

SQL Performance in Today's Digital World

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Executive Briefing Center

The Game Isn't Changing – It's Changed

The Next Three Years Are Critical

“40% of CEO'S think they will be running a different entity in the next three years”

– November 30, 2016 Rob Violino – Information Management

To thrive you must:



Use Advanced Automation

- Can't keep up manually any more
- Frees you from drudgery and errors
- Much more than scheduling



Ensure your Data Integrity

- Be confident/sign off on your data today
- Stop losing sleep
- Protect your company from fines and fees



Deploy Easy to Use Solutions

- With current staffing, you can't keep up
- The next generation won't use a green screen



Improve Application Performance

- Reorg more often for better results
- Save CPU and money
- Deliver the BEST application performance

Become a Digital Master

The Data and Transaction Flood can Erode your **Efficiency**

- **Application response time suffers**
- **Hardware upgrades needed to meet SLAs**
- **Additional storage requirements**
- **Staff and tools strain to cope**
- **Unable to quickly and easily rollout new apps**

Increased costs and reduced customer satisfaction

Reboot Your Thinking – Paul Sloane



1. Check your assumptions
2. Break the rules
3. Ask searching questions
4. Deliberately take the opposite point of view
5. Generate many ideas
6. Look outside for ideas
7. Manage Risk
8. Empower your team to try new things

Agenda for SQL Performance Part 1 & 2

- Learning what applications are using CPU and causing wait
- Analyzing online and DDF SQL for optimal response times
- Investigating DB2 batch jobs to reduce overall runtimes
- Exploring access path efficiency by examining the EXPLAIN
- Scrutinizing Information contained in the DB2 Catalog

Part 2

- How do you know you have a problem?
- Is it solvable from a DB2 perspective?
- Getting to the bottom of your problem
- Better preparation to solve problems
- “Reactive Tuning”
- What about performance problems you DON’T know about?
- “Proactive Tuning”

```
ConnectionString="Database=DB_home; Username=dbuser; Password=...
DBProvider = " Database provider" DB.connect ConnectionString
SelectSQL1 = " Select id, name, quantity from all
QuerySQL1 = " where id between decode(name, 'Scott'
QuerySQL2 = " group by id, name"
SelectQuery = SelectSQL1 & QuerySQL1 & QuerySQL2
Execute Query; Commit Transaction; Select new data
Form Navigation
If KeyAscii = 13 Then Execute Query
If Not Chr(KeyAscii) Like "#" And KeyAscii <> 0
```

Destructive Forces can Erode your Efficiency

Bad SQL



Bad Access Paths

Missing these increases your costs

Top CPU Consumers 7/23 – 8/1

| STMT_ID | CPU | EXECS | ELAPSED | GETPAGES | EXAMINED ROWS | PROCESSED | STAT_SORT | STAT_INDX | STAT_RSCN |
|---------|--------|--------|---------|-------------|------------------|-----------|-----------|-----------|-----------|
| 1022787 | 4705.7 | 5258 | 4722.46 | 729,475,051 | 298,690,230 | 2629 | 0 | 283543230 | 5606 |
| 996083 | 214.98 | 112873 | 179.02 | 11902513 | 68238 | 112873 | 0 | 112873 | 0 |
| 800016 | 214.56 | 113783 | 190.44 | 11947215 | 0 | 113783 | 0 | 113783 | 0 |
| 180 | 212.79 | 3133 | 223.76 | 25086005 | 186142343 | 544 | 0 | 3677 | 3133 |
| 811731 | 133.36 | 1 | 355.89 | 8391890 | 61498510 | 124 | 3 | 6692952 | 4 |
| 811935 | 111.59 | 1 | 164.33 | 22201871 | 13229919 | 12 | 2 | 6818081 | 2 |
| 800294 | 88.55 | 47141 | 79.04 | 4949805 | 0 | 47141 | 0 | 47141 | 0 |
| 1187852 | 83.56 | 48 | 199.23 | 12753975 | 5221945 | 48 | 0 | 4957226 | 98 |
| 811873 | 70.09 | 1 | 149.42 | 4655522 | 83330320 | 12315 | 2 | 0 | 2 |
| 586165 | 50.99 | 562 | 43.2 | 6722678 | 67118156 | 0 | 1686 | 0 | 1686 |
| 812268 | 48.87 | 2 | 41.67 | 1784878 | 1068132 | 0 | 0 | 6400 | 0 |
| 554554 | 46.81 | 691 | 54.01 | 5497295 | 40785747 | 111 | 0 | 802 | 691 |
| 810650 | 45.92 | 227 | 53.73 | 1657091 | 58 | 0 | 0 | 227 | 0 |
| 802159 | 45.14 | 227 | 43.62 | 1657091 | 58 | 0 | 0 | 227 | 0 |
| 1018056 | 40.78 | 588 | 47.69 | 4764061 | 35334083 | 149 | 0 | 737 | 588 |
| 14 | 40.62 | 810760 | 66.2 | 178263428 | 2147483647 | 810760 | 0 | 0 | 810760 |
| 810268 | 38.65 | 1 | 31.91 | 1532765 | 27355055 | 0 | 0 | 6562 | 3327 |
| 802007 | 38.59 | 1 | 31.58 | 1532765 | 27355055 | 0 | 0 | 6562 | 3327 |
| 801173 | 38.54 | 107043 | 211.23 | 2299891 | 1057733 | 164887 | 107043 | 1079805 | 106271 |
| 811624 | 36.51 | 6 | 31.74 | 1785618 | 1462602 | 6 | 0 | 4524 | 0 |
| 197385 | 36.41 | 1 | 213.26 | 1316327 | 5207786 | 171086 | 4 | 6036203 | 4 |

