QUEST SOFTWARE

Key Methods for Managing Complex Database Environments

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WHITE PAPER

Contents

Abstract

This white paper addresses key methods for successfully managing today's complex database infrastructures, including balancing key business metrics, understanding the challenges DBAs face, and finding the right tools to monitor and manage the database environment.

Introduction

A slow relational database can substantially impact the performance of the applications it supports. Users may issue thousands of transactions every minute, which are serviced by perhaps dozens of redundant web and application servers – and a single database. The relational database must preserve consistency and availability, making it a highly centralized asset. It concentrates the transactions and places a great deal of pressure on the database stack to operate at optimal levels of performance and availability. This is why the database is so critical, and it's also why the DBAs who manage it are more than average administrators.

To successfully manage these complex database environments, one must balance key business metrics, understand the DBA's unique challenges, and select the right tools for database administration.

Balancing Key Business Needs

Managing the database and the DBA team is a complex challenge that requires attention to three primary business metrics: cost, service, and risk.

Cost

DBA salaries account for the major direct cost of the database team. The production DBA performs a specialized role in the IT organization and is generally well compensated as a result.

Enhancing the productivity of the DBA team is essential to maximizing cost effectiveness. Tools that automate tasks via an intuitive user interface are often the first step toward improving DBA productivity. For DBAs managing critical databases, productivity is widely measured by the number of databases they can manage while maintaining service levels.

Service

Databases carry a service expectation that is either implicitly understood by the administration teams or formalized into a service level. Service levels are usually defined by the application team and passed on to the administrators of each asset in the application stack. Given the vital role of the database to the application, the service level the DBA inherits is aligned to application criticality and is typically measured by availability and response time.

Risk

The centralized nature of the database relative to the other components in the application stack makes it highly sensitive to change – and with change comes risk.

Moderate-risk changes are small and incremental (e.g. operating system upgrades, database patches and regular maintenance tasks like backup, data archiving, and object reorganization).

When larger changes are required, however, the risk to database stability is much higher. Significant upgrades to server hardware often require downtime, but upgrades to the application code or to a new major release of the database carry the added risk that application performance may become slower as a result of the change.

Balancing these factors requires intuition, good judgment, and accurate data.

Understanding New DBA Challenges

Application Support – The Internal Customer

Traditionally, applications supported the business, and IT operations supported the applications. Advances in technology, fueled largely by the mainstream expansion of the Internet, have led to applications that directly drive business, generate revenue, and interact with customers.

The critical nature of these applications has driven the need for dedicated support teams within the application organization. These application support teams sometimes include dedicated DBAs, but more often the relationship resembles that of an internal customer, where DBAs within the operations organization provide level-three support to the application team.

In those cases, the DBA faces unique and often conflicting pressures from both the operations and application organizations. IT administrators typically focus on the resources they manage, while application support is centered on service quality. Therefore, the central role of the database within the application stack requires the DBA to effectively manage resources as well as be highly sensitive to the service experience of the application users. Wearing both hats simultaneously can be challenging for the production DBA.

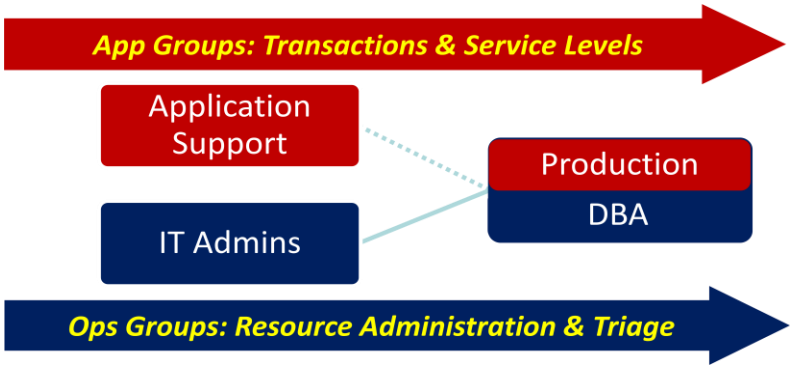

Figure 1. The production DBA is tasked with managing resources as well as monitoring service levels.

Terminology from the Information Technology Infrastructure Library (ITIL) articulates the dual-role dilemma of the DBA, and is helpful when comparing incident management with problem management.

The objective of the incident management lifecycle is to restore service as quickly as possible to meet SLAs. The focus of problem management is to resolve the root cause of errors and to find permanent solutions – a process that prioritizes accuracy in problem resolution over speed. This focus on problem resolution is essential to achieving a state of continuous improvement, as when problem recurrence is prevented, service levels are enhanced.

Managing Complex Database Environments

Why Have Multiple Platforms?

