Mainframe Application Performance Management is more imperative today with processor speeds approaching the 7 GHZ limit. Throwing hardware at performance issues is not enough anymore. Application response
times and runtimes need to be tuned to run as efficiently as possible and often times when it's DB2 in the application, most of the performance opportunities will be found there. Various CICS, Batch, and DDF DB2 Version 10 tuning opportunities will be examined; analyzing SQL Text, DB2 Access Paths, and the DB2 Catalog Objects involved.

* What on Mainframe 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

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
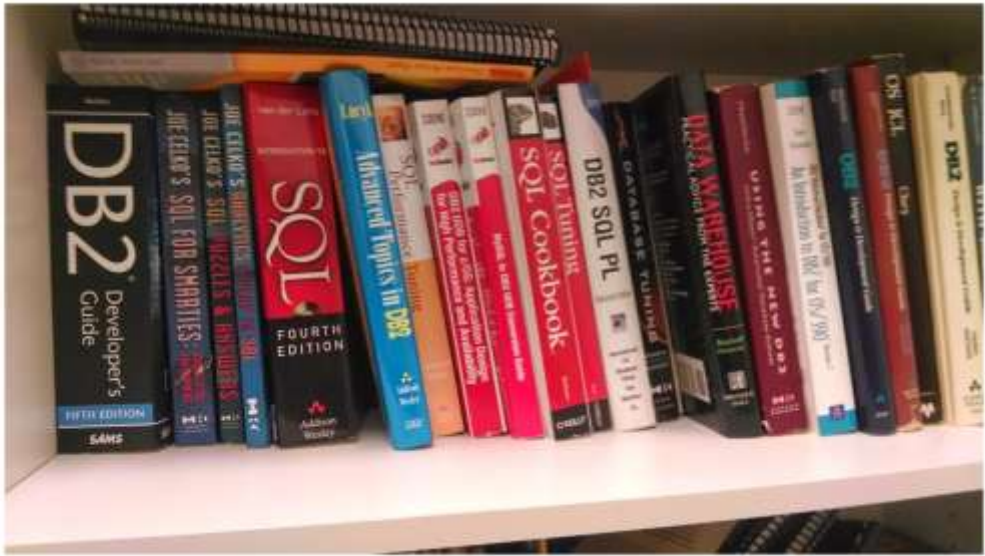7. Manage Risk
8. Empower your team to try new things

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Rob Violino – Information Management

Next Three Years Most Critical of All For Technology, Say CEOs – November 30, 2016

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

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

With this massive wave of data coming down on your system, the only way to be prepared like a true tidal wave is to have the warning early enough to be prepared, to build their seawall high enough to stop this. Once the wave crashes on you, there's really nothing you can do. Let's look at some of the effects of that if you're not prepared. Applications slow down, response time decreases, response time increases, the tools and your staff are under strain. Don't forget the tools that you're using to manage this new wave of data were designed 30 years ago when DB2 looked nothing like it does today. In Summary, your applications cost more and your customer satisfaction decline. Those are the two worst things that can happen to your business.

Destructive Forces can Erode your Efficiency

Bad SQL

Bad Access Paths

Missing these increases your costs

In addition to the data flood there can be internal destructive forces like bad SQL and Access Paths.

Consider DB2 developers (especially the ones coming from a distributed environment) as Tasmanian Devils. They code things like SELECT COUNT(*) just to see if DB2 is up and running before EVERY SQL statement. They code queries that access way more data than necessary. Most of the time they just don't know any better.

Consider typical DBA departments with reduced head count, explosive number of DB2 objects, object sizes, transaction rates, etc. They simply do not have enough time in one day to keep up with indexes for today's dynamic exploding workloads. How many SQL's does your company execute per day? A US wireless phone carrier runs through 150 BILLION SQL's (SELECT, INSERT, UPDATE, DELETE) a day!

!

