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Managing SQL Performance with BMC Software

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Business issues

DB2 for z/OS is the premier IBM database management system for mainframe processing. DB2 performance is always a hot topic at conferences and user groups. Many software products have been written to address various aspects of DB2 system and application performance issues, ranging from performance monitors to software designed to analyze and recommend changes to the environment. Consultants and experts are regularly engaged in projects to tune the DB2 system and applications.

Because more DB2 data is being processed, there is more performance data to manage. As such, it is increasingly difficult to identify and isolate a performance problem.

As the business demands higher availability from mainframe DB2 applications (for example, for web front-ends to legacy DB2 databases), optimal performance is required. You need a unified way to provide a comprehensive picture of performance and availability, and to meet increasingly aggressive SLAs.

DB2 experts and CPU resources are scarce. You cannot afford to waste CPU cycles on unnecessary maintenance or on poorly performing SQL. And you cannot afford to have DB2 experts chasing down problems. You need tools that help improve performance and reduce costs.

Why tune SQL?

A general rule of thumb is that 80% of the benefits of tuning efforts can be achieved by analyzing and tuning the SQL statements in an application. A good overview of SQL tuning can be found here:

<http://documents.bmc.com/products/documents/50/83/65083/65083.pdf>

Although written in 2004, it is still a timely overview of the SQL Performance topic.

BMC SQL Performance for DB2

The BMC SQL Performance for DB2 solution enables DBAs, application developers, and system programmers to identify and correct performance problems in DB2 applications that run in z/OS environments. This solution is the answer to the ongoing quest for optimal application efficiency. BMC SQL Performance for DB2 provides a unique set of tools that allow an application to be fine-tuned through its conception and growth, to its retirement.

The BMC SQL Performance for DB2 solution provides the following benefits:

- > solves application performance problems by quickly identifying the most expensive SQL statements and making tuning recommendations
- > avoids application performance problems by proactively correcting problems before an application reaches production
- > increases programmer productivity and efficiency by providing both analysis of access paths and easy-to-use tuning tools
- > quickly and easily pinpoints resource-consuming SQL statements without executing a DB2 SQL trace
- > provides in-depth index optimization recommendations, including identification of unused indexes and "What-If Index" analysis

BMC SQL Performance for DB2 is composed of existing products with additional technology components. The integrated products and components are:

- > BMC APPTUNE for DB2 (a product also available stand alone)
- > BMC SQL Explorer for DB2 (a product also available stand alone)
- > Index Component (a technology feature only available with the solution license)
- > Workload Access Path Compare (a technology feature only available with the solution license)
- > Performance Advisor (a technology feature only available with the solution license)
- > Several additional features

BMC APPTUNE for DB2

BMC APPTUNE for DB2 is an application performance and resource analysis product that gathers and displays data from a single SQL statement or a set of SQL statements. The gathered data provides valuable information about the performance of SQL statements and resource usage by DB2 applications. BMC APPTUNE for DB2 collects all relevant performance measurements in real time for every SQL statement executed in one or more DB2 subsystems. The collected data is summarized and stored for analysis.

BMC SQL Explorer for DB2

BMC SQL Explorer for DB2 is an SQL analysis tool that you can use to proactively manage performance problems. With BMC SQL Explorer for DB2, you can quickly and easily analyze SQL statements and database structures to optimize the performance of applications—before and after the applications are put into production.

Index component

The Index component automatically collects and displays actual access counts for each unique SQL statement (table and index, and predicate usage frequencies). A “what-if” index analysis lets you model changes to indexes. The Index Component provides on-demand, dynamic data collection of index dependencies and catalog statistics. Table and index reports provide quick access to listings of the most-used object based on GETPAGE volume or ratio.

The Index component extends the capability of BMC APPTUNE for DB2 object analysis by collecting and reporting on column usage data for SQL statements. It also extends the capability of the Explain function by comparing access paths after making “what if” changes to indexes in a cloned database.

The Index component provides a way to obtain accurate, real-time performance information about DB2 indexes. Because the Index component presents data at the object level, you can review the index access data to evaluate the performance of your indexes and identify candidates for index improvements.

