real-World Performance

# **Resource Management**

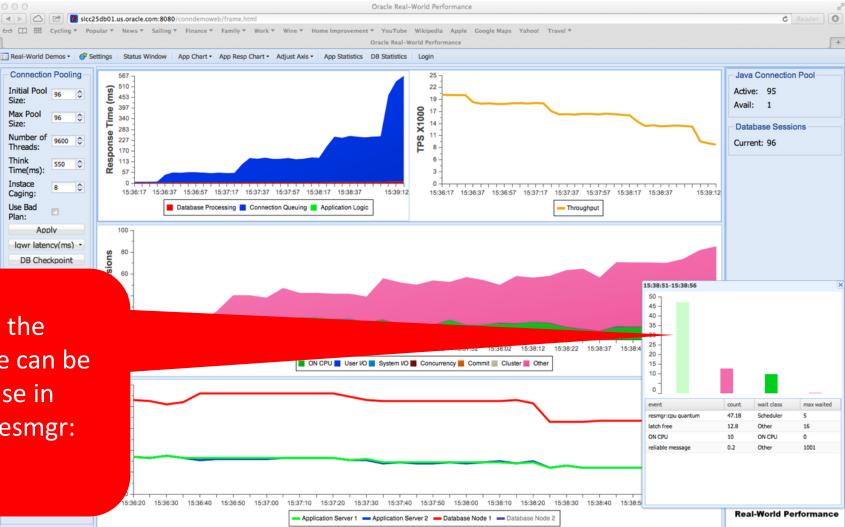
Size:

Size

Think

Plan.

#### **Performance Data**



By reducing the CPU\_COUNT in the resource manager, the database can be throttled back. Note the increase in response time and wait event resmgr: cpu quantum

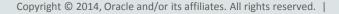
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# Bad Performance Observations

- A problematic application has never met performance objectives
- Response time and throughput are poor
- Everybody blames the database
  - DBA sees no real issues
  - DBA suggests adding more connections to drive up workload
- The system must be able to execute a minimum of 35,000 transactions per second to survive Thanksgiving and Black Friday







#### Parsing Demo Cursors and Connections CURACLE: RWP Video





#### Parsing Demo Bad Performance with Logons

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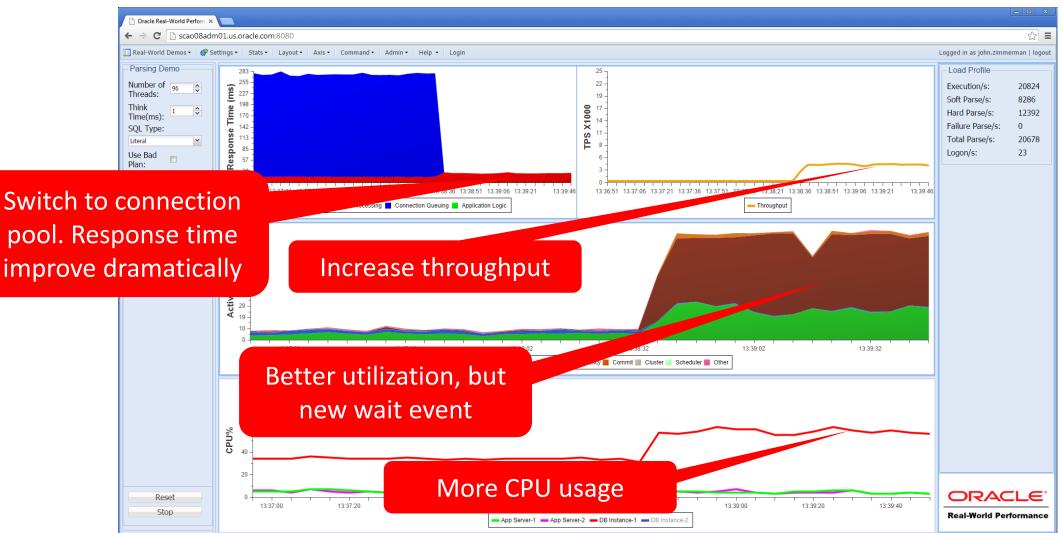
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#### Parsing Demo **Connection Pools and Hard Parse**



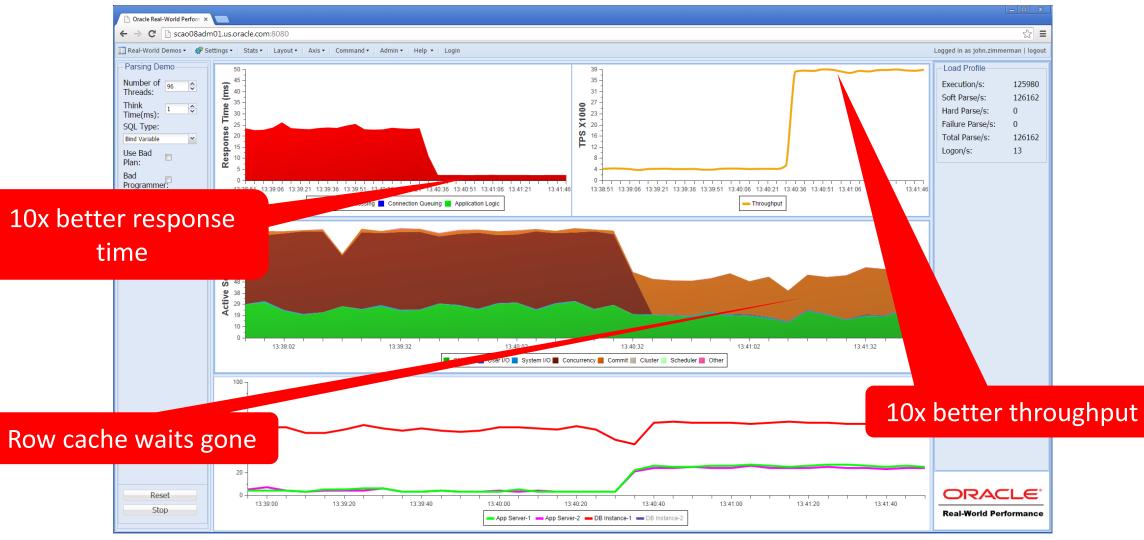


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#### Parsing Demo Bind Variables and Soft Parse



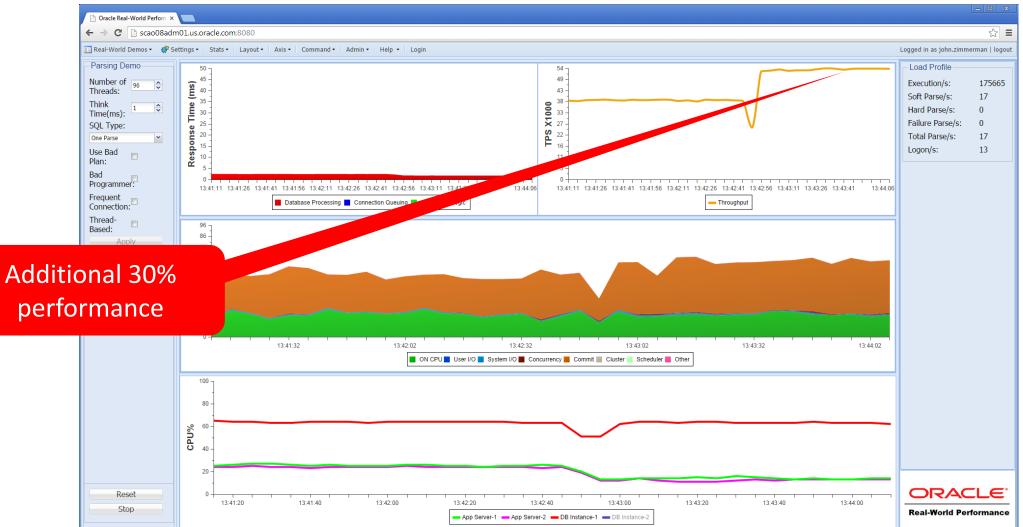




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#### Parsing Demo Shared Cursors and One Parse