January 8, 2013 Top SQL

DESC
Jan. 8, 2013

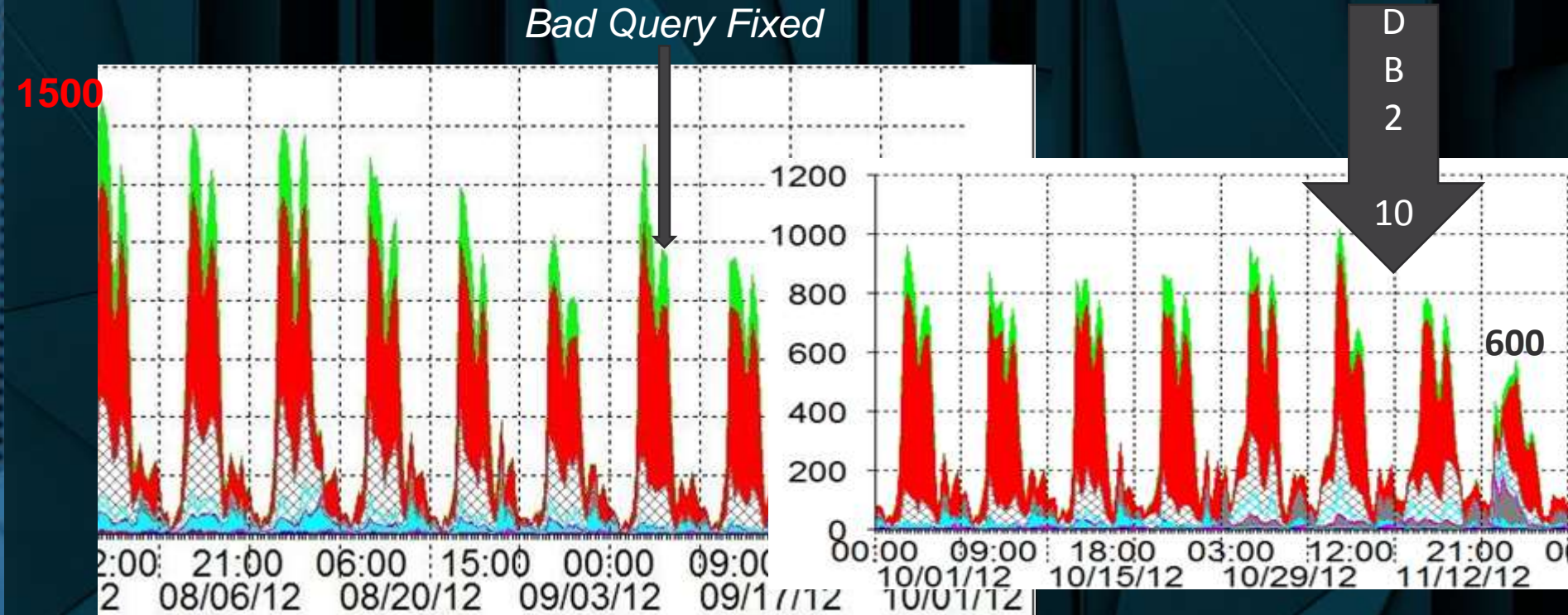
| STMT | CPU | TOT | TOT | NUM | WHEN | | | | | | | |
|--------|----------|-------|-------|-----------|----------|----------|-----------|----|---------|-------|------|------------|
| PER | NUM | ROWS | ROWS | NUM INDEX | TABLE | PARALLEL | CACHED | | | | | |
| ID | PROGRAM | EXEC | EXECS | ELAPSED | GETPAGES | FETCHED | PROCESSED | S | HITS | SCANS | GRPS | DATE |
| 100421 | SYSLN300 | 2.107 | 3 | 6.28 | 240324 | 9342 | 0 | 0 | 2010 | 0 | | 0 1/8/2013 |
| 32783 | SYSSH200 | 1.633 | 10 | 18.45 | 870600 | 2478110 | 305480 | 10 | 3613050 | 20 | | 0 1/8/2013 |
| 100903 | SYSSH200 | 1.612 | 5 | 7.79 | 435300 | 1239055 | 152740 | 5 | 1806525 | 10 | | 0 1/8/2013 |
| 102142 | SYSLN300 | 1.32 | 3 | 4.27 | 228747 | 108300 | 3 | 0 | 1206 | 0 | | 0 1/8/2013 |
| 39005 | SYSLN300 | 1.137 | 3 | 4.53 | 291018 | 556107 | 3 | 0 | 447 | 0 | | 0 1/8/2013 |
| 40181 | SYSLN300 | 0.977 | 3 | 8.61 | 77982 | 44496 | 33 | 12 | 1250718 | 15 | | 0 1/8/2013 |