One of the biggest challenges facing today's IT organizations is managing the complexity of an environment that consists of multiple operating systems, databases, and applications. In addition, larger organizations have to manage this complexity across multiple geographies.

IT standards help to align the skills of the administration team and streamline operational costs. However, when an application (new or existing) creates the requirement for platforms that are outside of the standard that IT has defined, the standard generally adapts.

Recommended practice is to maintain platforms from at least two competing vendors in order to avoid over-exposure to the contract negotiation leverage of a single vendor. Consolidating vendors reduces the operational costs associated with multi-platform management, but over-consolidation increases the pricing power of the remaining vendors, potentially erasing the savings.[1] Finding the right number of vendors is crucial to optimizing costs. Most companies — as many as 90 percent — have IT organizations managing at least two DBMS platforms; typically, each DBA is responsible for approximately 35 databases.[2]

Choosing Third-Party Tools

Many sites introduce trusted third-party vendors because they provide objective measurement and management of performance across multiple database platforms. Solutions from third-party vendors aim to increase DBA productivity and reduce costs while ensuring high service quality. Specialized administration and management technology that operates independently of the database platform provides a productivity gain of at least 20 percent, according to Forrester Research.[3]

On top of this are the productivity gains achieved by DBAs who are able to manage problem scenarios with agility and accuracy. By resolving the root cause of problems faster, their skills can be applied to prevent problems, optimize resources, and improve user response times.

[1] 25 July 2008 (ID Number: G00159724) "How Many Database Management Systems Should You Have?" Donald Feinberg, Jeff Comport
[2] 23 February 2010 "Take Advantage of New Ways to Save Money on Database Costs" Noel Yuhanna
[3] 23 February 2010 "Take Advantage of New Ways to Save Money on Database Costs" Noel Yuhanna

Holistic Database Monitoring

A single, consolidated view of database health is fundamental to addressing the challenges associated with managing multiple database systems. The coverage must extend across several layers of the application and database stack to ensure that the view presented to the DBA is accurate and facilitates the user workflows that drive problem resolution and prevention as well as performance optimization.

Important requirements for holistic monitoring include:

1. A view into the performance of every component that could potentially disrupt database operations, including the operating system and virtual machines.
2. An intuitive user interface that enables the management of cross-platform performance, accommodating different levels of administrator skill.
3. Visibility into the transaction workload that is driven into the database by the application users and processes.
4. Sufficient depth to support detailed analysis and optimization activities.
5. A low total cost of ownership, especially in regard to deployment and upgrade efforts.

Comprehensive Coverage

The database is dependent on the operating system as well as virtual machines and their storage subsystems for resources. Coverage of these components is necessary to accurately isolate the source of problems.

An Intuitive, Cross-Platform User Interface

The most visible aspect of the third-party advantage is the user interface. The central benefit of platform neutrality is technology that abstracts platform-specific complexity, allowing a service-centric perspective on performance. Cross-platform management significantly improves DBA productivity and minimizes training costs.

Figure 2: DBA productivity is directly influenced by the quality of the user interface.

Application Transaction Workload

The database is linked to the application by the transactions that are directed into the database. Measuring the database transaction workload is the only way to accurately report on the service quality of the database in regard to application users, batch jobs, and automated tasks.

Detailed Measurement

The complexities of modern databases, and the critical applications they support, require far more sophisticated analysis of performance than is provided by the raw metrics of the database engine. DBAs striving for continuous improvement need to fully understand performance in order to make good decisions and avoid creating new problems, which is always a possibility with inadequate data. Achieving understanding requires intelligent analysis of performance history, from real-time to data that has aged by weeks or months. Only with sufficient historical data can the DBA determine important trends, identify chronic conditions, and prevent emerging issues.

Data richness is a function of granularity. Monitoring takes a sampling approach to metric collection, so the rate of collection determines granularity. A robust monitor collects data at rates that reflect the vitality of the measured component, but can also adjust the rate to increase or decrease granularity when necessary (e.g., when load volumes change or during the diagnostic analysis of a problem).

Of course, collection overhead must be minimal to ensure that the cost of collection doesn't exceed the value of the collected data. This is an important factor in assessing a monitoring technology.