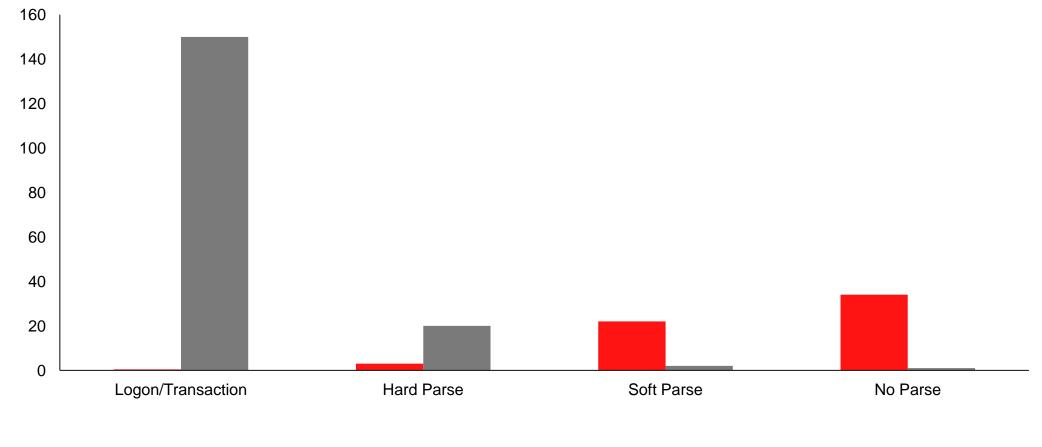




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# Parsing Demo

#### **Incorrect Use of Sessions and Cursors**



Transaction Rate x 1000
Response time(ms)



## Parsing Demo Observations

- Both the development and DBA teams are confused.
  - Performance in the development and test systems is as anticipated
  - Performance in production is nowhere near level of test system
  - DBAs see shared pool contention but developers have coded diligently to ensure no parsing
  - Development has confirmed the same code is running in both test and production

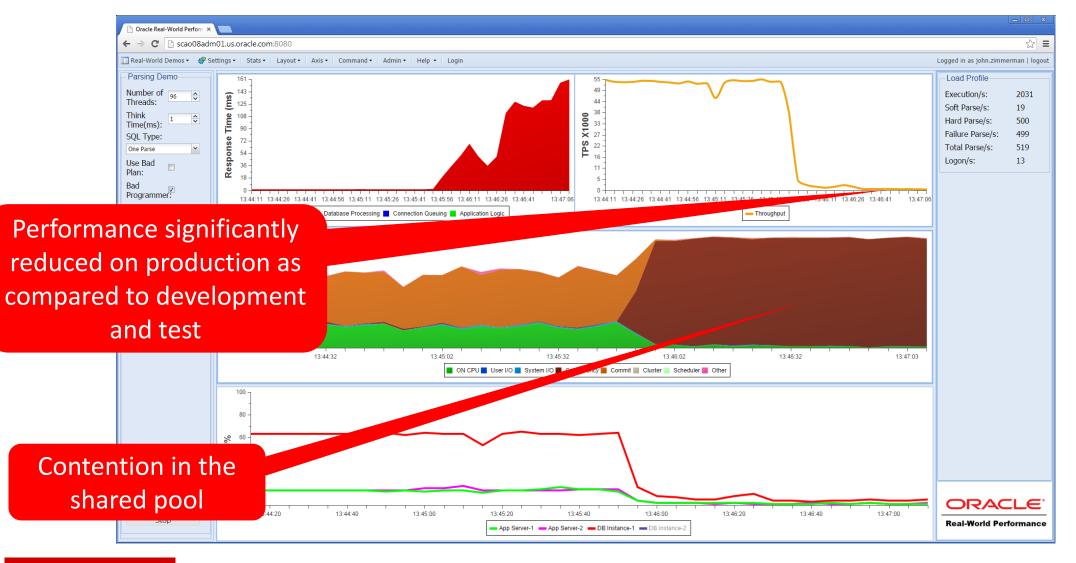


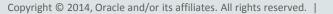
#### Invalid SQL Performance Data

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# Invalid SQL

- A page refresh trigger attempts to set a session-level initialization parameter to enable a diagnostic patch that is not installed in production — This results in a failed parse
- All users are frequently attempting to parse the same SQL, sessions serialize within the shared pool
- How to find invalid SQL:
  - Look for parse count failures from v\$sysstat
  - Check session traces for error messages
  - Look for SQL\*Net Break/Reset











### Leaking Observations

- Intermittent error: "ORA-01000: Maximum number of cursors exceeded". Application server fails and must be restarted
- The DBA has suggested that the init.ora parameter open\_cursors be reset to 30,000 to make the problem "go away for a while".
- Symptoms of cursor leaking



#### Leaking Performance Data

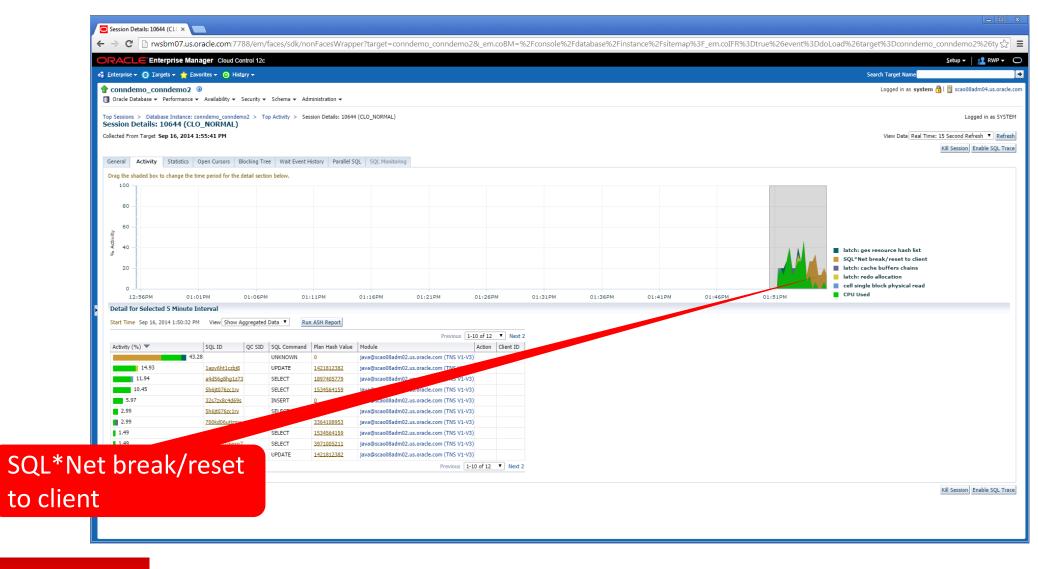
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#### Leaking Session Details