Things Can Sneak Up on You

```
Interval Time ==> 01:00                    Interval Elapsed ==> 40:53.05
---------------------------------------------------------------------------
-

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
```

Objectives/Agenda for SQL Performance

- What Mainframe 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

- Monetizing savings with compares

What Mainframe Applications are Using CPU and Causing Wait?
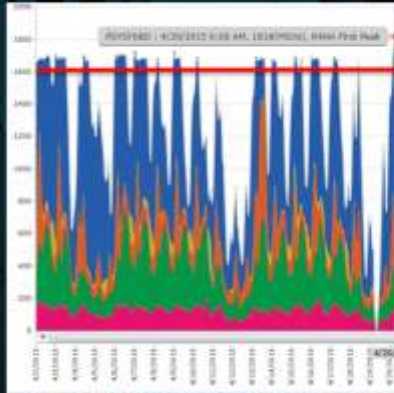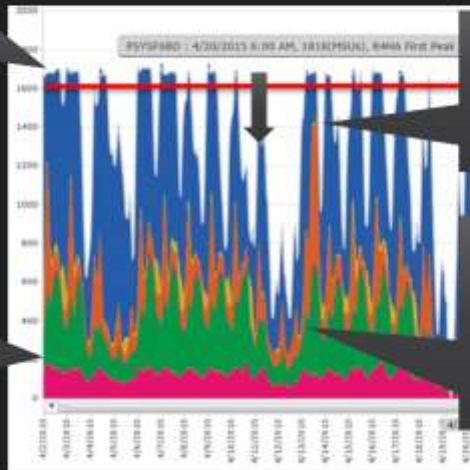
What are the Tidal Wave Warning Signs?

The only way to be prepared for this flood of data is to know where it is on the horizon. For some companies, it's already crashing down on them; for others, it's still a slow rumble out in the ocean.

If you do not have the tools that can help you respond you may go out of business.

DB2 Resource Optimization is the Key

Optimized DB2 databases

Reduced risk of bad SQL and Access Paths in the Peak

Reorg Advisors to Keep Data Perfect

SQL Performance Advisors Proactively report Degradation or Failure

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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!

"The Real World of the Database Administrator", Unisphere Research, March 2015

Thoughts:
Keeps your business on calm seas….
Helps your business master the sea….

Analyzing Online and DDF SQL for Optimal Response Times

COLID	PROGRAM	QUERYNO	NOTES	
E	DB2VRFRM	N/A	More popular than CIMB4500 and more GETPAGES Has the same problem as no current or future index can help this query. Needs new index	

Interval Date => 11/20/12   Interval Time => 07:00:00   Elapsed Time => 08:00

CREATE IXPANH10 ON TRFRMH A8
(FRT_DOB_DT ASC
, DIAG_CD_1 ASC
, PROV_TYP_CD ASC
, SUB_CONT_ID ASC)

Stage	Index	CARD	PREDICATES	Filter Factor
Match	1	10,624	FST_DOB_DT = '2012-01-01'	0.01
I	2	11,992	DIAG_CD_1 LIKE	0.01
I	3	821	PROV_TYP_CD <>	0.88
I	4	499,780	SUB_CONT_IDNOTIN	1.00

Buffer Manager Activity

GETPAGE	-> 33647744	GETPFAIL	-> 0
SYNCREAD	-> 621400	SPFETCH	-> 0
LPFETCH	-> 2	DYNPFETCH	-> 1666399
PFPAGES	-> 17872912	PAGEUPDT	-> 61806
IMWRITE	-> 0	FETCHED	-> 11232
INSERTED	-> 0	UPDATED	-> 0