| 103638 | DQPS024 | 0.94 | 3 | 11.01 | 142224 | 392352 | 392352 | 0 | 3 | 0 | | 0 1/8/2013 |
| 40422 | SYSLN300 | 0.923 | 3 | 3.2 | 114354 | 25398 | 0 | 0 | 753 | 0 | | 0 1/8/2013 |
| 39297 | SYSLN300 | 0.883 | 6 | 8.93 | 276426 | 162894 | 6 | 0 | 1230 | 0 | | 0 1/8/2013 |
| 102459 | DB2V9PRM | 0.478 | 4 | 29.54 | 100740 | 116896 | 5352 | 24 | 74084 | 4 | | 0 1/8/2013 |
| 39759 | SYSSH300 | 0.447 | 3 | 1.65 | 11756 | 0 | 5247 | 3 | 174 | 3 | | 0 1/8/2013 |
| 148586 | SYSLN300 | 0.435 | 4 | 1.84 | 24972 | 832 | 4 | 8 | 12 | 8 | | 0 1/8/2013 |
| 41291 | SYSLN300 | 0.428 | 4 | 4.64 | 24568 | 60 | 4 | 8 | 4 | 8 | | 0 1/8/2013 |
| 41304 | SYSLN300 | 0.428 | 4 | 1.93 | 24192 | 0 | 4 | 8 | 4 | 8 | | 0 1/8/2013 |
| 96015 | SYSLN300 | 0.421 | 22 | 8.6 | 137060 | 3674 | 22 | 44 | 22 | 44 | | 0 1/8/2013 |
| 101553 | SYSLN300 | 0.418 | 5 | 2.08 | 30410 | 180 | 5 | 10 | 20 | 10 | | 0 1/8/2013 |
| 148587 | SYSLN300 | 0.417 | 3 | 1.13 | 18735 | 624 | 3 | 6 | 9 | 6 | | 0 1/8/2013 |
| 96016 | SYSLN300 | 0.413 | 22 | 8.62 | 133452 | 0 | 22 | 66 | 22 | 66 | | 0 1/8/2013 |

