IDC OPINION

One of the critical success factors for today’s online and Web-enabled applications is good performance, especially fast end-user response times over the Web. However, performance management of distributed applications continues to grow in complexity, with the proliferation of application components and operating platforms, and the increasing use of multi-tier architectures. Keeping pace with this constantly changing environment is a challenge for IT and for performance management software vendors alike. With the acquisition of Precise Software, VERITAS has moved into a favorable position as a performance management software vendor, with products that span a variety of performance functions for the components and platforms typically used to deploy today’s multi-tier distributed applications. The performance management technology is one of the pillars of the VERITAS Utility Computing strategy, along with Availability and Automation.

- VERITAS i³ technology provides comprehensive performance monitoring and reporting for distributed application components and also measures end-to-end user and application transaction response times.

- VERITAS i³ supports performance management for Web servers; J2EE application servers, including WebSphere and WebLogic; ERP applications such as SAP and PeopleSoft; and major databases including Oracle, DB2, and SQL Server.

- VERITAS i³ provides support for other performance functions including tuning, particularly optimization for SQL databases; trending; and capacity planning.

IN THIS WHITE PAPER

This white paper demonstrates growth in value of distributed applications accessed over the Web, especially for eCommerce applications, and analyses the requirements needed for performance management of distributed applications in today’s complex heterogeneous environments. Issues are discussed regarding the necessity of performance management for the delivery of required end-user service levels and transaction response times. Problems and requirements regarding performance management of multi-tier applications are discussed. The applications performance management approach taken by the VERITAS i³ software products is presented, together with a summary of VERITAS i³ product functional capabilities.
SITUATION OVERVIEW

Growth in eCommerce and Distributed Applications

Despite the economic slowdown of the past few years, access to distributed applications over the Web continues to grow strongly, and the commercial value of Web-based transactions is increasing at an impressive rate. Indeed, according to a recent IDC study, the worldwide market for business and consumer commerce conducted over the Internet achieved a spending level of $1.6 trillion dollars in 2003, and is forecast to grow at a compound annual rate of over 50% per year through 2007, as shown in Figure 1. (See: Worldwide Internet Usage and Commerce 2004-2007 Forecast: Internet Commerce Market Model Version 9.1 IDC #30949, March 2004). Indeed, the Web has become a major business channel and is more and more treated as a part of ordinary business operations, with transactions enabled by distributed applications.

FIGURE 1

Worldwide eCommerce Spending 2002–2007

![Worldwide eCommerce Spending 2002–2007](image)

Source: IDC, 2004
**Increasing Application Complexity: Multiple Tiers**

With the growth in Web-enabled transactions and direct end-user access to applications, performance management software must increasingly be able to deal with distributed application architectures that often include multiple functional components or "tiers", deployed on individual servers. Multi-tier applications include such components as end-user clients, Web servers, application servers, databases and back-end storage. Individual components may be deployed on a variety of distributed operating platforms including Unix, Linux and Windows.

In the case of these complex distributed applications, performance software needs to be able to "understand" the operating characteristics and performance measures of the major architectural components, and must be capable of detecting and identifying the sources of bottlenecks and other slowdowns in performance, so that corrective actions can be taken at the appropriate component(s) to achieve desired operational service levels. Figure 2 shows an example of a distributed application architecture with tiers that include a Web server, an application server, and a relational database.

**FIGURE 2**

**Distributed Application Architecture**

Source: VERITAS, 2004
**Application Performance Management**

Performance management has long been established as a necessary part of datacenter operations for delivering efficient use of hardware resources and providing fast response times for end-users and applications transactions. IDC recognizes performance management as a functional market consisting of software that is used for such functions as performance monitoring, performance data collection, service level management, tuning, simulation, and capacity planning, when applied to systems and applications. With the growth of applications deployment on distributed systems such as Unix, Linux and Windows, the term "Application Performance Management" has frequently been used to characterize performance management functions when applied to specific applications or application components. Often, specific packaging and functionality is provided by vendors for application-specific performance management products.

**Managing the Transaction Path**

In order to provide effective management of distributed applications, performance management software must not only be able to measure and optimize individual application components, such as those shown in Figure 2, but must also be able to monitor and manage the overall path taken by transactions or user interactions, so that end-to-end service level objectives such as response time requirements or throughput volumes can be achieved. Figure 3 illustrates an example of a complex transaction path.

**Figure 3**

*Application Transaction Path*

Source: VERITAS, 2004
As suggested by the diagram in Figure 3, a transaction path can be viewed in terms of a series of "visits" a transaction must make to various distributed application components, accessed over local and wide area networks, in order to execute required functions. The overall end-to-end response time of a transaction is essentially the sum of the response times at each component visited by the transaction. When an end-to-end response time exceeds a desired service level objective or threshold, the cause is often due to an excessively long response time at a particular application component (or network element) due to a bottleneck-causing condition. In these situations, the challenge for performance management is to be able to quickly identify where (at which component) the problem is occurring, diagnose a probable cause, and to recommend or even automatically apply a corrective action so that desired performance characteristics can be restored.