The “what if” index analysis feature simulates the effects of adding, dropping, or updating statistics for an index via use of cloned structures. You can save the DDL for “what if” index changes to a data set, and then import another statement to see the effects of the changes on that statement. The “what if” index process is cumulative, so incremental changes followed by Explains enable you to see the effects of each change.

Workload Access Path Compare

The Workload Access Path Compare capability allows you to define a set of SQL statements to analyze for access path changes within or between DB2 systems. The input to the Extract step can be a DBRMLIB, the DB2 catalog, or archive trace data sets. The results of the Explains are compared, and any differences are noted and highlighted. This capability can be particularly effective when migrating from one version of DB2 to the next. For example, migrating from DB2 version 8 to DB2 9 could have a significant impact on your systems because of unforeseen access path changes.

The Workload Access Path Compare function provides a set of ISPF panels that identify the plans, packages, DBRMs, and COLIDs that are to be compared. An extract process takes input from any of several sources (including the DB2 Catalog, DBRMLIBs, and BMC APPTUNE for DB2 trace data sets), and the resulting files are processed with an Explain execution. The resultant access paths are compared and differences are highlighted. You can compare static and dynamic SQL.

Workload Interval Analysis Compare

The Workload Interval Analysis Compare function enables you to compare the performance metrics of the application from trace data from two or more points in time. Comparison can be made at the plan, package, or statement number level to detect performance changes over time.

Performance Advisor technology

Advisors turn data into information and information into action. Performance Advisor technology enables exploitation of a performance management database (PMDB). The PMDB can contain statement and object performance data collected by

- > BMC APPTUNE for DB2
- > errors, exceptions, SQL text, and index usage patterns as seen by BMC APPTUNE for DB2
- > daily snapshots of real-time statistics (RTS) collected by DB2 itself
- > the results of analyses that provide recommendations to improve your system and application performance.

You can use the BMC APPTUNE for DB2 and RTS data to identify performance trends, compare recent performance against a baseline, identify usage patterns, and to generate recommendations for improved performance.

Performance Management Database (PMDB)

The PMDB is a set of tables maintained in DB2. You can maintain a localized PMDB at each location (DB2 subsystem or data-sharing group) where data is collected, or a centralized PMDB at one central location.

The PMDB tables can be queried to discover interesting information such as which indexes are not being used, or what objects are being touched by which users or statements. Several sample reports are provided in the SQL Performance documentation.

Reorg Advisor

The Reorg Advisor identifies potential candidate objects for REORG, based on two criteria:

- > the level of disorganization of the object
- > the level of performance degradation for the object since the last REORG occurred.

To arrive at these recommendations, the advisor uses data from the daily real-time statistics tables (BMCTABLESPACESTATS and BMCINDEXSPACESTATS), and the daily object statistics table (DAILY_OBJ_STATISTICS). The candidate objects are listed in the output of the advisor and also maintained in the REORG_CANDIDATE_TABLE. In this table, the DISORGANIZED column indicates whether an object is considered to be disorganized, and the REORG_CANDIDATE column indicates whether a disorganized object also meets the performance degradation criteria to be considered a candidate for reorganization.

Additional features

BMC SQL Performance for DB2 provides additional solution-level features to improve SQL performance.

Complete SQL capture

The Complete SQL capture feature enables you to capture data for each SQL statement (OPEN, FETCH, CLOSE, and so on) executed during a collection period. BMC SQL Performance for DB2 provides the information needed to tune application performance, while Explain-based products provide only part of the information needed.

SQL-level statistics

Using SQL Performance, you can obtain statistics and data at the SQL statement level about accounting, buffer, I/O, and lock activities. This feature provides you with the information needed to identify a costly SQL statement quickly and to undertake effective tuning.

Application groups and application profiles

You can define the plans, programs, and users that make up an application group (using your own criteria) and the application groups that make up an application profile. You can define application groups and application profiles by each user or at the system level. Public access to an application group can be limited to NONE, READ, or UPDATE. This allows you to create collections of plans, programs, users, correlation IDs, or a combination of these elements in groups that you want to analyze for application performance.