January 17, 2013

| STMT_ID | PROGRAM | CPU | SEC PEREXEC | EXECS | ELAPSED | GETPAGES | EXAMINEd | PROCESSEd | SORT | INDEX | NumTscans | Cach Date | Cach Time |
|---------|----------|------|----------------|-------|---------|----------|----------|-----------|------|-------|-----------|-----------|-----------|
| 1515682 | DB2V9PRM | 2.37 | 0.5925 | 4 | 12.65 | 191500 | 189956 | 80 | 12 | 1772 | 12 | 1/18/2013 | 12:14:47 |
| 1321212 | DQPS024 | 1.95 | 0.4875 | 4 | 6.07 | 28967 | 462554 | 462554 | 0 | 4 | 0 | 1/17/2013 | 10:58:26 |
| 1515740 | DB2V9PRM | 0.83 | 0.27666 | 3 | 7.76 | 82572 | 113148 | 42984 | 0 | 74787 | 0 | 1/18/2013 | 12:15:03 |
| 1512737 | SYSLN300 | 0.78 | 0.156 | 5 | 0.67 | 15115 | 25 | 5 | 5 | 105 | 5 | 1/18/2013 | 12:00:41 |
| 1320091 | SYSLN300 | 0.46 | 0.15333 | 3 | 0.39 | 8973 | 0 | 3 | 3 | 33 | 3 | 1/17/2013 | 10:55:28 |
| 1512739 | SYSLN300 | 0.75 | 0.15 | 5 | 0.63 | 15260 | 0 | 5 | 5 | 105 | 5 | 1/18/2013 | 12:00:41 |
| 1320093 | SYSLN300 | 0.45 | 0.15 | 3 | 0.34 | 9360 | 0 | 3 | 6 | 33 | 6 | 1/17/2013 | 10:55:28 |
| 1510143 | SYSLN300 | 1.14 | 0.1425 | 8 | 1.46 | 59136 | 777906 | 0 | 0 | 21 | 0 | 1/18/2013 | 11:48:10 |
| 1322156 | SYSLN300 | 0.29 | 0.09666 | 3 | 1.36 | 35064 | 49473 | 0 | 0 | 2199 | 0 | 1/17/2013 | 11:01:13 |
| 1513226 | DB2V9PRM | 0.47 | 0.07833 | 6 | 1.71 | 25726 | 19590 | 6114 | 12 | 66 | 6 | 1/18/2013 | 12:03:13 |
| 1321228 | SYSSH300 | 0.18 | 0.045 | 4 | 0.76 | 29320 | 276152 | 394 | 0 | 0 | 4 | 1/17/2013 | 10:58:27 |
| 1511653 | SYSLN300 | 0.78 | 0.04105 | 19 | 0.96 | 51802 | 6308 | 293 | 95 | 8066 | 0 | 1/18/2013 | 11:56:19 |
| 1515344 | SYSLN300 | 0.11 | 0.03666 | 3 | 0.16 | 7743 | 330 | 3 | 3 | 729 | 3 | 1/18/2013 | 12:12:45 |
| 1513216 | DB2V9PRM | 0.22 | 0.03666 | 6 | 0.4 | 9486 | 33732 | 22668 | 6 | 5430 | 12 | 1/18/2013 | 12:03:13 |
| 1322154 | SYSLN300 | 0.11 | 0.03666 | 3 | 0.13 | 6618 | 294 | 0 | 0 | 3 | 0 | 1/17/2013 | 11:01:13 |
| 1315477 | SYSLN300 | 0.32 | 0.03555 | 9 | 0.53 | 22318 | 884 | 0 | 9 | 893 | 9 | 1/17/2013 | 10:39:08 |
| 1515339 | SYSLN300 | 0.14 | 0.035 | 4 | 0.14 | 9092 | 392 | 3 | 0 | 4 | 0 | 1/18/2013 | 12:12:41 |
| 1513794 | SYSLN300 | 0.17 | 0.034 | 5 | 0.15 | 11365 | 490 | 0 | 0 | 5 | 0 | 1/18/2013 | 12:06:06 |
| 1512699 | SYSLN300 | 0.1 | 0.03333 | 3 | 0.09 | 6821 | 296 | 0 | 0 | 3 | 0 | 1/18/2013 | 12:00:32 |

Tuning in Seven Months, Days, Hours, Seconds ?