VERITAS Software

VERITAS Software, headquartered in Mountain View, California, was founded in 1989 initially to provide high availability software products. The foundation for high availability is VERITAS Cluster Server software, which today can be used for applications, databases, and storage area networks. In 1997, through a merger with OpenVision Technologies, VERITAS broadened the scope of its product offerings to include software for storage backup and recovery and hierarchical storage management. In 1999, VERITAS acquired the Network and Storage Management group of Seagate Software, thus enabling VERITAS to expand from Unix–based solutions to also include solutions for Windows and NetWare platforms.

In 2003, VERITAS expanded the company's product and marketing direction to focus more heavily on applications management, especially applications performance management, and to position the combined VERITAS server, storage and applications management offerings as enabling IT organizations to implement utility computing. Key to this shift was the acquisition of three companies in 2003: Precise Software, Jareva, and Ejasent. The Application Performance Management products obtained through the acquisition process are now marketed as VERITAS i^3.

VERITAS i^3 Application Performance Management

Origins and Core Competencies

Originating in 1991, the i^3 technology evolved over a considerable period of time, beginning with the initial business focus of developing and marketing performance management software tools for databases and database applications. Key competencies include SQL and SQL query performance optimization, relational database technology including Oracle, DB2 and SQL Server, ERP applications such as SAP R/3 and PeopleSoft, storage devices and storage technology, and distributed operating platforms including Unix, Linux and Windows.

In terms of the competencies needed to optimize applications performance, the i^3 products are based on core technology that incorporates in-depth knowledge of the architecture, operation and performance of Oracle and other major relational databases, the SQL statements that access them, the applications that use them (especially SAP R/3 and other ERP), the platforms they run on, such as Unix and
Windows, and the impact of hardware devices, especially storage devices, storage arrays, and SANs. Performance management of this domain requires understanding database elements; knowing how SQL statements access and process RDBMS data; being able to measure operational performance, including resource consumption and response times for SQL statements, applications transactions and end-users; and how to evaluate alternatives – such as more efficient SQL statements - to improve performance.

In recent years, the \textsuperscript{3}i focus has further expanded to keep pace with the evolution of distributed applications architectures. In particular, strong \textsuperscript{3}i product technology has been developed to support J2EE applications servers, especially WebSphere and WebLogic. Another particularly strong point of focus is performance management of multi-tier applications. This requires performance monitoring and management at a number of application tiers: the Web client or browser, the Web server, the application server, the database, and storage components. Equally important is the ability to understand the interaction of application transactions with these components and be able to understand which component or tier may be causing a performance problem, in order to get an overall end-to-end application performance perspective. Specialized correlation techniques have been developed as part of the \textsuperscript{3}i technology that can link transaction activity from one tier to the next. This linkage helps to identify the thread of calls across the infrastructure that make up an end user transaction. Overall, the \textsuperscript{3}i software products today provide a variety of performance management functions for distributed, multi-tier applications including performance management of a wide variety of eBusiness, ERP and data warehousing applications.

\textbf{VERITAS \textsuperscript{3}i Methodology for Application Performance Management}

VERITAS \textsuperscript{3}i performance management products provide a structured, step-by-step process for managing the performance of distributed applications. The processes are organized by major sub-tasks to help reduce the complexity of managing distributed applications components. The major elements in the VERITAS performance management process can be described as follows.

1. \textbf{Performance Monitoring and Reporting}

The basis for understanding the performance of any computer-based application starts with measuring and monitoring what is happening, especially during peak periods, and providing reports that show system, application and database performance measurements. In the VERITAS methodology, performance monitoring is performed for each of the major application components or tiers, continuously in real time. Performance data collection methodologies have been developed for production environments that are designed to ensure minimal impact on end users.

2. \textbf{Problem Detection and Alerting}

The measurement data can be used to identify performance problems, such as slow response times caused by system bottlenecks or high resource utilization caused by inefficient applications. This information can be leveraged to take a proactive approach to avoid potential performance bottlenecks before they occur.
3. **Identification of Problem Sources**

VERITAS products help isolate where a performance problem is occurring by identifying the major sources of resource consumption, identifying the largest consumers, and pinpointing the origin of the consumption. One of the key functions is to identify which component is the likely source of a performance problem.

4. **Analysis to Determine Problem Causes**

Once a component is identified as a problem source, an in-depth analysis is required. For example, in the case of a major database component, performance problems can be caused by such factors as inefficient SQL statements, poor database design, improper indexes and overloaded application servers. Analysis is performed on indexes, SQL statements and objects that were accessed to help determine the root cause of performance degradation due to database issues.

5. **Recommend Changes for Performance Improvements**

In the case of database performance bottlenecks, VERITAS i³ tools can "suggest" alternative SQL statements that can eliminate common problems (such as excessive "joins") and can help the user choose the most appropriate index - or help design new indexes – for better performance. System and database parameters are reviewed looking for inefficiencies.

