Zen and the Art of IMS Database Maintenance
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THE EVOLUTION OF IMS

In his famous book Zen and the Art of Motorcycle Maintenance, author Robert M. Pirsig compared the structure of a motorcycle to the hierarchy that is the basic structure of society.

When humans developed the technology to fly to the moon, IBM built a hierarchical database management system - IMS - to support the space flight. The structure and hierarchy that IMS depends on made it possible to track the thousands of parts needed to build the rockets.

More than 40 years have passed since IMS was first delivered, and much has changed in that time. But some things never change: the moon is still in the sky, and IMS is still at the heart of data centers. And IMS DBAs are still the smartest people in the data center - they understood how to maintain IMS for optimal performance. But just as IMS matures, the DBAs who manage it mature. Some day, perhaps in the near future, those DBAs will retire. Who will learn IMS and manage the critical applications your organization depends on?

TIMES HAVE CHANGED

In the early days of data processing, data centers had large staffs and relatively few databases. Because availability needs were limited to 8:00 a.m. to 5:00 on weekdays, DBAs had plenty of time to maintain (reorganize) databases for optimal performance. DBAs had time to inspect pointer checker and DASD reports every week, analyzing how to improve performance and reduce the outages required for reorganization.

Managing IMS databases has become more complex with the introduction of Fast Path DEDBs and High Availability Large Databases (HALDBs). IMS DBAs manage more databases than ever, with higher availability requirements. Unplanned outages are unacceptable.

Web-enablement has breathed new life into legacy IMS data, but web-enablement brings even higher requirements for availability and performance. We depend on IMS in our day-to-day lives:

- When we do an ATM transaction, we expect to get our money quickly.
- When we make an airline reservation, we expect a quick response.
- When we ship a package, we expect it to arrive on time and we want to be able to track it along the way.

Without fast and efficient IMS data and applications, your customers would move on to another bank, airline, or shipper… and you cannot afford for that to happen. In today’s economic environment, every penny counts and IMS can help you increase those pennies.

WHAT COMES NEXT?

IMS data is growing, IT budgets are shrinking, and IMS experts are retiring. Who will maintain your critical IMS data? How can they do it efficiently? How can you ensure that your IMS databases are performing optimally when your customers need them?

You need tools that make it easy to manage your complex IMS environments. At some point, new DBAs must learn how to manage IMS. This next generation of IMS DBAs grew up with easy-to-use graphical user interfaces and intuitive tools. To ensure a fast learning curve for the new DBAs—and to ensure the long-term viability of your IMS environment—you need tools that:

- Simplify IMS maintenance
- Gather information about your databases and environment and proactively predict database problems
- Recommend the best course of action for preventing or correcting detected problems
- Tell you which databases need maintenance—and when
- Handle all of the database types you use—full-function (including HALDB) and Fast Path

One of the most important jobs for an IMS DBA is reorganizing databases to ensure optimal performance. But reorganizations are not inherently easy. Batch windows are shrinking, and reorganizations cannot be
completed in the early morning weekend hours. IT organizations cannot afford the downtime or CPU time associated with unnecessary reorganizations.

REORGANIZATION: A NECESSARY EVIL

IMS databases can have a significant impact on the overall performance and usability of critical business applications. Databases must be reorganized to ensure acceptable performance, to modify the database schema, and to reclaim physical disk space. In a hierarchy, everything has a defined order. Hierarchical (IMS) databases provide the best performance when the data is organized and in order.

When you initially load a database, you have the information in the order you need to ensure fast application processing. However, as information is added, updated and deleted, the database becomes physically disorganized, decreasing operating efficiency. More I/O operations are needed to retrieve a segment and its dependents when they are physically disorganized than when they are physically adjacent to one another. More I/O operations cause slower response times and more CPU processing.

During a physical reorganization, each root segment is placed with its dependent segments into one block (or adjacent blocks) so that fewer I/O operations are needed to retrieve the root and its dependents. Any secondary indexes for the reorganized database must be rebuilt, and logical relationship pointers between databases must be resolved and updated.