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# Leaking Cursor Data

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865qupcdygglk     select spare from user's where user#=:1       0x520bmikrv     UPDATE T_SESSION SET FRIZENOTAX = 65431; ISCLENTRECEIVED       1x527x1bc4669     NISERT INFO       1x557x1bc4669     NISERT INFO       1x517x1bc4     select SYS_CONTEXT(USEREW,'SERVER_HOST), SYS_CONTEXT(U       1x00d66sigirnc     UPDATE T_server_HOSTO, SYS_CONTEXT(USEREW,'SERVER_HOST), SYS_CONTEXT(U       1x00d66sigirnc     UPDATE T_SERVER_HOST, SYS_CONTEXT(USEREW,'SERVER_HOST), SYS_CONTEXT(U       1x00d66sigirnc     UPDATE T_SERVER_HOST, SYS_CONTEXT(USEREW,'SERVER_HOST), SYS_CONTEXT(U       1x00d66sigirnc     UPDATE T_SERVER_HOST, SYS_CONTEXT(USEREW,'SERVER_HOST), SYS_CONTEXT(U       1x00d7     SELCT BonusCount,LineCost FROM Lgame_XYDC WHERE seriald=       1x00d7     SELCT BonusCount,LineCost FROM Lgame_XYDC MILL 0, BasCI, 1,       1x00d7     SELCT BonusCount_Beat VALL 0, BasCI, 1,       1x00d7     SELCT BonusCount_Beat VALL 0, BasCI, 1,       1x00d7     SELCT BonusCount_Beat VALL 0, BasCI, 1,		
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32s7za8cHd69s       MSERT INTO t_game_XYDC_detail VALUES(11, 2, 13, 'HallD',         f0h5spzmiju11       select SS_CONTEX/USERBN/_SERVER_HOST), SYS_CONTEXT(U         700kd6dujjunc       UPDATE_T_SERVI_SERVER_HOST), SYS_CONTEXT(U         9tg14g9+tny8       select type=,blocks, extents, mixeds, maxeds, settize, extpt, u         4xulyn2layonn7       SELECT BonusCount_LineCot FROM t_game_XYDC WHERE setaild=         1apy6ht1cbj8       UPDATE T_SESSION SET WFDETAILLD = 1, PRIZENOTAX = 100, LAST         4xd5xsplsptx73       SELECT seatHame from do_normal, east where id = 1 FOR UPD         4kdd2vx3s2uy       INSERT INTO t_game_XYDCDOED(to_cbi Count)         9sydd20hm4spl       update T_SESSION SET WFDETAILLAD = 1, FOR UPD         9sydd20hm4spl       update to set set set set accode(upper(filla) VALUES(1) = VME         9sydd20hm4spl       update tu set set set set accode upper(filla) VALUES(1) = VME         9sydd20hm4spl       update tu set set set set accode upper(filla) VALUES(1) = VME         9sydd20hm4spl       update tu set set set set accode upper(filla) VALUES(1) = VME         9sydd20hm4spl       update T_SESSION SET VME       update T_SESSION SET VME         9sydd20hm4spl       update T_SESSION SET VME       update T_SESSION SET VME		
fbh5pzmhJu11       select SYS_CONTEXT(USERENV, SERVER_HOST), SYS_CONTEXT(U         700kd06ujimc       UPDATE L_game_XYDC SET FinishBonus = 2 WHERE seniald=:1 an         9tgl4g0y/invy8       select hype=/blocks, extents, minestage, extp.ctu         9tgl4g0y/invy8       select hype=/blocks, extents, minestage, extp.ctu         1apy6h1czbj8       UPDATE T_SESSION SET WFDETALLID = 1, PRIZENOTAX = 100, LAST         bvkchya8/hypk       select decode/uper(fallower_method), NULL, 0, BASIC; 1,         a4d56g8hg1z73       SELECT seatName (LES): 1, FIOR UPD         4kdrf2xv3zuy       INTO L_game_xi7COChonus_detail VALLUES: 1, FIOR UPD         9tgl4g8/mspu       update user's set spare6=DECODE(to_choine user, or of update user's set spare6=DECODE(to_choine user, or of update user's set spare6=DECODE(to_choine user, or update user's set spare6=DECODE(to_choine user's set spare6=DECODE(to_choine user, or update		
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* xujvn21qvxn7       SELECT BonusCount,LineCost FROM t_game_XYDC WHERE serialid=         1apv6httzbj8       UPDATE T_SESION SET WFDETALLD = 1,PRIZENOTAX = 100,LAST         bvkckyyaShyqx       select decode(uper(fallover_method),NULL 0, 'BASIC', 1,         addSpdsph_173       SELECT seatName from d_normal.set where is a : 1F OR UPD         4kdr2xv3s2uv       INSERT INTO t_game_XYDCbonus_detail VALUES(1, integame_XYDCbonus_detail VALUES(1, integame_XYDCbonus_d		
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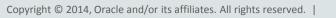
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## Leaking Observations

- After a period of time, the system performance begins to decline and then degrades rapidly
- After rapid degradation, the application servers time out and the system is unavailable
- The DBA claims the database is not the problem and simply needs more connections
  - The init.ora parameter processes is increased to 20,000





#### Leaking Performance Data





## Leaking Session Leaking

- Due to coding errors on exception handling, the application leaks connections in the connection pool making them programmatically impossible to use
- This reduces the effective size of the connection pool
- The remaining connection are unable to keep up with the incoming workload
- The rate of connection leakage is accelerated until there are no useable connections left in the pool



## Leaking Session Leaking

- Potential indicators of session leaking:
  - Frequent application server resets
  - init.ora parameters process and sessions set very high
  - Configuration of large and dynamic connection pools
  - Large number of idle connections connected to the database
  - Free memory on database server continually reduced
  - Presence of idle connection kill scripts or middleware configured to kill idle sessions



### Leaking Observations

- Without warning, the database appears to hang and the application servers time out simultaneously
- The DBA sees that all connections are waiting on a single lock held by a process that has not been active for a while.
- Each time the problem occurs, the DBA responds by running a script to kill sessions held by long time lock holders and allowing the system to restart.

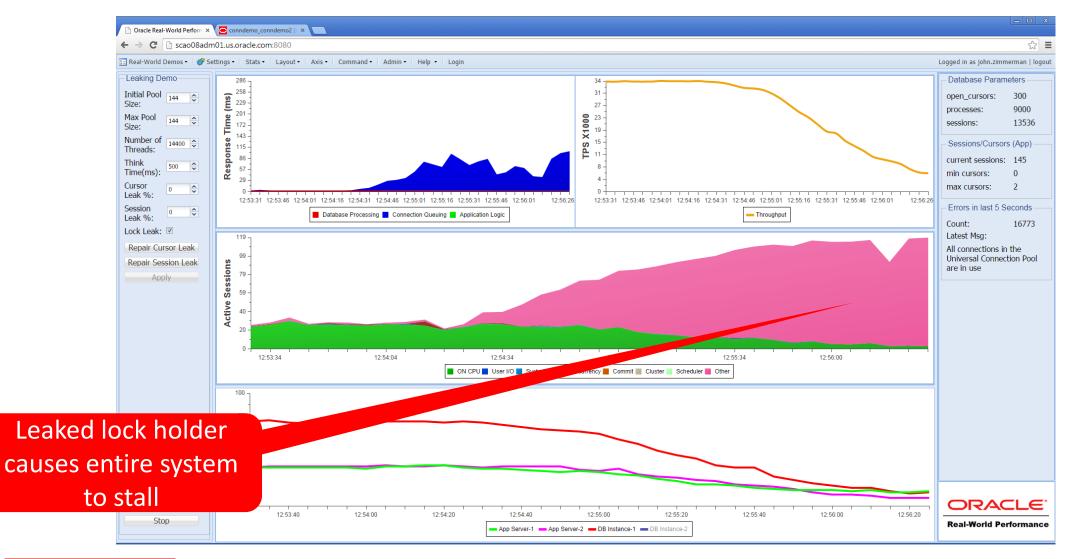


#### Leaking Performance Data

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# Leaking Blocking Tree

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#### Leaking Performance Data