IN-SQL measurement

To find the most accurate data for measuring the cost of an SQL statement, you can measure only the resources consumed during the execution of an SQL statement. IN-SQL measurements exclude the time spent on associated DB2 housekeeping tasks. Measurements based on IN-DB2 time are less accurate and might not reflect the actual cost of an SQL statement.

Intuitive interface

BMC SQL Performance for DB2 has a highly intuitive user interface that conforms to ISPF standards and includes a comprehensive online Help facility. You can use the product with unparalleled ease and minimal supporting documentation.

Explain function

You can Explain dynamic and static SQL statements, providing both statistical and textual information about the access path, with suggestions on how to improve SQL statement performance.

SQL Error Reporting

You can identify SQL errors and view the corresponding SQLCA data and SQL text. Using BMC SQL Performance for DB2, you can capture SQL error data automatically without having to change existing programs, and to determine which errors occurred when and to whom.

DB2 current status

BMC SQL Performance for DB2 can display current information about a DB2 subsystem and active threads quickly and easily. From an active thread, you can also zoom down to the text of the SQL statement currently executing and Explain it, if needed. This feature is very helpful for diagnosing a system-level problem, such as a long-running transaction or batch job.

Object reports

You can collect and analyze information about access, usage, and response times for DB2 buffer pools, databases, page sets, tables, and indexes.

Analysis of dynamic SQL from trace data sets

This feature is useful when you plan to migrate to a different version of DB2 and want to find out how your existing data will perform, or when you want to Explain and Compare the access paths for dynamic SQL from subsystems running on different versions of DB2.

Support for static and dynamic SQL

BMC SQL Performance for DB2 captures performance data for both static and dynamic SQL statements and enables you to view both as a single workload. You can capture data for all SQL statements—including dynamic SQL statements that usually cannot be captured—to determine the tuning needs of applications and users.

Dynamic Statement Cache

The dynamic statement cache provides a general picture of dynamic statement cache performance at a low cost.

Analysis criteria

You can specify the time period, DB2 subsystems, and data source (archived data or online data) used to generate online or batch reports. This feature allows you to exclude unnecessary information from generated reports, include real-time data as needed, analyze historical data, and choose a report format that best suits your needs.

Graphical data reporting option

You can choose whether reports are displayed in a traditional, numeric format or a graphical format.

Variable and fixed length collection intervals

You can establish a set interval for data collection and vary this interval as needed (for problem diagnosis, for example).

Trace data set archiving

You can perform a comprehensive historical analysis for a specified period of time.

Archive directory

BMC SQL Performance for DB2 can provide a list of all archived data sets and the IFCIDs they contain. Using this feature, you can find the DB2 and the time period that you want to examine. Then you can see which archived data sets have records for that DB2 subsystem and time period and use them as the source for your batch report request.

SQL export function

You can export SQL statement data for additional processing with a third-party analysis tool. It provides additional compatibility between BMC SQL Performance for DB2 and analysis tools from other vendors, extending your existing investment in software and training.

Product compatibility

BMC SQL Performance for DB2 works with the following BMC Software products and solutions to perform common functions:

- > BMC System Performance for DB2
 - BMC MAINVIEW for DB2
 - BMC OPERTUNE for DB2
 - BMC Pool Advisor for DB2
- > BMC CATALOG MANAGER for DB2
- > BMC DASD MANAGER for DB2

Support for multiple DB2 subsystems

You can analyze all of the DB2 subsystems across the sysplex where BMC SQL Performance for DB2 is installed, or you can support BMC SQL Performance for DB2 from a single data collector. You can have concurrent access to multiple DB2 subsystems and work with multiple BMC Software products using only one started task.

Fully functional administrative facility

You can define data collector parameters and user privileges completely. If multiple instances of BMC SQL Performance for DB2 and/or BMC System Performance for DB2 are installed, you can control all products from one console.

Use Cases

You can use BMC SQL Performance for DB2 to improve performance in a wide range of areas.