Bad Query Fixed



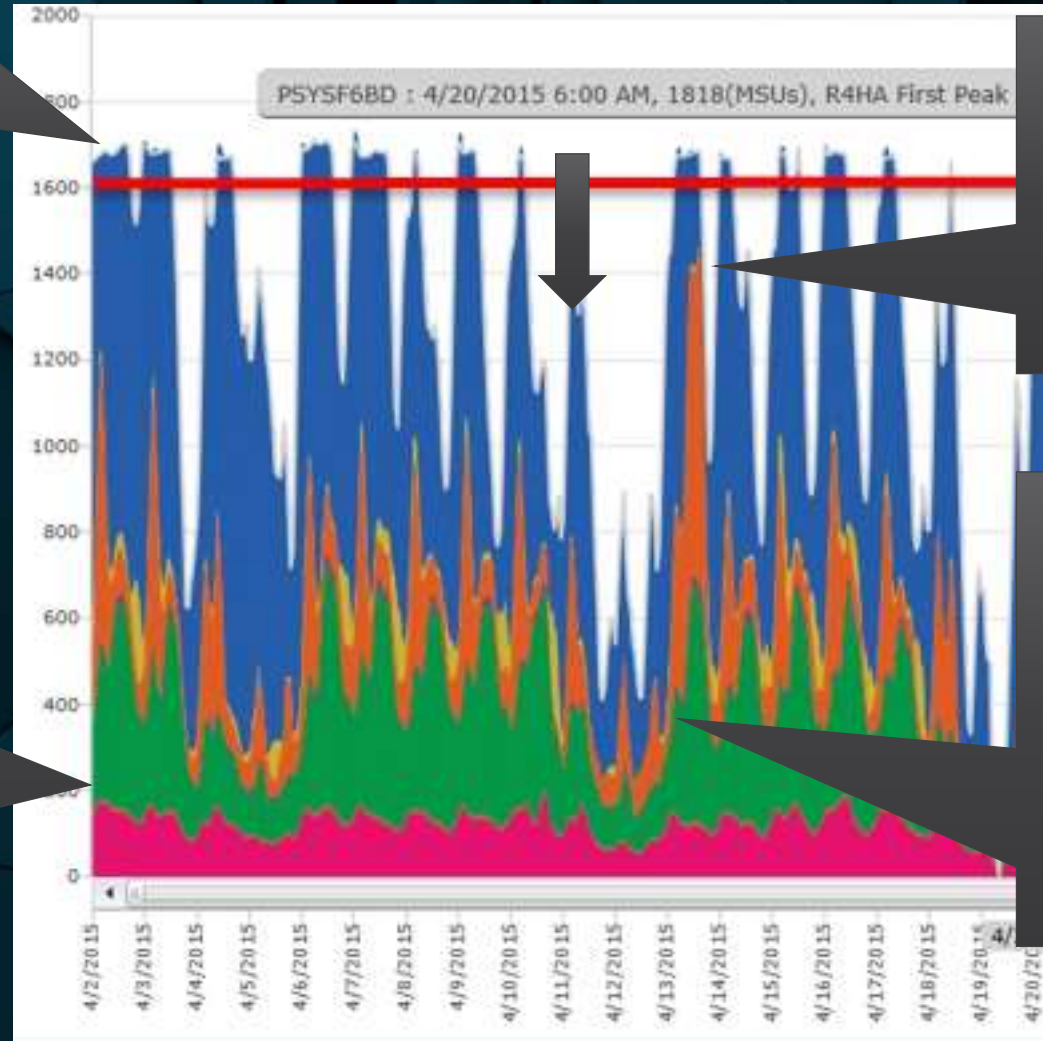
900 MIP Reduction

How long do you have to tune your applications?