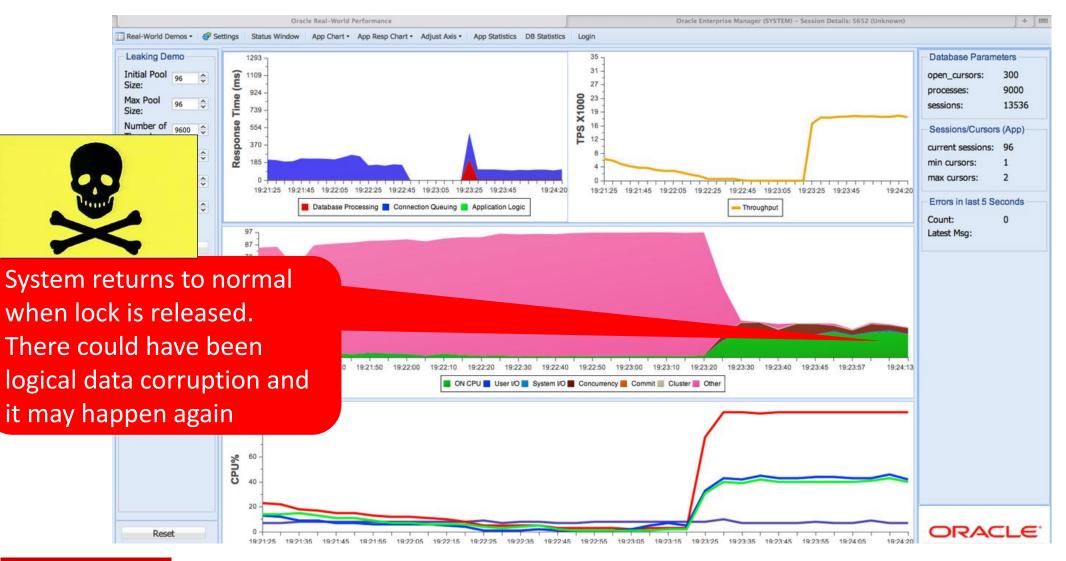
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1.20UNNOWN0jav@sca008adm03.us.orade.com (TNS V1-V3)1.60iapySh1rzbjaUPDATE142181282jav@sca008adm03.us.orade.com (TNS V1-V3)1.404xujm21quxm2SELECT327105211jav@sca008adm03.us.orade.com (TNS V1-V3)1.403257282cH4695NSERTQjav@sca008adm03.us.orade.com (TNS V1-V3)1.40b2rs70299ytSELECT1534564159jav@sca008adm03.us.orade.com (TNS V1-V3)																
1.80       lapySh1tchja       UPDATE       142181232       java@scao08adm03.us.orade.com (TNS V1-V3)         1.40       4xujm21qwxn2       SELECT       327105211       java@scao08adm03.us.orade.com (TNS V1-V3)         1.40       2252x8cH4692       INSERT       Q       java@scao08adm03.us.orade.com (TNS V1-V3)         1.40       2252x70cH99ty       SELECT       133456H159       java@scao08adm03.us.orade.com (TNS V1-V3)			5h6jt076zc1rv													
.40         4xujm21quxx7         SELECT         3971005211         java@sca008adm03.us.orade.com (TNS V1-V3)           .40         22s72x8cH469s         INSERT         Q         java@sca008adm03.us.orade.com (TNS V1-V3)           .40         22s72x8cH469s         INSERT         Q         java@sca008adm03.us.orade.com (TNS V1-V3)           .40         b2rs7t0z99yt         SELECT         1534564159         java@sca008adm03.us.orade.com (TNS V1-V3)			1 anu Chitanhi0													
1-40         32x7xx8x2469s         INSERT         Q         java@scao08adm03.us.orade.com (TNS V1-V3)           1-40         xb2rrx70r299yt         SELECT         15345541529         java@scao08adm03.us.orade.com (TNS V1-V3)																
1.40 rb2rs7t0r99yt SELECT 1534564159 java@scao08adm03.us.orade.com (TNS V1-V3)																
Kill Session Enable SQL Traci																
															Kill Session Enable SQL Trace	

**CRACLE**<sup>°</sup> REAL-WORLD PERFORMANCE

#### Leaking Performance Data





## Leaking Lock Leaking

- Lock leaking is usually a side effect of session leaking and the exception handling code failing to execute a commit or rollback in the exception handling process.
- A leaked session may be programmatically lost to the connection while holding locks and uncommitted changes to the database.



## Leaking Lock Leaking

- Programming error impact:
  - Potential system hangs: all connections queue up for the held lock
  - Potential database logical corruptions: end users may have thought transactions were committed when in fact they have not been
  - If sessions return to the connection pool but still have uncommitted changes, it is not deterministic, if and/or when the changes are committed or rolled back. This is a serious data integrity issue.



# Leaking

How to Develop High Performance Applications

- Developer Bugs
  - Incorrect/untested exception handling
    - Cursor, session and lock leaking
      - High values for init.ora ( open\_cursors, processes, sessions )
      - Idle process and lock holder kill scripts
      - Oversized connection pools of largely idle processes



# Database / Middleware Interaction RWP Video





### Database / Middleware Interaction **Scenario**

Threads:

Steps Per

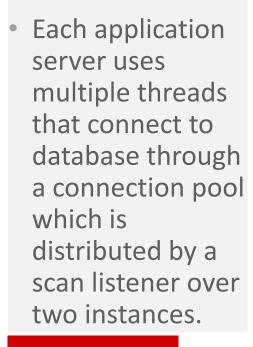
SCAN Service

ORACLE

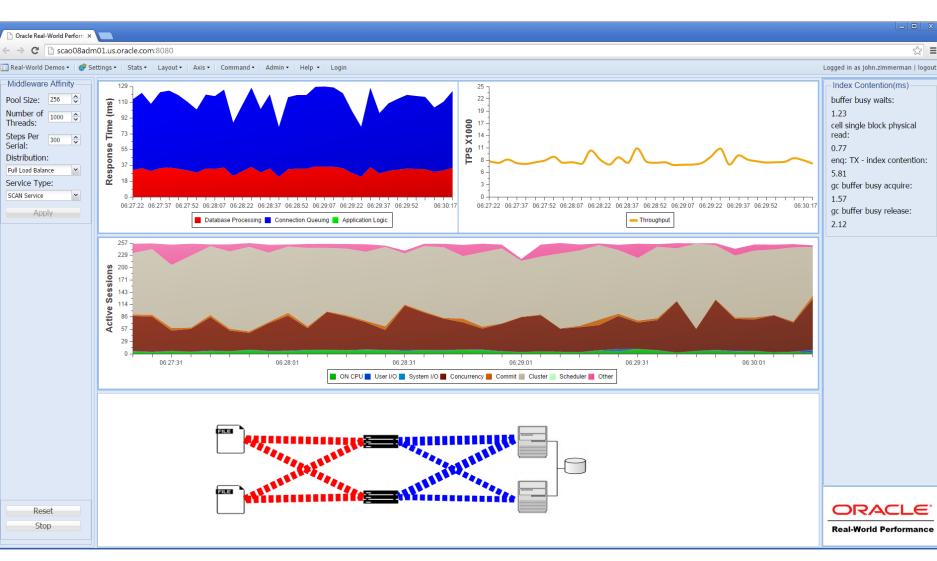
REAL-WORLD PERFORMANCE

Serial:

- Devices ship files.
- Files read and processed by multiple application servers



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### Database / Middleware Interaction **Problem**

Threads:

Steps Per

SCAN Service

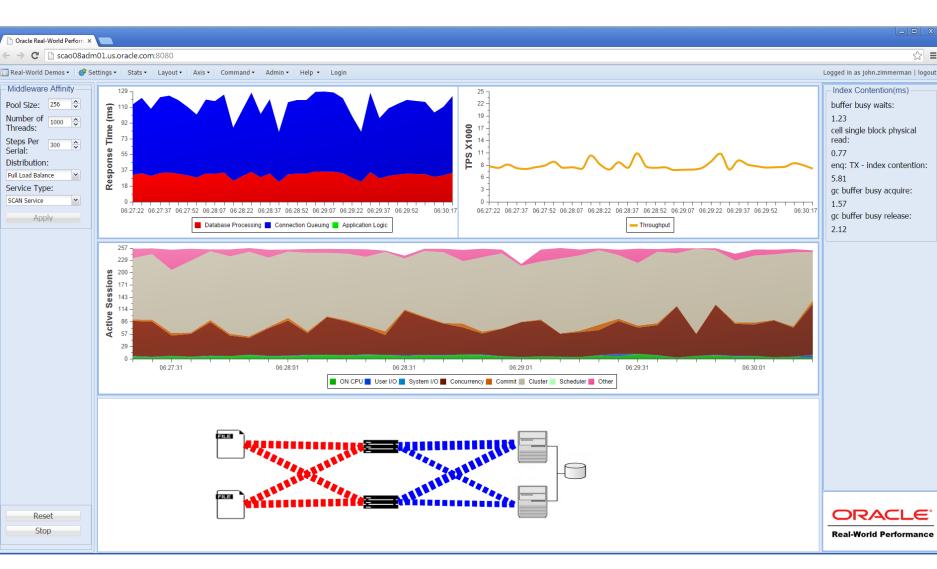
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**REAL-WORLD PERFORMANCE** 

Serial:

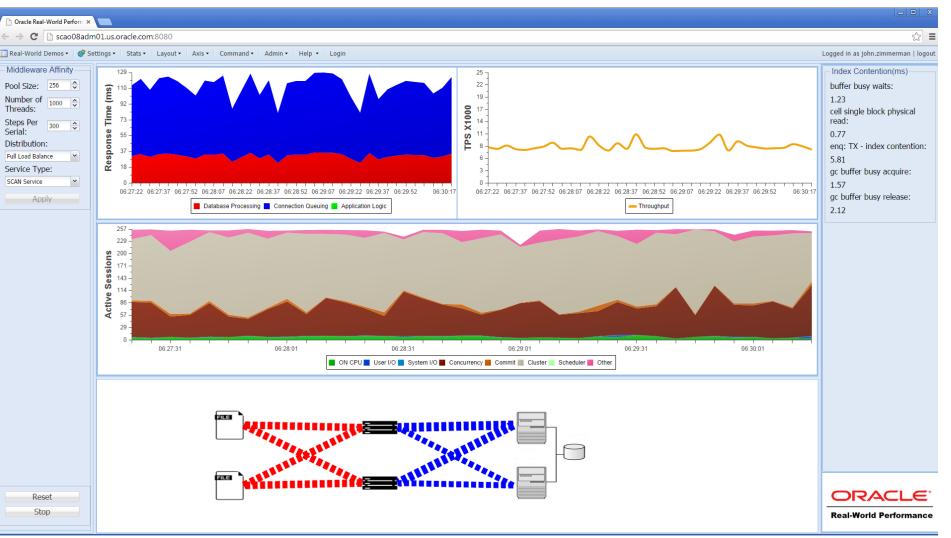
- It's too slow
- It's a problem with the database
  - Look at all those waits
- Need to be able to process an order of magnitude more data
- **Obviously need** to move to Hadoop

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### Database / Middleware Interaction Analysis

- Only small amount of data being processed.
- Both instances essentially idle with most processes waiting in RAC and concurrency waits.







# Database / Middleware Interaction Solution

 Remove all of those RAC waits by running against a single database instance.

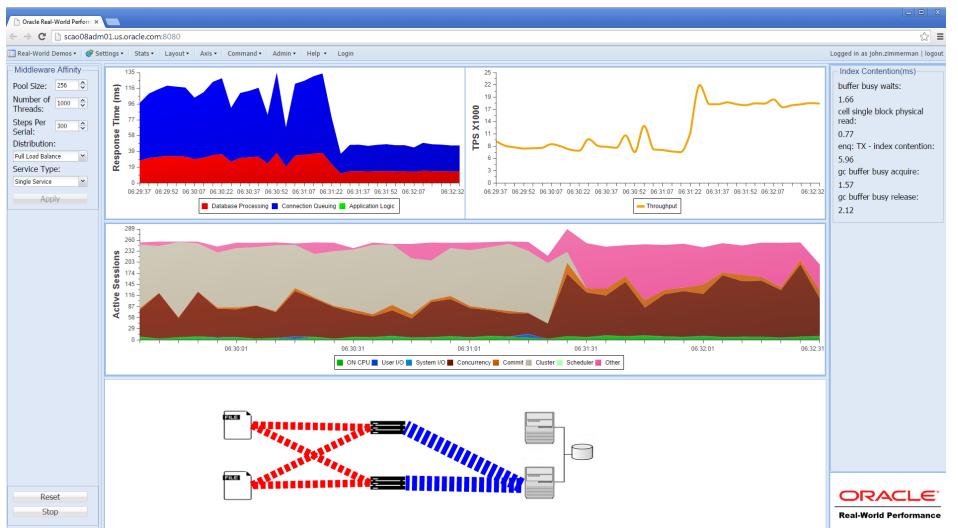






# Database / Middleware Interaction Analysis

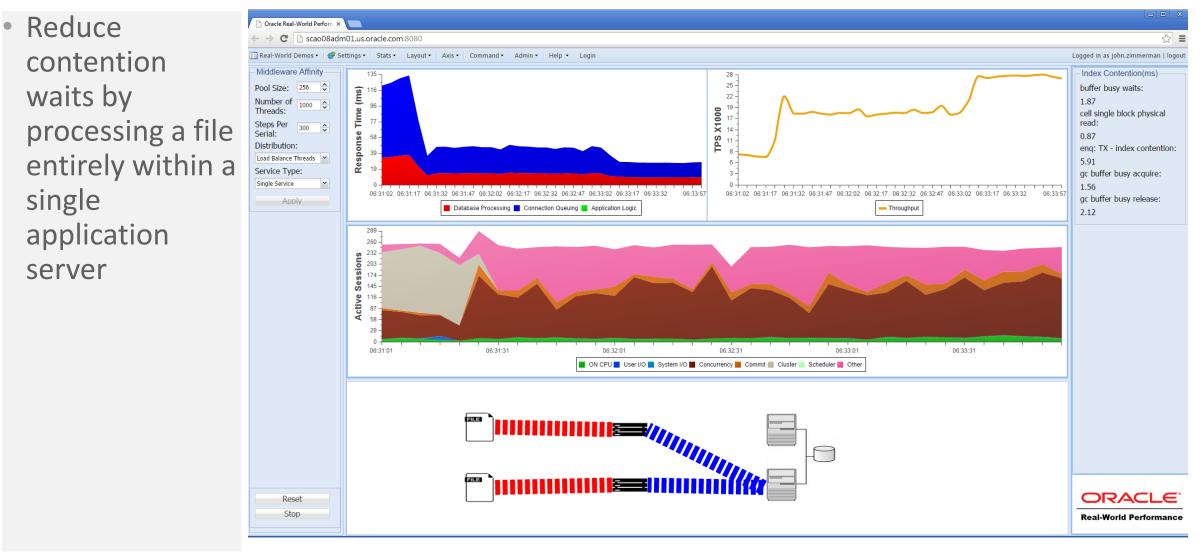
- Throughput up by factor of 10x
- RAC waits gone
- CPU time actually visible
- High concurrency waits
  - Buffer busy
  - Tx index contention