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```sql
SELECT DISTINCT PAMH.SUB_CONT_ID, PAMH.PROV_TYP_CD, PAMH.MBR_NBR,
  PAMH.DCN_ID, PAMH.TOT_CHG_AMT, PAMH.TOT_ALWD_AMT, PAMH.TOT_PMNT_AMT,
  PAMH.DIAG_CD_1, PAMH.DIAG_CD_2, PAMH.DIAG_CD_3, PAMH.FST_DOS_DT,
  PAMH.PROC_DT, PAMH.CAUSE_CD, PRV.PROV_ID, PRV.PROV_CD, PRV.PROV_NM_T,
  PRV.ADDR_1_T, PRV.ADDR_2_T, PRV.PHN_NBR, PRV.PROV_IRS_ID, VWC.MKT_GRP_CD,
  COVD.EFF_DT, COVD.TERM_DT, EXD.CLM_STAT, VWC.POT_CD, SPC.PROV_SPCL_CD,
  SPC.PROV_SPCL_T
  FROM
        CIMP.TBPAMH AS PAMH LEFT OUTER JOIN CIMP.VWCCPMS0 AS VWC ON (PAMH.SUB_CONT_ID =
VWC.SUB_CONT_ID AND PAMH.MBR_NBR = VWC.MBR_NBR
    AND PAMH.DCN_ID = VWC.DCN_ID) LEFT OUTER JOIN CIMP.TBEXDESC AS EXD ON (EXD.CLIENT =
'03' AND PAMH.EX_CD = EXD.EX_CD) LEFT OUTER JOIN CIMP.TBPRVMST AS PRV ON (PAMH.PROV_ID =
PRV.PROV_ID AND PAMH.PROV_CD = PRV.PROV_CD) LEFT OUTER JOIN CIMP.TBSBCOV AS COV ON
(PAMH.SUB_CONT_ID = COV.SUB_CONT_ID) LEFT OUTER JOIN CIMP.TBSBCOVD AS COVD ON
(COV.SUB_CONT_ID = COVD.SUB_CONT_ID) LEFT OUTER JOIN CIMP.TBPRVTCD AS TCD ON
(TCD.PROV_TYP_CD = PRV.PROV_TYP_CD) LEFT OUTER JOIN CIMP.TBSPCLCD AS SPC ON
(SPC.PROV_SPCL_CD = PRV.PROV_SPCL_CD AND SPC.PROV_TYP_ID = TCD.PROV_TYP_ID)
WHERE COVD.TERM_DT >= '2012-11-20' AND COVD.TERM_DT <> COVD.EFF_DT
    AND PAMH.FST_DOS_DT >= '2012-01-01'
    AND VWC.MKT_GRP_CD IN ('C0', 'C1', 'C2', 'C3', 'C4', 'C5', 'C6', 'C7',
  'C8', 'C9')
    AND ((PAMH.DIAG_CD_1 LIKE ('493%')) OR (PAMH.DIAG_CD_1 LIKE ('465%'))
    OR (PAMH.DIAG_CD_1 LIKE ('466%')) OR (PAMH.DIAG_CD_1 LIKE ('487%'))
    OR (PAMH.DIAG_CD_1 LIKE ('786%')) OR (PAMH.DIAG_CD_1 LIKE ('480%'))
```

Center

Investigating DB2 Batch Jobs to Reduce Overall Runtimes

– we found a *SINGLE job which was costing 7% of their monthly MLC*!

– traced this back to a *single individual* (lovely lady) who had NO idea her queries were driving up the MLC peak by 7%.

– we found a *SINGLE job which was costing 10% of their monthly MLC*!

– delayed the job 3 hours and reduced the MLC by 10% reducing the MLC bill by $10,000/month

Exploring Access Path Efficiency by Examining the EXPLAIN

COLLID	PROGRAM	QUERYNO	NOTES	
			Query did 8 million GETPAGES in 4 executions on TB_BAD_ADDR. Data Studio showed misleading filter factors. Verified Detector is telling the truth by running 2 queries.	
			The Cache verifies Detector's output for those expensive queries.	
			Needs a new index on TB_BAD_ADDR and Histogram statistics.	
			Rewrote query to use EXISTS subquery	
			Rewrote again to use a table expression	
M		1177380	Rewrote again to only return a flag	Y

TB_BAD_ADDR Query has Misleading Stats
Update: 26 s: 177 ms original query run time
499 ms Query rewrite run time with the new index
78 ms Query rewrite run time with a table expression
16 ms Query rewrite run time to only return a flag

Access Path Analysis

Code Analysis