DB2 Resource Optimization is the Key

Optimized
DB2
databases

Reorg
Advisors
to Keep
Data
Perfect



Reduced risk of bad
SQL and Access
Paths in the Peak

SQL
Performance
Advisors
Proactively
report
Degradation or
Failure

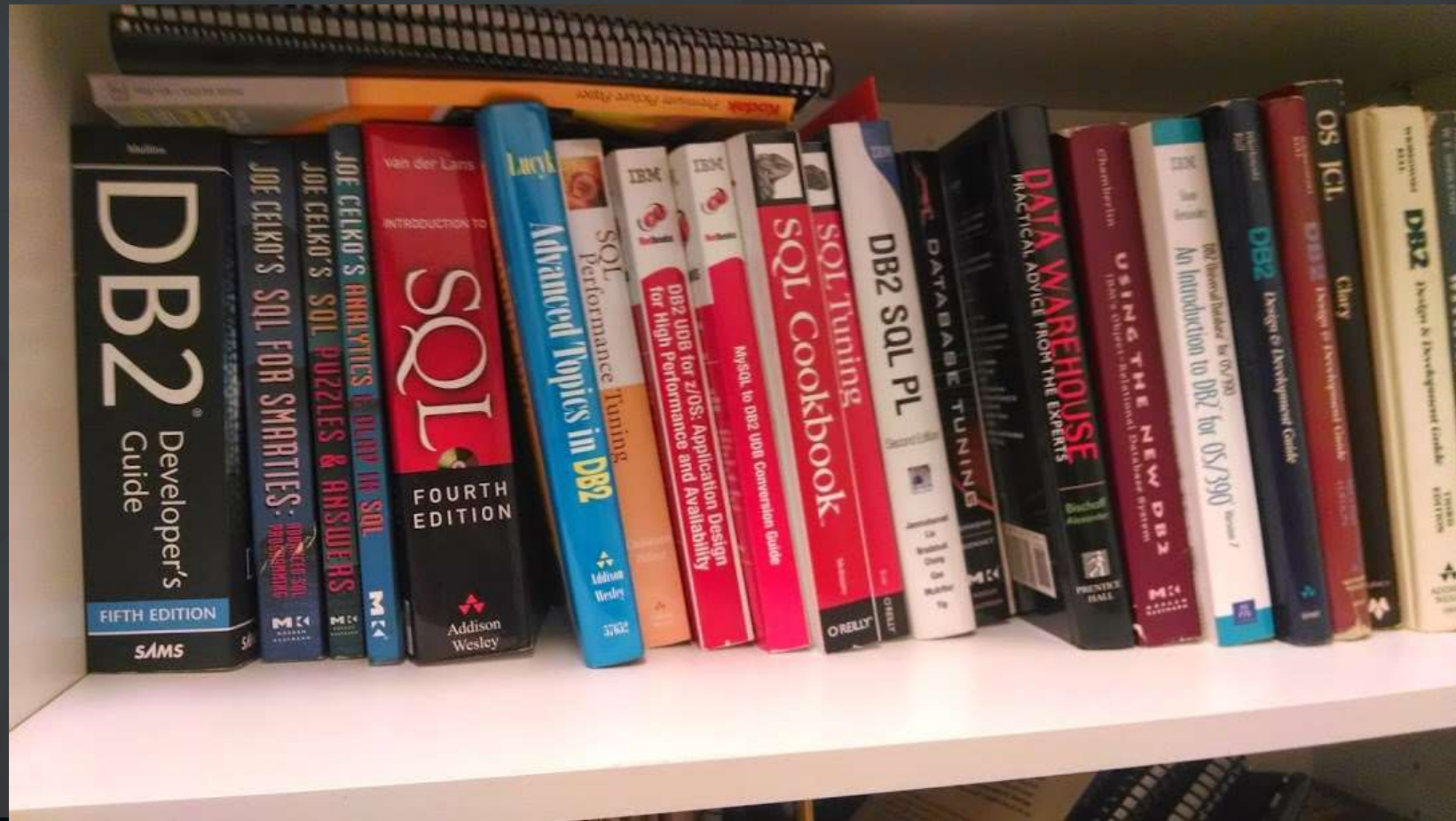
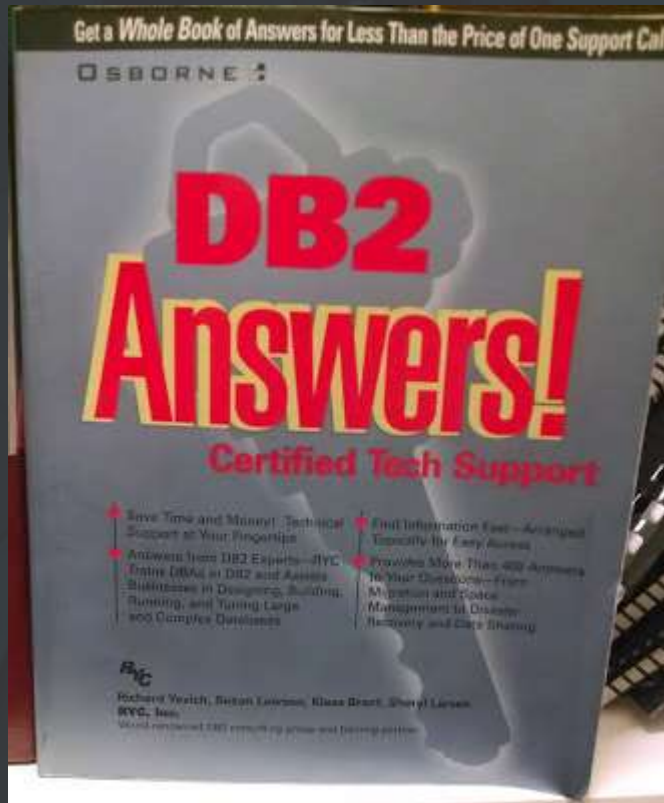
Wish List for SQL Performance Software