# Database / Middleware Interaction Solution

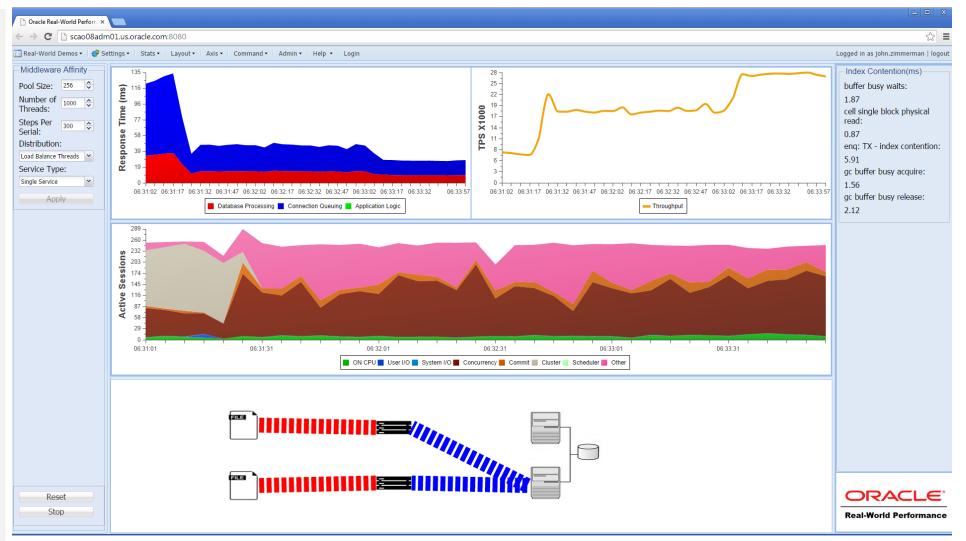






# Database / Middleware Interaction Analysis

- Throughput improved again
- Concurrency events reduced but still present



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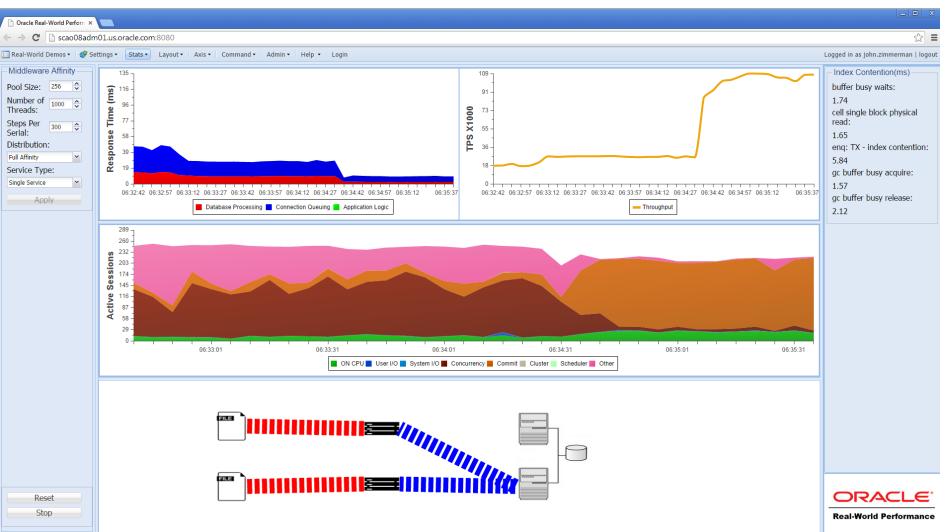
# Database / Middleware Interaction Solution

- Introduce affinity for a related set of records to a single thread by hashing
- All records for the same primary key processed by single thread so no contention in index for same primary key vale

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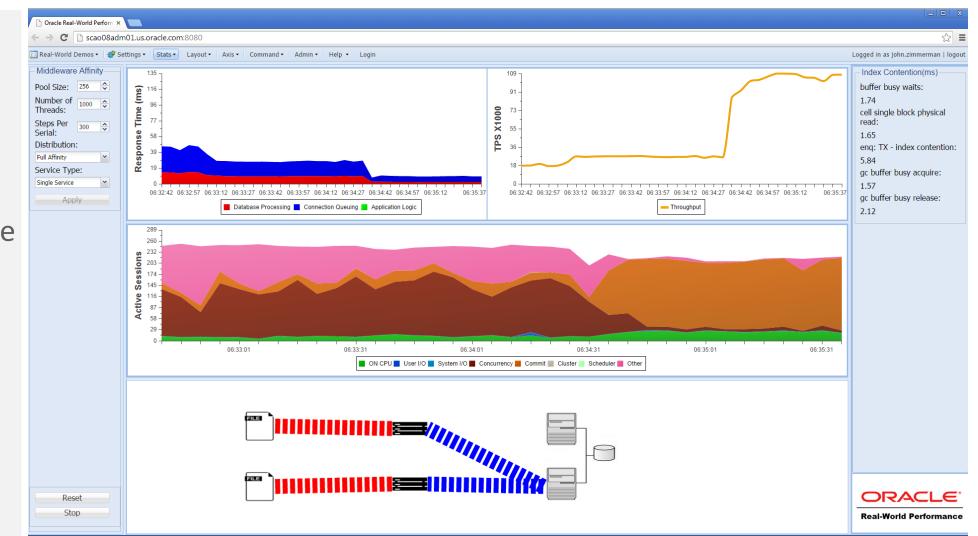
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REAL-WORLD PERFORMANCE



# Database / Middleware Interaction Analysis

- More throughput
- Log file sync predominant event
- CPU usage close to core count



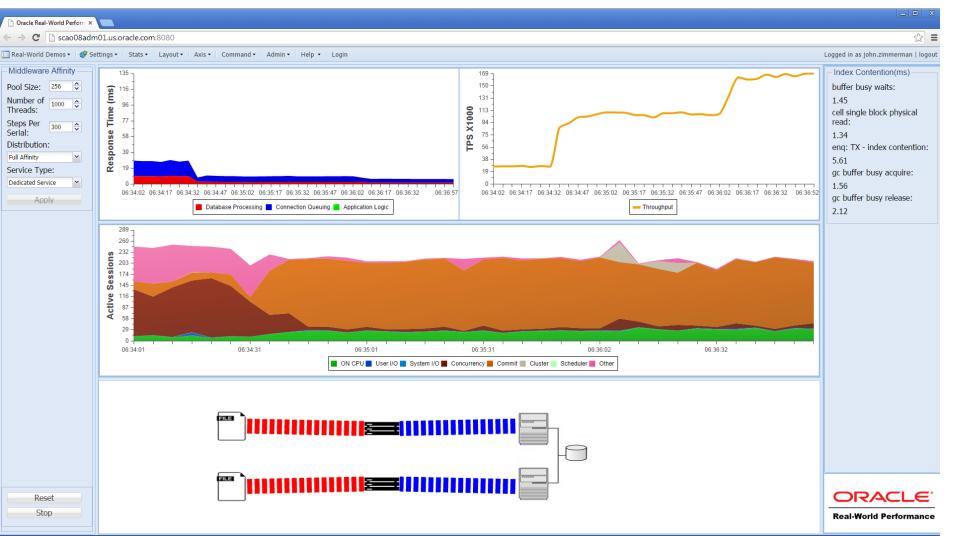




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# Database / Middleware Interaction Solution

- Reintroduce RAC to add more CPU resource
- Implement separate service for each instance
- Connect application server to one instance



#### **ORACLE**



AWR Architecture Analysis More than just wait events and top SQL

- Large amount of data in the AWR report
- Tells us about the way that the system has been architected and designed as well as about how it is performing
- Often see common mistakes



## AWR from online system

**Ready for Black Friday?** 





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### AWR from Online system

- Testing system for Black Friday readiness
- Cannot generate load expected on test system
- Do you see any problems with this system scaling up from this test?
- Will we survive Black Friday ?