A structure change, such as adding or deleting segment types, is also a reason for reorganizing a database.

Reorganization can be painful for a number of reasons:

- With traditional reorganization utilities, data is not available during the reorganization. This means lost revenue as well as lost productivity for your employees.
- Several different utilities are required. The traditional reorganization process is cumbersome.
- The lack of IMS expertise in many IT centers causes reorganizations to be executed incorrectly or not at all.

You could take a Zen-like approach to database reorganizations: realize that no matter how organized a database is just after a reorganization, it will become disorganized over time. Every application update has the potential to move data and degrade performance. You know that you must reorganize, but how do you want to do it? Do you want to step through a manual process, or would you prefer to let an intelligent, automated solution do the work for you?
TRADITIONAL DATABASE MAINTENANCE CYCLE

The database maintenance cycle has basically remained constant since IMS was introduced. Figure 1 shows the general processes in this cycle.

Figure 1: Traditional database maintenance cycle

You can refine this cycle by employing tools and techniques to improve the reliability, usability, and performance of these processes and their related tasks, while reducing resource usage. However, when the related tasks are performed with traditional tools and techniques, they are unavoidably time-consuming, difficult, and burdensome. BMC MAXM Database Advisor for IMS automates the database maintenance cycle to reduce the time, effort, and skill that are required for related tasks.

PLAN PROCESS

The traditional Plan process involves researching and making decisions about the tools and techniques that you will use to implement your maintenance strategy. The ideal approach is to determine which tasks and goals are necessary and then to find the tools that are best designed to help you carry out your plan.

You must examine the techniques to use for the Gather, Analyze, and Execute processes of your strategy. Key considerations may include identifying the specific data elements that you must collect about your environment and databases, formulating a method of analysis, developing a monitoring schedule, and designing a system of rules that tell you when and how to react to the analysis.

GATHER PROCESS

The traditional Gather process involves collecting and managing information about your environment and databases. You must build and run the jobs to collect data. You also must manage the storage of the data that is gathered, which includes performing regular backups, purging data according to established retention schedules, and recovering data when necessary.
The Gather process provides all information on which you base your analysis. You must collect key elements about the state of each database. You need to know about any events that occurred in your system that may affect the databases. While you must ensure that the data which is gathered is current, you also need historical details about your databases. Using the historical details, you can identify and chart data trends.

**ANALYZE PROCESS**

The traditional Analyze process involves organizing and interpreting the gathered data. You must process the data into meaningful and manageable reports. You must build and run jobs to generate the reports. Finally, you must read, compare, and interpret the reports.

The Analyze process identifies problems with your databases. Because it would be impractical, if not impossible, to review reports for thousands of databases manually, the Analyze process must be efficient and consistent. You need a method of analysis that pinpoints specific database problems and delivers repeatable results.

**EXECUTE PROCESS**

The traditional Execute process involves taking action to correct problems that were found during the analysis. You must decide which solutions to execute and then build and run the jobs. You also must monitor the jobs and review job output.

The Execute process is important because the overall health and performance of your databases depend on taking the appropriate action at the appropriate time. Because you must limit the frequency and duration of taking databases offline, the Execute process must use resources economically. You must execute solutions that correct as many problems as possible with as few resources as possible.

**REPEAT ALL PROCESSES**

Database administration processes are cyclical. When solutions have been executed to correct problems that were reported by the analysis, the cycle begins anew. You must collect current data, analyze the data to identify problems, and then execute the appropriate solutions to correct those problems. To implement your database administration strategy, you may also have to assess and modify the plans that you made.

**BMC MAXM DATABASE ADVISOR FOR IMS DATABASE MAINTENANCE CYCLE**

BMC MAXM Database Advisor for IMS handles reorganizations differently than any other product or process. BMC MAXM Database Advisor for IMS automates full-function, HALDB, and Fast Path reorganizations, reorganizes databases only when they need to be reorganized, and frees DBAs to work on mission-critical processes and problems.