- Monitor workload impact with a light footprint
- Identify expensive queries
- Send alerts for degrading SQL
- Give smart REORG advice
- Give smart index advice
- Compare SQL **across a workload**
- Support a user interface for a new user

**For
the
Workload!**

Performance Advisors

Reorg, Index, and Exception Advice



Things Can Sneak Up on You

Interval Time ==> 01:00
40:53.05

Interval Elapsed ==>

-
D -Detail, E -Explain, G -Programs, P -Plans, Q -SQL, K -Keys, T -Table/Index

SQL_TEXT

CPUPCT

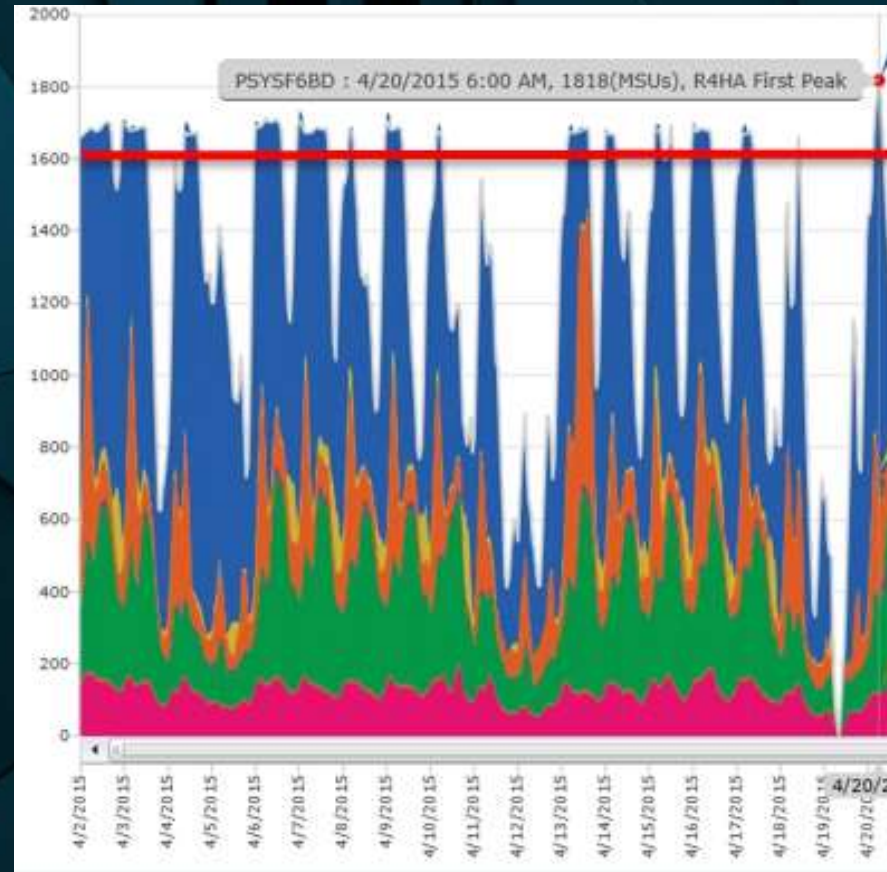
INDB2_TIME

INDB2_CPU

_ **SELECT COUNT (*)**

> 50.93% 00:39.988277 00:31.137233

Which Applications are Using CPU and Causing Wait?