### AWR Header

#### WORKLOAD REPOSITORY report for

DB Name	DB Id	Instance	Inst num	Startup Time	Release	RAC
SHOPPING	1722515684	SHOPPING02	2	07-Oct-13 16:10	11.2.0.2.0	YES

Host Name	Platform	CPUs	Cores	Sockets	Memory (GB)
hlq11db.na.bigretail.com	Linux x86 64-bit	64	32	4	504.03

	Snap Id	Snap Time	Sessions	Cursors/Session
Begin Snap:	3037	15-Oct-13 02:45:11	3351	8.2
End Snap:	3044	15-Oct-13 04:30:00	4635	26.2
Elapsed:		104.82 (mins)		
DB Time:		27,641.09 (mins)		

#### **Report Summary**

#### Cache Sizes

	Begin	End		
Buffer Cache:	30,720M	30,720M	Std Block Size:	16K
Shared Pool Size:	16,384M	16,384M	Log Buffer:	14,772K

#### Load Profile

	Per Second	Per Transaction	Per Exec	Per Call
DB Time(s):	263.7	0.2	0.00	0.00
DB CPU(s):	39.0	0.0	0.00	0.00
Redo size:	9,829,605.5	7,222.2		
Logical reads:	802,177.1	589.4		

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- 32 Cores available
- Over processed



- Sessions is 100x cores
- Session count growing
  - Session leak
  - Dynamic connection pools
- Cursors per session growing



- Cursor leakage

### Load Profile

#### Load Profile

	Per Second	Per Transaction	Per Exec	Per Call
DB Time(s):	263.7	0.2	0.00	0.00
DB CPU(s):	39.0	0.0	0.00	0.00
Redo size:	9,829,605.5	7,222.2		
Logical reads:	802,177.1	589.4		
Block changes:	44,854.5	33.0		
Physical reads:	10,749.2	7.9		
Physical writes:	2,085.7	1.5		
User calls:	104,774.4	77.0		
Parses:	39,775.4	29.2		
Hard parses:	0.1	0.0		
W/A MB processed:	96.0	0.1		
Logons:	10.5	0.0		
Executes:	59,560.7	43.8		
Rollbacks:	878.3	0.7		
Transactions:	1,361.0			

- ~260 sessions active on average
- ~40 on CPU
  - Only have 32 cores
  - System CPU limited
- 10 logons per second
  - In a stable system?
    - Session leaks
    - Dynamic connection pools
- 40% of user txns are rollbacks
   Coding for failure





### Init.ora

#### init.ora Parameters

Parameter Name	Begin value	End value (if different)
_bloom_filter_enabled	FALSE	
_disable_image_check	TRUE	
_fix_control	6239971:off	
_kghdsidx_count	1	
_kgl_debug	hash='69cd9f156d9ccd9b245ebaccce65c558' debug=33554432	
_kgl_hot_object_copies	16	
_memory_imm_mode_without_autosga	FALSE	
_shared_pool_reserved_min_alloc	6000	
aq_tm_processes	4	
audit_file_dest	/u01/app/oracle/admin/SHOPPING02/adump	
audit_sys_operations	TRUE	
audit_trail	DB	
cluster_database	TRUE	
cluster_database_instances	2	
compatible	11.2.0.2.0	
control_file_record_keep_time	35	
control_files	+SHOPPING_DATA01/SHOPPING/controlfile/current.762.823865529, +SHOPPING_REC001/SHOPPING/controlfile/current.375.823865531	
core_dump_dest	/u01/app/oracle/admin/SHOPPING02/cdump	
cursor_sharing	FORCE	
db_block_size	16384	
db_cache_size	32212254720	
db_create_file_dest	+SHOPPING_DATA01	
db_domain	world	
db_file_multiblock_read_count	32	
db_files	4096	
db_name	SHOPPING	
db_recovery_file_dest	+SHOPPING_RECO01	

- Underscore parameters
- Db\_block\_size=16384
- Cursor\_sharing=FORCE
- Db\_file\_multiblock\_read\_count=32





### Init.ora

db_file_multiblock_read_count	32
db_files	4096
db_name	SHOPPING
db_recovery_file_dest	+SHOPPING_RECO01
db_recovery_file_dest_size	64424509440
db_recycle_cache_size	4429185024
db_writer_processes	12
diagnostic_dest	/u01/app/oracle
disk_asynch_io	TRUE
fal_client	SHOPPING
fal_server	op99eodb01_linux
fast_start_mttr_target	3600
instance_name	SHOPPING02
instance_number	2
java_pool_size	134217728
job_queue_processes	20
large_pool_size	2147483648
local_listener	SHOPPING02_local
log_archive_config	dg_config=(SHOPPING, op99eodb)
log_archive_dest_1	location=+SHOPPING_REC001
log_archive_dest_2	
log_archive_dest_state_2	DEFER
log_archive_max_processes	10
log_archive_min_succeed_dest	1
log_buffer	3407872
nls_date_format	DD-MON-RR
open_cursors	2000
open_links	255
optimizer_capture_sql_plan_baselines	TRUE
optimizer_dynamic_sampling	1
optimizer_index_cost_adj	50
optimizer_mode	ALL_ROWS
optimizer_secure_view_merging	FALSE

- Db\_writer\_processes=12
  - On a system that supports asynchlO?
- Open\_cursors=2000
  - Per session limit
  - Implies <u>cursor leaking</u>



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### Init.ora

open_cursors	2000
open_links	255
optimizer_capture_sql_plan_baselines	TRUE
optimizer_dynamic_sampling	1
optimizer_index_cost_adj	50
optimizer_mode	ALL_ROWS
optimizer_secure_view_merging	FALSE
os_authent_prefix	
parallel_adaptive_multi_user	FALSE
parallel_max_servers	180
parallel_min_servers	8
pga_aggregate_target	16106127360
processes	5500
recovery_parallelism	90
remote_listener	qlocdb17:50000
remote_login_passwordfile	EXCLUSIVE
resource_manager_plan	
sec_case_sensitive_logon	FALSE
service_names	SHOPPINGsvc, SHOPPING02svc
session_cached_cursors	200
session_max_open_files	20
sessions	8320
sga_max_size	56505663488
shared_pool_reserved_size	262144000
shared_pool_size	17179869184
spfile	+SHOPPING_DATA01/SHOPPING/spfile
sql_trace	FALSE
star_transformation_enabled	false
streams_pool_size	134217728
thread	2
timed_statistics	TRUE
trace_enabled	TRUE
undo_management	AUTO
undo_retention	18000
undo_tablespace	undo02
workarea_size_policy	AUTO

- Optimizer\_index\_cost\_adj=50
  - Classic hack parameter
- Processes=5500
- Sessions=8320

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### Top events

### Where is the time going?

#### **Top 5 Timed Foreground Events**

Event	Waits	Time(s)	Avg wait (ms)	% DB time	Wait Class
library cache: mutex X	51,206,131	377,179	7	22.74	Concurrency
enq: TX - row lock contention	259,719	298,891	1151	18.02	Application
db file sequential read	40,457,009	282,531	7	17.04	User VO
latch: row cache objects	141,091	247,016	1751	14.89	Concurrency
DB CPU		245,536		14.81	

- Concurrency waits > 35% of time
  - Library cache: mutex X
  - Latch:row cache objects
  - Typical of high CPU load
  - A symptom, not the problem
- Row lock contention 18% of time
- IO with 7ms avg read time
- CPU only 15% of DB Time
- Log file sync?





