



WHITE PAPER

Application Performance Management

Application Performance Management
for SAP Environments

Executive summary.....	3
Introduction.....	4
Typical environment.....	5
Challenges of managing the environment.....	6
The Precise for SAP methodology.....	8
Precise for SAP solution set.....	10
The Precise Performance Warehouse.....	10
The Web browser component.....	11
The network component.....	11
The Enterprise Portal Web component.....	11
The Web AS Java component.....	12
The Web AS ABAP component.....	12
The database component.....	12
The storage devices component.....	13
Precise for SAP features.....	14
Proactive management through exceptions.....	14
End-user experience and SLAs.....	15
Correlated end-to-end view.....	15
Investigating the SAP ABAP application tier.....	15
Investigating the SAP database tier.....	16
Long-term analysis.....	16
An SAP operations dashboard.....	16
Benefits of Precise for SAP.....	17
Summary.....	17

Executive summary

There is no doubt that the SAP world is becoming increasingly complex and interconnected. The number of different SAP architectures and usage patterns found in the industry is also rising.

Management of these environments is more challenging due to the number of technologies and application tiers involved (e.g., both ABAP and Java on the application server side), multiple points of failure, and a greater number of components to manage.

A major challenge facing SAP Basis administrators today is defining a systematic process for understanding application behavior, usage patterns, and service levels. Precise for SAP provides SAP Basis teams the tools they need to understand SAP application performance and drill into the root cause for batch processing or user transaction slowdowns.

Introduction

The introduction of SAP NetWeaver has enabled companies to build complex SAP landscapes consisting of a number of interconnected SAP and third-party systems that, together, drive sophisticated business processes. SAP Enterprise Portal has revolutionized the way end users access those SAP landscapes. Everybody can connect from anywhere, using a Web browser. For the end user, NetWeaver means more flexibility, functionality, and convenience—but for SAP Basis administration teams, it means more responsibility and complexity. In such environments, Application Performance Management is a vital necessity in order to achieve optimal SAP availability and end-user response time as well as SLA compliance.

Many problems can occur in a complex environment—whether in the network, the Web components, the SAP application servers, the database, or the storage devices. To make the situation worse, problems tend to be inconsistent (i.e., they can appear and disappear) or to occur only when a certain load is reached. Managing these environments is a challenging task.

It is crucial to run 24x7 health checks for notification of potential problems before end users are affected. It is important to understand the application behavior and the usage of the organization from a performance point of view to verify that business objectives are met, find where bottlenecks are, and determine the required next step to fix them.

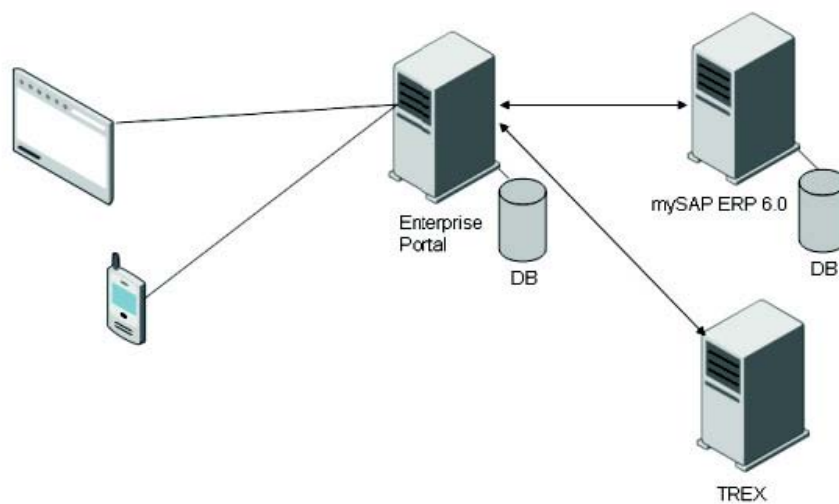
Sometimes, companies rush to finish the SAP implementation phase—which includes customizations and changes—and pay less attention to performance issues, scalability, and load. Once the system has gone “live” and performance problems have begun, it is very expensive to fix them.

Typical environment

SAP R/3 customers typically run on traditional ABAP 3-tier architecture consisting of a smaller number of production systems (together with development and test systems) with several ABAP application servers, a dedicated database instance and SAP GUI clients. However, the introduction of SAP NetWeaver and the new generation of mySAP Business Suite applications has led to more complex customer implementations, including more application tiers, more SAP applications, and more interconnections.

The example below shows a small, but typical, SAP system landscape. This environment is based on NetWeaver 7.0 and mySAP ERP 6.0. One machine is running an SAP Enterprise Portal (EP) and other components requiring SAP Web AS Java application server infrastructure. The other functions as the back end and runs a mix of ABAP and Java components, namely ECC (Enterprise Central Component, the core of ERP 6.0), several add-ons for mySAP ERP, and Business Intelligence (BI). From an infrastructure perspective, running these components on one host requires a Web AS “Add-In” application server installation, consisting of both ABAP and Java execution stacks. For simplicity, no additional application servers for EP and ERP are included in the figure, but they exist in almost every customer environment. Also, depending on load and scalability requirements, BI could run on a separate machine. Each SAP system (ERP and EP) has its private database instance.