Under this new paradigm, the database maintenance cycle is shortened and automated. Because BMC MAXM Database Advisor for IMS intelligently manages the reorganization cycle, DBAs can focus on more critical IMS processing.

BMC Software has refined and automated the basic processes of the general database maintenance cycle to provide a robust database maintenance solution. BMC MAXM Database Advisor for IMS provides a complete, integrated solution that directs and automates the database maintenance cycle.

Figure 2 shows the BMC MAXM Database Advisor for IMS database maintenance cycle.
BMC MAXM Database Advisor for IMS uses state-of-the-art techniques to:

- Gather information about your databases and environment
- Proactively predict database problems
- Recommend the best course of action for preventing or correcting detected problems

You interact with BMC MAXM Database Advisor for IMS through a convenient Windows-based user interface that is included with the product.

**CONFIGURE PROCESS**

The Configure process replaces the Plan process in your general database maintenance cycle. Instead of spending countless hours and resources planning a strategy, you can implement BMC MAXM Database Advisor for IMS with little preparation, and the product starts working immediately.

The Configure process identifies your IMS systems and populates the systems with groups and databases. BMC MAXM Database Advisor for IMS automates configuration activities through automated discovery techniques. The Configure process also tailors parameters that are used to control other processes.

BMC MAXM Database Advisor for IMS stores configuration information and customized parameter values in self-managing repositories that require minimal administration.

**GATHER PROCESS**

The Gather process automates collection, storage, and management of data about your databases and environment. BMC MAXM Database Advisor for IMS stores gathered data in self-managing repositories. During the Gather process, BMC MAXM Database Advisor for IMS collects key indicators of database performance and space usage. This data is evaluated during the Analyze process. BMC MAXM Database Advisor for IMS collects data only when necessary, such as when the state of a database has changed or when an event that may have affected your databases has occurred in your environment.
ANALYZE PROCESS

The Analyze process uses the key database performance and space indicators that BMC MAXM Database Advisor for IMS collected during the Gather process to detect database problems and to predict them proactively. The Analyze process is initiated to execute automatically after any new data has been collected about your databases.

The Analyze process uses base values, current state values, and threshold values to identify and predict database problems. Base values reflect the optimal state of a database, which normally follows a database reorganization. Current state values are the most current data that BMC MAXM Database Advisor for IMS has collected about a database. Threshold values are user-defined, maximum acceptable deviations from base values. A threshold represents a limit that the current state value should not exceed.

During analysis, BMC MAXM Database Advisor for IMS uses the base value and the current state value to calculate the rate at which a threshold is being approached and to detect whether the threshold has been met or exceeded. When a threshold violation occurs or is predicted to occur, or if a problem is found, BMC MAXM Database Advisor for IMS reports the problem (called an exception) in a central location (the Exception List) on the Data Management console. The Exception List is an interactive table where you can view the details about an exception, correct all (or selected) exceptions, and research an exception.

EXECUTE PROCESS

The Execute process guides you through the process of correcting exceptions that have been reported on the Exception List. With BMC MAXM Database Advisor for IMS, you can take action on all reported exceptions across any level of defined components: sysplex, IMSplex, IMS system, group of databases, database, partition, or database data set or area.

Determining the action to take in response to an exception is also simplified. BMC MAXM Database Advisor for IMS presents all solutions that are available to you and recommends the best solution for each exception (or combination of exceptions). The recommended solution is based on the utilities that you have installed and on user-defined goals that tell BMC MAXM Database Advisor for IMS about your general priorities (the relative importance of performance, availability, and space usage).

BMC MAXM Database Advisor for IMS generates and displays JCL for a recommended solution to correct all problems that are reported or forecast for the database. When you review the generated JCL, you can submit the job to correct the problems and remove the database from the Exception List.

BENEFITS

BMC MAXM Database Advisor for IMS takes the guesswork out of IMS database maintenance. It provides the following benefits.