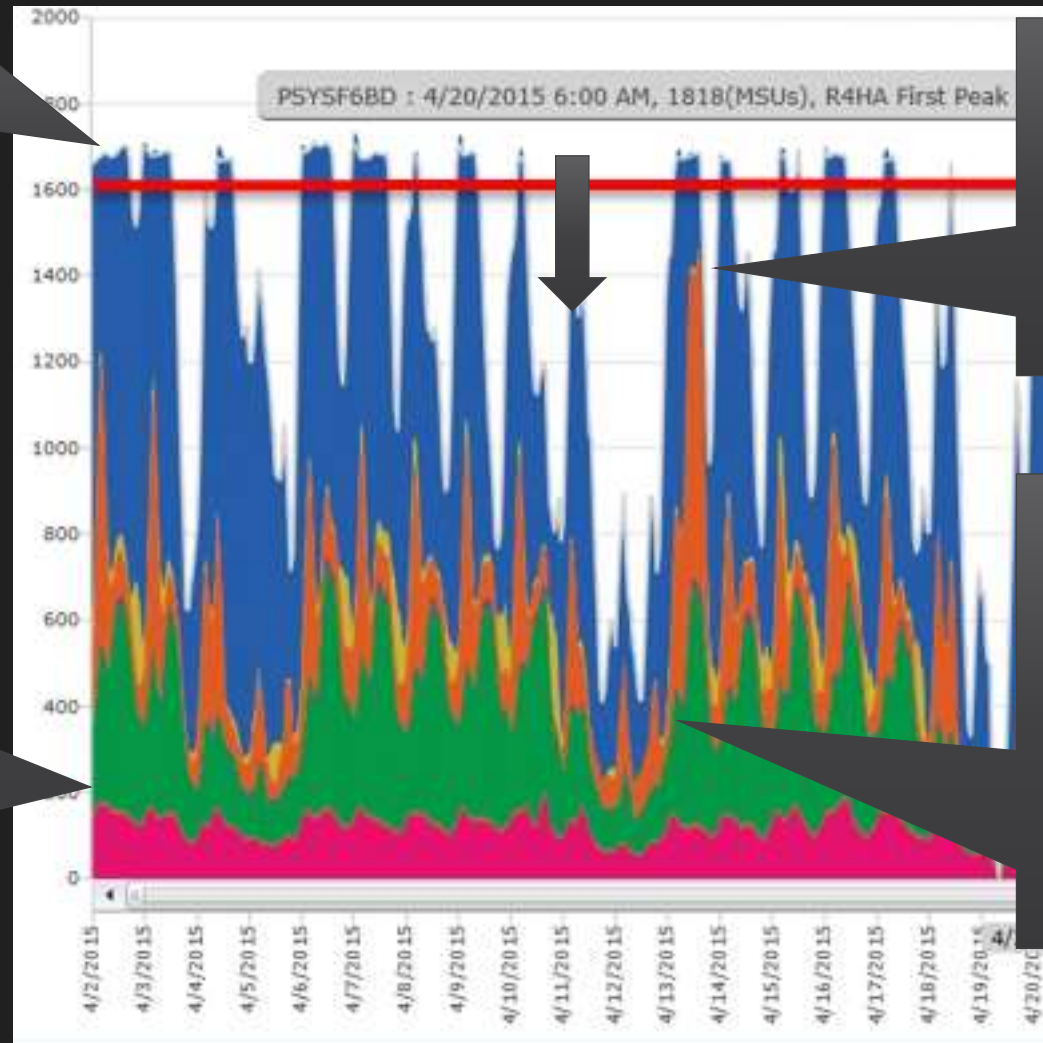


What are the Warning Signs?

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Optimized
DB2
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Reorg
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Reduced risk of bad
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Paths in the Peak

SQL
Performance
Advisors
Proactively
report
Degradation or
Failure

5 ways to make your SQL execute **Faster**

- ✓ Keep the data organization perfect
- ✓ Rewrite SQL
- ✓ Alter/change or add indexes
- ✓ Improve Catalog statistics
- ✓ Move the SQL to a quieter time

**For
the
Workload!**

Rewrite SQL

- Rewrite suspicious queries
- Promote Stage 2's if possible
COL NOT IN (K, S, T) = COL IN (known values)
- Verify Join conditions
UPPER(LTRIM(RTRIM(TM.LAST_CHNG_USER_ID))) =
UPPER(LTRIM(RTRIM(WU.USER_ID)))
- Should be: TM.LAST_CHNG_USER_ID = WU.USER_ID
- Prune SELECT lists
- Verify local filtering sequence

Add or Alter Indexes

- What if the optimizer started to favor many smaller indexes?

Runtime decision



177 Used Bentleys for sale

Clear All × Bentley × Used

- Location
60126
- Price
- New/Used
- Year
- Make
- Model
- Mileage



Used 2015 Bentley Continental GT
\$297,500 736mi
Black (ext) | Black (int)
8-Speed Automatic | AWD
[CarFax Report](#)



Used 2015 Bentley Continental GT W12 Speed
Convertible Executive Demo
\$229,999 17mi
Beluga (ext) | Beluga (int)
8-Speed Automatic w/OD | AWD
[Free CarFax Report](#)