### Top SQL

#### Where is the time going?

#### SQL ordered by Elapsed Time

- Resources reported for PL/SQL code includes the resources used by all SQL statements called by the code.
- % Total DB Time is the Elapsed Time of the SQL statement divided into the Total Database Time multiplied by 100
- %Total Elapsed Time as a percentage of Total DB time
- %CPU CPU Time as a percentage of Elapsed Time
- %IO User I/O Time as a percentage of Elapsed Time
- Captured SQL account for 43.8% of Total DB Time (s): 1,658,465
   Captured PL/SQL account for 13.9% of Total DB Time (s): 1,658,465

Elapsed Time (s)	Executions	Elapsed Time per Exec (s)	%Total	%CPU	%10	SQL Id	SQL Module	SQL Text
204,008.97	1,967,640	0.10	12.30	0.59	2.83	ccfrfn4vuhtt0	ScheduleReturn	SELECT /*SHOP*/ YFS_ORDER_HE
116,892.49	26,600,256	0.00	7.05	6.12	0.00	4xrbd7rw15at7	INT&CAP_AgentServer	BEGIN DBMS_APPLICATION_INFO.SE
110,919.39	28,684,565	0.00	6.69	6.30	0.00	<u>bmx990q2tsqib</u>	JDBC Thin Client	BEGIN DBMS_APPLICATION_INFO.SE
79,569.63	13,172,207	0.01	4.80	8.40	0.00	8pvr9fks6m1r9	ADJUSTEOMSINV	SELECT /*SHOP*/ TO_CHAR(sysd
57,474.41	108,429	0.53	3.47	0.17	0.05	<u>1f72kz03ydy4x</u>	Sourcing	SELECT /*SHOP*/ YFS_ORDER_HE
20,853.07	53,990	0.39	1.26	0.17	0.00	f110q31ahqbb5	CONFIRMFPSHIPMENT	SELECT /*SHOP*/ YFS_ORDER_HE
19,865.13	1,580,843	0.01	1.20	6.48	0.00	2tq3dknsjum6d	JDBC Thin Client	SELECT :"SYS_B_0" FROM DUAL
19,820.14	93,037	0.21	1.20	0.16	0.01	<u>4htst3fakwa0m</u>	CONSOLIDATE_ADDNL_INV	SELECT /*SHOP*/ YFS_INVENTOR
19,064.37	19	1,003.39	1.15	4.03	97.93	d7ufw6t6n4qrn	JDBC Thin Client	SELECT /*SHOP*/ count(:"SYS
16,954.77	2,418,713	0.01	1.02	8.52	91.24	<u>fqq27u174x4t1</u>	RETEK_ORDER_CREATE	SELECT /*SHOP*/ YFS_ORDER_LI

#### • Top statement

SELECT /\*SHOP\*/ YFS\_ORDER\_HEADER.\*
FROM YFS\_ORDER\_HEADER
WHERE (ORDER\_HEADER\_KEY = :1 )
FOR UPDATE

- -12% of load
- 2 million executions
- Average execution 0.1 sec





### Top SQL

#### Segments by Row Lock Waits

• % of Capture shows % of row lock waits for each top segment compared

with total row lock waits for all segments captured by the Snapshot

Owner	Tablespace Name	Object Name	Subobject Name	Obj. Type	Row Lock Waits	% of Capture
SHOP	SHOPDATA	YFS_ORDER_HEADER		TABLE	250,888	38.42
SHOP	SHOPDATA	YFS_INVENTORY_ITEM		TABLE	83,732	12.82
SHOP	SHOPINDEX2	YFS_ORDER_HEADER_19		INDEX	63,183	9.68
SHOP	SHOPINDEX1	YFS_STATISTICS_DETAIL_PK		INDEX	30,675	4.70
SHOP	SHOPINDEX1	YFS_ORDER_RELEASE_STATUS_PK		INDEX	25,905	3.97

#### Top statement

SELECT /\*SHOP\*/ YFS\_ORDER\_HEADER.\*
FROM YFS\_ORDER\_HEADER
WHERE (ORDER\_HEADER\_KEY = :1 )
FOR UPDATE

-40% of RLWs are on that object





### **Top SQL**

#### SQL ordered by Elapsed Time

- Resources reported for PL/SQL code includes the resources used by all SQL statements called by the code.
- % Total DB Time is the Elapsed Time of the SQL statement divided into the Total Database Time multiplied by 100
- %Total Elapsed Time as a percentage of Total DB time
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204,008.97	1,967,640	0.10	12.30	0.59	2.83	ccfrfn4vuhtt0	ScheduleReturn	SELECT /*SHOP*/ YFS_ORDER_HE
116,892.49	26,600,256	0.00	7.05	6.12	0.00	4xrbd7rw15at7	INT&CAP_AgentServer	BEGIN DBMS_APPLICATION_INFO.SE
110,919.39	28,684,565	0.00	6.69	6.30	0.00	<u>bmx990q2tsqjb</u>	JDBC Thin Client	BEGIN DBMS_APPLICATION_INFO.SE
79,569.63	13,172,207	0.01	4.80	8.40	0.00	<u>8pvr9fks6m1r9</u>	ADJUSTEOMSINV	SELECT /*SHOP*/ TO_CHAR(sysd
57,474.41	108,429	0.53	3.47	0.17	0.05	<u>1f72kz03ydy4x</u>	Sourcing	SELECT /*SHOP*/ YFS_ORDER_HE
20,853.07	53,990	0.39	1.26	0.17	0.00	f110q31ahqbb5	CONFIRMEPSHIPMENT	SELECT /*SHOP*/ YFS_ORDER_HE
19,865.13	1,580,843	0.01	1.20	6.48	0.00	<u>2tq3dknsjum6d</u>	JDBC Thin Client	SELECT :"SYS_B_0" FROM DUAL
19,820.14	93,037	0.21	1.20	0.16	0.01	<u>4htst3fakwa0m</u>	CONSOLIDATE_ADDNL_INV	SELECT /*SHOP*/ YFS_INVENTOR
19,064.37	19	1,003.39	1.15	4.03	97.93	d7ufw6t6n4qrn	JDBC Thin Client	SELECT /*SHOP*/ count(:"SYS
16,954.77	2,418,713	0.01	1.02	8.52	91.24	<u>fqq27u174x4t1</u>	RETEK_ORDER_CREATE	SELECT /*SHOP*/ YFS_ORDER_LI

#### • Next two statements

- Call of DBMS\_APPLICATION\_INFO
  - Application instrumentation
- -14% of load
- 26M executions each
- Instrumentation is a good thing BUT
- Not needed since Oracle 10g
- Use parameters to OCI or Java instead





### Other SQL

98sp81sbwt4vc	select /* SHOP */: "SYS_B_0" as ENTITY, sum(quantity) QUANTITY, DEMAND_TYPE, B.shipnode_key from yfs_inventory_demand B where B.inventory_item_key = (select inventory_item_key from yfs_inventory_item A where A.item_id = :1
	and A.product_class = :2 and A.UOM = :3 and A.organization_code = :4 ) and B.demand_ship_date >= :5 and B.demand_ship_date <= :6 and B.shipnode_key in (:7, :8, :9, :10, :11, :12, :13, :14, :15, :16, :17, :18, :19, :20, :21, :22,
	23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70,
	171 .72 .73 .74 .75 .76 .77 .78 .79 .80 .81 .82 .83 .84 .85 .86 .87 .88 .89 .90 .91 .92 .93 .94 .95 .96 .97 .98 .99 .100 .101 .102 .103 .104 .105 .106 .107 .108 .109 .110 .111 .112 .113 .114 .
	115,:116,:117,:118,:119,:120,:121,:122,:123,:124,:125,:126,:127,:128,:129,:130,:131,:132,:133,:134,:135,:136,:137,:138,:139,:140,:141,:142,:143,:144,:145,:146,:147,:148,:149,:150,:151,:152,:131,:132,:131,:132,:133,:134,:135,:136,:137,:138,:139,:140,:141,:142,:143,:144,:145,:146,:147,:148,:149,:150,:151,:152,:131,:151,:152,:131,:152,:131,:152,:131,:152,:131,:152,:131,:152,:131,:152,:131,:151,:152,:131,:152,:131,:151,:151,:152,:131,:151,:151,:151,:151,:151,:151,:151
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	A.organization_code = :1010 ) and B.demand_ship_date >= :1011 and B.demand_ship_date <= :1012 and B.shipnode key in (:1013, :1014, :1015, :1016, :1017, :1018, :1019, :1020, :1021, :1022, :1023, :1024, :1025, :1027,
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### **Online Summary**

Not looking good for Black Friday

- System is CPU bound at test load levels
- System seems to be leaking both cursors and sessions (and maybe locks)
- System is running far too many processes
- High overhead application instrumentation



## Why is My SQL Slow ?







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