6. **Test, Verify and Quantify Improvements**

VERITAS i³ provides facilities that let users "test drive" alternative SQL statements, measure the impact on response time, and compare the new performance to the original to assess the impact and quantify the magnitude of improvement.

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**VERITAS i³ APM Product Family**

The VERITAS APM methodology is implemented through the VERITAS i³ product family. Figure 4 illustrates the VERITAS i³ Product Family functional capabilities and shows the relationships among the major products.

As can be seen in Figure 4, the VERITAS i³ Product Family consists of three major functional components, plus a performance data warehouse. The i³ products can be summarized as follows.

- **VERITAS Insight** is the i³ product component that monitors performance, providing end-user response times for multi-tier applications as well as comprehensive performance measures for key application components such as ERP applications, J2EE application servers and Oracle database servers. Insight decomposes response times into individual segments for each of the major application tiers, so that identification of the specific devices causing bottlenecks can be quickly accomplished. In essence, Insight can be used to find out which tier has the slowest performance.
VERITAS Inform is the i³ product component that provides performance reporting and alerting functions. Inform communicates operational performance information in the form of real-time alerts to IT staff, indicating immediate performance problems such as slowdowns that exceed required service-level thresholds. Inform also provides performance reports that indicate whether service level requirements are being met over time, and can be used for trend analysis to show whether response times are heading toward unacceptable levels.

VERITAS Indepth is the i³ component that is focused on performance problem determination, root cause analysis, making recommendations, and impact analysis. In the case of SQL statements, simulation of the impact of SQL tuning changes on performance can be provided. Indepth has a specialized component which addresses performance management of Oracle-based environments. VERITAS i³ provides a specific Indepth product for J2EE environments, with focus on Java and Java-related elements such as Java Servlets, EJBs, and JDBCcs. A smart tuning feature helps identify the root cause of performance problems in J2EE applications environments.

**FIGURE 4**

VERITAS i³

Source: VERITAS, 2004
VERITAS i³ Performance Data Warehouse

VERITAS i³ supports a Performance Data Warehouse for storing applications performance data. This data enables users to analyze performance trends over time, generate reports to help optimize current and projected application performance, and plan future system capacity. Based on the information stored in the i³ Performance Warehouse, users can:

- Track historical resource utilization trends to understand and predict long-term behavior.
- Perform period-to-period comparisons to analyze performance improvements or degradation over time.
- Track application database access patterns, object changes, object statistics and database parameter changes to understand the effects on performance of data structure changes and object growth.
- Track data growth and data distribution changes to optimize data storage management.
- Generate alerts when performance measures degrade from pre-established baselines, and proactively detect performance bottlenecks before they can severely impact service levels.

CHALLENGES AND OPPORTUNITIES

The VERITAS i³ products come with a significant history of technology, product development and positioning, product marketing, and support in the performance management space particularly in the performance management of applications that depend on major relational databases, especially Oracle. As is the case with many acquisitions, the principal challenges for VERITAS are to keep the i³ product focus and market momentum going while, at the same time, delivering on the promise of expanded infrastructure management capabilities leading to VERITAS-based utility computing solutions. Some of the challenges specifically relating to the VERITAS i³ product family are as follows:

- VERITAS is widely known for its storage software products and for its high-availability server management products. VERITAS needs to become equally well known for i³ applications performance management, by appropriate sales, marketing, and product initiatives.
- VERITAS needs to increase the corporate mindshare given to applications management, in effect moving beyond a storage-centric view to a more application-centric view. This requires more focus on the uses and management of databases, as well as expanded attention to the key applications that use large databases, especially J2EE and ERP-based ones.
VERITAS needs to integrate the traditional VERITAS products with the newly acquired Application Performance Management capabilities. This combination could provide unique drill-down capabilities from an application perspective into storage, file systems and clustered servers.

Given the impressive range of functional capabilities now available under one roof, VERITAS has the opportunity to make a major market push around the combined server, database, and storage management offerings, using applications management as the unifying theme. Applications performance management is a natural starting point for this approach, which does not either pre-suppose or inhibit the larger move toward utility computing. Indeed, applications management appears to be a highly-focused immediate need for IT.

SUMMARY AND CONCLUSION

The continued growth in eBusiness and other web-based and distributed applications continues to drive-up the importance to IT of performance management. Methodologies, processes and software tools are needed in order to implement an ongoing process that will continually monitor, report, analyze and improve applications performance to ensure fast interactive response times for end users. If an eBusiness application is to succeed, the service level delivered to end users – application performance and application availability – must be sufficient to meet the overall business objectives in terms of revenue-generating transactions, including winning against competitors.

In today’s distributed environments, performance management must deal with an increasingly large number of components – applications servers, Web servers, databases - across multiple operating platforms. Delivering good end-to-end response time means ensuring that all the major components are performing well, especially the applications and database servers which often account for the major portions of the overall transaction response time. With strong emphasis on optimizing performance for distributed multi-tier applications, VERITAS i3 is well positioned to help IT organizations “deliver the goods” for successful performance of eBusiness applications.

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