```
DOC.ML_DOC_TYP_CD = ADDR.ML_DOC_TYP
CIMP.TB_RTN_RSN_CD RSN ON RSN.ML_DT
INNER JOIN CIMP.TB_MBR_ID MBR ON MB
MBR.MBR_NBR = 'OO' INNER JOIN CIMP.
ADDR.GRP_ID = GRP_WHO.GRP_ID AND GR
'9999-12-31' INNER JOIN CIMP.TB_GRP
ADDR.GRP_ID INNER JOIN CIMP.TB_SUB_
ADDR.SUB_ID AND SUB.GRP_ID = ADDR.G
WHERE ADDR.ADDR_RSLV_FL = 'N' AND SUB.SUB
SELECT MAX ( XSUB.SUB_CONT_TERM_DT )
FROM CIMP.TB_SUB_CONT XSUB
WHERE XSUB.SUB_ID = ADDR.SUB_ID AND XSUB.
SUB.SUB_CONT_TERM_DT > ( CURRENT DA
ADDR.GRP_ID IN (
SELECT XGRP.GRP_ID
FROM CIMP.TB_GRP_ELEC_ONLY XGRP
WHERE XGRP.EMPR_ID = 17469 )
-- FETCH FIRST 1 ROW ONLY FOR READ ONLY
```

```sql
SELECT 'Y'
FROM
    CIMP.TB_BAD_ADDR ADDR
    INNER JOIN CIMP.TB_GRP_ELEC_ONLY XGRP
                    ON XGRP.GRP_ID = ADDR.GRP_ID
    INNER JOIN CIMP.TB_SUB_CONT SUB
                    ON SUB.SUB_ID = ADDR.SUB_ID
                    AND SUB.GRP_ID = ADDR.GRP_ID
WHERE
    ADDR.ADDR_RSLV_FL = 'N'
    AND
    XGRP.EMPR_ID = 17469
    AND
    (SUB.SUB_CONT_TERM_DT > (CURRENT DATE - 90 DAYS))
    FETCH FIRST 1 ROW ONLY
    FOR READ ONLY        ;
```

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Scrutinizing Information Contained in the DB2 Catalog
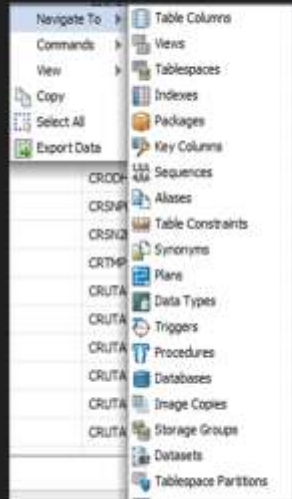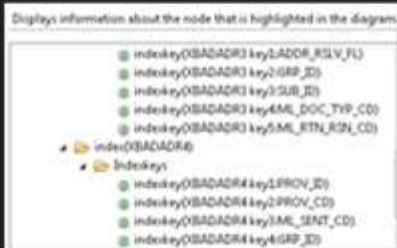
Monetize your savings with compares

Before and After

1. A REORG
2. Any SQL change
3. Any access path change
4. Any index change

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Future Proof Your SQL Performance

- Monitor workload impact with a light footprint
- Identify expensive queries, not the highest CPU
- Send alerts for degrading SQL day or night
- Get smart REORG advice
- Get smart index advice
- Track access path changes from migrations to new applications or DB2 upgrades across a workload
- Have many dashboards to enable a broader user audience

Wish list if you were starting from scratch
Master the waves…..for competitive advantage

FOR THE ECONOMIC BUYER

Thoughts:
Keeps your business on calm seas….
Helps your business master the sea….

ABOUT BMC

BMC is a global leader in software solutions that help IT transform traditional businesses into digital enterprises for the ultimate competitive advantage.

Our Digital Enterprise Management set of IT solutions is designed to make digital business fast, seamless, and optimized. From mainframe to mobile to cloud and beyond, we pair high-speed digital innovation with robust IT industrialization—allowing our customers to provide intuitive user experiences with optimized performance, cost, compliance, and productivity. BMC solutions serve more than 15,000 customers worldwide including 82 percent of the Fortune 500®.