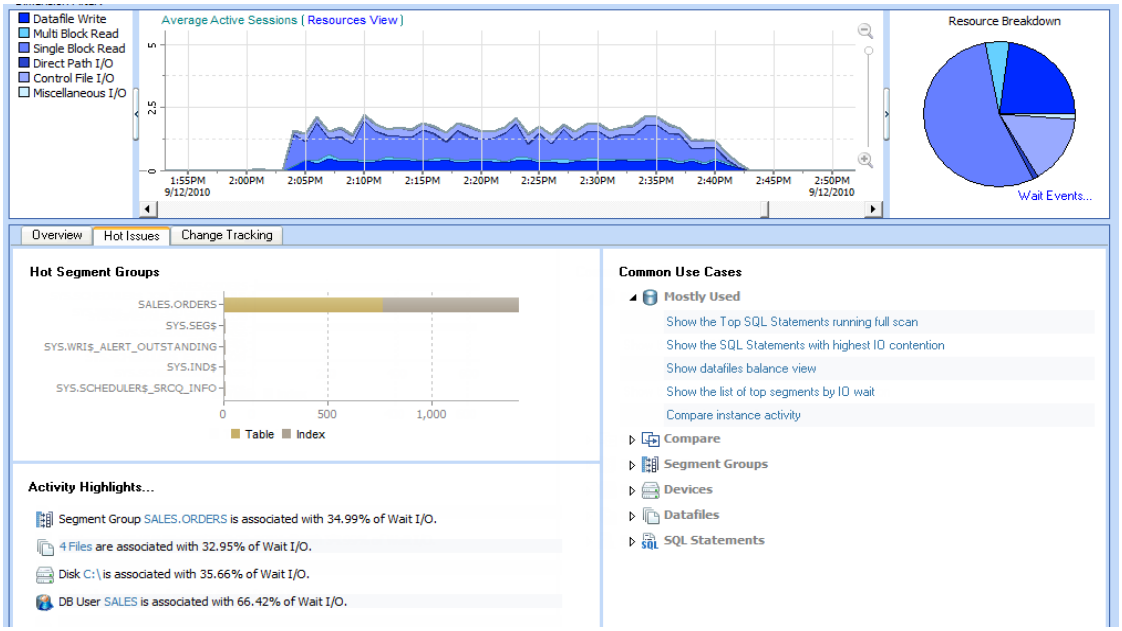

Figure 3: Detailed analysis of database I/O helps isolate problem areas and hot spots.

Total Cost of Ownership

Technology that is designed to reduce operational costs as a fundamental part of its value must demonstrate a low total cost of ownership (TCO).

Key components of a monitoring technology that improves TCO include:

- Centralized Architecture
  - Minimizes deployment and upgrade costs.
  - Offloads management, storage, and presentation overhead away from production.
  - Facilitates cross-instance, cross-platform, and cross-domain correlation of data and analyzes performance data.
- Production-Remote Collection
  - Reduces the collection cost to the overhead of the collection query only.
  - Facilitates deployment and speeds upgrades by avoiding the need to touch the production server.
- Database Auto-Discovery
  - Enables the monitor to be effective quickly in large database environments, removing the burden of the DBA team to individually specify each instance.
- Adaptive Baseline Alerting
  - Leverages historical performance to construct a baseline range of “normal” performance for each collected metric.
  - Addresses the inability of fixed thresholds to provide accurate warning alerts, allowing them to remain focused on protecting critical resource limits.
  - Reports emerging problems as deviations from normal behavior with great accuracy and timeliness.
- Service Level Modeling
  - Aligning groups of assets to a defined service level is an essential capability for a monitor designed to measure and report on the qualitative aspects of performance.
- Consistent, Cross-Platform User Interface
  - Reduces training costs.
  - Accelerates time to resolution for DBAs of varying skill levels.

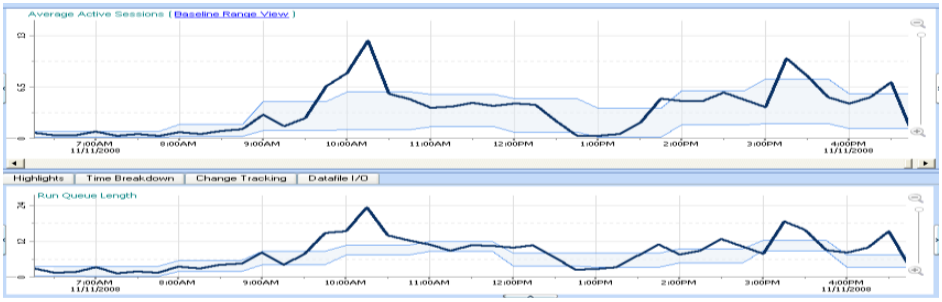

Figure 4: Adaptive baselining optimizes alert intelligence, accuracy, and timeliness

Conclusion

Today's production DBA teams must manage resources effectively as well as closely monitor transactions as they interact with the database. A monitoring tool that integrates these capabilities and a single, consolidated view of database health can substantially improve resolution time and DBA productivity while containing risks.

About the Author

Dave Pearson is a senior product manager at Quest Software, where he focuses on Oracle performance management products. He has been with Quest since 1999, and has 20 years of experience working with relational database systems and the applications that use them.

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