Wasted reorganizations

Today, you may reorganize application objects based on a schedule, or you may analyze statistics and reorganize when certain thresholds are reached. However, for some types of workload, even a “disorganized” object doesn’t degrade application performance because of the nature of the workload. The Reorg Advisor will identify objects that are both disorganized *and* experiencing performance degradation. These objects are loaded into a REORG_CANDIDATE_TABLE. You can trigger a reorganization process only for those objects that will benefit from reorganization. More importantly you can avoid scheduling reorganizations for objects that would not benefit, saving a lot of wasted CPU time in the process.

Wasted indexes

Over years of service and versions of DB2, many applications have acquired multiple indexes. It is not uncommon for some tables to have 3-6 indexes. Due to changes in the optimizer logic over time, some of these indexes may have become obsolete. With the SQL Performance PMDB, you can easily identify those indexes that have not been used in some period of time.

For instance, the query:

```
SELECT DBNAME, OBNAME, PARTITN
FROM BMCSTWR.INDEX_USAGE
WHERE READTM IS NULL
OR READTM < CURRENT_TIMESTAMP - 90
DAYS;
```

would result in a list of indexes that have not been read with SELECT in the last 90 days. You may be able to DROP these indexes if they are not used to enforce UNIQUE, CLUSTER, or primary/foreign key relationships.

Dropping these indexes will result in an immediate CPU performance benefit to every INSERT and DELETE on the table, and also to UPDATE to the columns that were in the dropped index.

Inefficient access paths

SQL and the DB2 optimizer have evolved into very complicated technologies. It is easy for even an experienced SQL user to code a statement that results in inefficient performance. The result set is correct, but the amount of work being done to derive it can consume (waste) a lot of processing time. Using “what if” index analysis, you can see the benefit (in CPU savings) of changing or adding a new index to an application and see a relative cost number for comparison on the CPU savings.

Access path conversion due to migration

Many users have been surprised by changes in access paths due to migrating to new versions of DB2. The Workload Compare capability allows you to Explain the statements *before* doing the REBINDs, so you can discover (and mitigate) poor performing access paths before migration. This can result in significant reduction of wasted CPU cycles in the new version.

Degrading I/O performance

Monitors see what is happening in real time. However, they don't do a good job of letting you know that performance is degrading over time. Using the data in the PMDB, you can identify objects that are degrading, but may not yet have reached a point where they have become a problem. Identifying such degrading objects early allows you to manage and tune the object, resulting in improved performance and reducing wasted resources.

For instance, this query:

```
SELECT INTVTIME, DBNAME, OBNAME, PARTITN,
CASE WHEN SYNCIO=0 THEN GETPAGES
ELSE GETPAGES/SYNCIO
END AS "GETPAGES PER SYNCIO"
FROM BMCSTWR.DAILY_OBJ_STATISTICS
ORDER BY DBNAME, OBNAME, PARTITN,
INTVTIME;
```

would list GETPAGEs and I/Os for a set of objects over time, allowing you to identify those objects with degrading performance.

Baseline Compare

If you are notified that users are experiencing bad performance, you can use BMC APPTUNE for DB2 to identify a particular static SQL statement. To see how different the execution performance is to the last time it ran, you can use the Interval Analysis Compare feature online (or in batch). To see the access path difference, you can identify the package as the input to Workload Access Path Compare and then compare it to the baseline version.

Futures

Performance Advisor technology and the PMDB provide building blocks to consolidate information from many places for analysis. BMC Software sees opportunities for automation and data integration between solutions that will allow you to make more informed decisions regarding your SQL, system, and database performance requirements, and support the increasing complicated DB2 environment more efficiently.



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BMC Software delivers the solutions IT needs to increase business value through better management of technology and IT processes. Our industry-leading Business Service Management solutions help you reduce cost, lower the risk of business disruption, and benefit from an IT infrastructure built to support business growth and flexibility. Only BMC provides best-practice IT processes, automated technology management, and award-winning BMC Atrium technologies that offer a shared view into how IT services support business priorities. Known for enterprise solutions that span mainframe, distributed systems, and end-user devices, BMC also delivers solutions that address the unique challenges of the midsized business. Founded in 1980, BMC has offices worldwide and fiscal 2008 revenues of \$1.73 billion. Activate your business with the power of IT. www.bmc.com.

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