PROACTIVE PROBLEM-SOLVING

By forecasting when problems are likely to occur, BMC MAXM Database Advisor for IMS lets you solve problems before they can attack your data integrity, availability, and performance. This proactive approach results in efficient and effective planning, scheduling, and resource usage. With BMC MAXM Database Advisor for IMS, database maintenance activities are performed only when necessary, and issues of the most immediate concern receive the appropriate attention.

AUTOMATIC NOTIFICATION

BMC MAXM Database Advisor for IMS provides automatic notification to help ensure that exceptions are reported promptly and appropriately so that the people who need to know about the problem are told in a timely way and non-critical problems do not wake them up in the middle of the night.

You can set up the notification system to send an e-mail message, WTO message, or both when an exception is added to the Exception List or when the status severity of an exception is changed. For example, your senior DBAs can be notified when an exception with a critical status is detected.
FREEDOM THROUGH AUTOMATION

The automation in BMC MAXM Database Advisor for IMS frees DBAs from the manual work of collecting data about their databases and examining piles of reports to pinpoint problems. Automatic data collection and analysis make database maintenance activities efficient and effective. Data is collected and analyzed only when necessary and, because parameters such as thresholds and goals are in place, analysis and subsequent recommended solutions are applied consistently. Thorough analysis of all defined objects and display of exceptions in a central location make it unlikely that problems will be overlooked.

EFFORTLESS BEST SOLUTIONS

To address identified exceptions, BMC MAXM Database Advisor for IMS selects and generates the best possible solutions. The BMC Software–recommended solution is easy to access from the Exception List. You spend less time and effort working on problems.

BMC MAXM Database Advisor for IMS helps less-experienced DBAs learn about (and gain skills to solve) IMS database problems as these DBAs examine reported exceptions and review recommended solutions. Even DBAs who are relatively new to IMS database management can be confident that they are taking the right actions.

CONSISTENT RESULTS

BMC MAXM Database Advisor for IMS helps to ensure a consistent approach to solving database administration problems. Because most problems can be solved in a variety of ways, a DBA is likely to choose a different solution than another DBA would choose. With BMC MAXM Database Advisor for IMS, the solution does not depend on which DBA is working on the problem -- an optimal solution is generated consistently for every problem, based on your availability goals.

NO UNNECESSARY REORGANIZATIONS

Most maintenance strategies involve scheduling reorganizations to occur on a routine basis, regardless of whether the reorganization is necessary. This results in database unavailability and wasted system resources.

With the Conditional Reorg feature, reorganizations of full-function databases and HALDBs are performed only when indicated (because BMC MAXM Database Advisor for IMS has identified a problem that can be solved by reorganization) rather than on an arbitrary schedule (because the true status of the database is unknown but a reorganization might be required). The Conditional Reorg feature bypasses reorganization unless the BMC MAXM Database Advisor for IMS analysis process indicates that a reorganization is necessary.

ACCESSIBLE STATISTICS

BMC MAXM Database Advisor for IMS provides a DBA Toolkit that automatically creates and maintains an organized collection of current and historical statistics with all the information that you need for research about an exception. These statistics are easy to access from the Exception List, making your research activities efficient and effective. The DBA Toolkit eliminates the need to find, examine, and manually manage clumsy listings that might be cryptically named and might be scattered in data sets throughout the system.

EASE OF USE

BMC MAXM Database Advisor for IMS is easy to use, and even inexperienced DBAs can make informed, intelligent decisions about managing IMS databases. The Data Management Console is the graphical user interface from which you manage your database maintenance tasks. A single Console provides the ability to connect to multiple MVS systems spread across different geographical locations. The console also provides the ability to monitor job outputs from multiple systems on a single screen. They can use the ISPF type tools and JES viewer to manage those databases without switching GUI windows. Figure 3 shows the console with a typical IMS database administration environment that has been defined.
SUMMARY

It is imperative to keep IMS databases running optimally at all times. BMC MAXM Database Advisor for IMS enables proactive management of your IMS databases while saving time and resources. The easy-to-use interface enables even inexperienced DBAs to manage complex, critical databases and keep them available to applications. BMC MAXM Database Advisor for IMS provides a unique and innovative model for managing all types of IMS databases easily.
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