SAP end users typically connect via Web browser to Enterprise Portal, which provides a role-based environment for each user group and connects the end users to the back-end system. However, there are still many “traditional” SAP environments where end users use the SAP GUI to access ABAP-based SAP systems such as R/3.



A Small, but typical SAP environment with NetWeaver 7.0 and mySAP ERP 6.0

Challenges of managing the environment

The management of SAP, spread across multiple tiers and multiple interconnected applications, makes it extremely difficult to pinpoint the source of a performance problem. There are significant challenges to managing these environments, including:

- Defining, measuring, and committing to organizational business objectives and SLAs, as associated with the real organization users, working from multiple geographic locations
- Finding the SAP users, transactions, application modules, programs, functions, and screens that impact the performance and those that are most easily influenced by performance degradation
- Defining baselines of normal and abnormal application and usage behavior
- A comprehensive, yet straightforward, way to measure the user's experience
- Identifying problem patterns and characteristics before the user is affected proactively, through alerts, while maintaining satisfactory service levels
- Maintaining historical data for trending, exception, and capacity planning analysis
- 24x7, real-time, low-overhead collection and correlation of performance metrics across the SAP infrastructure
- Correlating SAP application metrics such as user-activated URLs, invoked transactions, and database SQL statements across the whole SAP infrastructure
- The ability to break down response times by tier and application component to determine the amount of time spent in each component
- Determining the time spent in Java vs. ABAP vs. SQL statement processing
- Presenting one integrated, correlated view of all SAP infrastructure components, from the Web user through the network, SAP Web Application Server, database, and storage devices
- Ability to focus on application server bottlenecks, such as waits while work processes complete, memory issues, inefficient database access, high CPU utilization, etc.
- Tracking the performance of local and remote geographical locations
- Coping with unpredictable load periods and handling massive transaction and data volumes
- Aiding SAP Basis administrators in analyzing performance issues and suggest remedies

These challenges are not covered by system management frameworks or by traditional management tools—which only provide uncorrelated snapshots from various servers within the SAP application infrastructure.

System management frameworks focus on system parameters, availability, and utilization. Their primary focus is monitoring the system and the system elements' health. Frameworks are well suited for detecting system- and network-level issues, such as servers and applications with high utilization, high packet rates, and numerous retries. Unfortunately, frameworks don't focus on the end-user experience, transactions, and usage—so, when all the system parameters look acceptable, how can you tell why a specific location suffers from poor response time, or why certain SAP URLs are slow?

The “stovepipe approach,” which takes isolated snapshots from various servers, does not resolve the problem either. Snapshots provide very coarse information consisting of generic statistics taken from each tier separately. For example, you can look at Java components, SAP application servers, or Oracle metrics and still not understand which component is causing a bottleneck. By following the real end-user transaction across the SAP tiers, snapshots can tell you that the average Java object, SAP transaction, and SQL response time are acceptable, but they cannot tell which SQL statements belong to which transactions and, therefore, cannot help much in isolating the problem.

Compounding this issue, many of the data collectors deployed sample too infrequently (e.g., once every five to ten minutes), and as a result they rarely gather enough information to perform meaningful analysis.

Metrics for end-to-end application analysis must be captured with agents that have application knowledge and visibility into those that reflect the user experience. Real-time performance metrics should be collected 24x7, with extreme efficiency and low overhead, and correlated across the SAP infrastructure path to enable problem isolation and root cause identification.

Additionally, historic information must be kept for long-term analysis, exceptions, baselines, trends, and capacity planning. Using historic data, we can calculate typical SAP behavior—for example, there may be peaks each Monday morning for some transactions. Knowledge of typical behavior facilitates generating exceptions for abnormal behavior and setting the right service-level agreement (SLA) thresholds. This information also helps calculate database table growth—allowing us to allocate enough space for critical SAP data in advance of a slowdown or create appropriate indexes to reduce the fetch times.

In short, typical infrastructure frameworks provide important system and network management bottoms-up detail, but do not look at necessary end-user and transaction activity. Traditional tools look at each tier separately—providing generic statistics for that tier—but do not perform any correlation between tiers. These approaches lack the power to find, isolate, and focus on the root cause of the problem or help to identify the real user response-time experience.

Precise for SAP fills this gap by providing the actual user experience and application end-to-end response-time contribution detail. This enables SAP administrators to “see” how their applications are performing from the perspective of their users, and to correlate that experience with the underlying application components in terms of end-to-end performance.

The Precise for SAP methodology

It is vital for all organizations to understand the importance of a systematic approach to managing performance issues and to realize the inherent ineffectiveness of ad-hoc problem-solving. The foundation of the Precise for SAP solution is a methodology designed to facilitate the rapid detection, isolation, analysis, correction, and verification of application performance problems. All organizations can benefit from the discipline that the Precise for SAP solution brings to the performance management process. The Precise performance management methodology enables you to use a proven process, as well as proven supporting solutions, to implement effective performance management within your organization. The Precise solution helps:

1. identify the symptoms that could indicate a performance problem
2. determine the problematic tier and application component
3. drill down into the root cause of the problem
4. determine the steps required to improve performance
5. and make sure the steps taken have achieved the desired goal

These combine to form a process that provides a systematic approach to finding and resolving all kinds of performance issues, both predictable and unforeseen.

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For example, the methodology begins with an automated proactive detection (Detect) through baselines and SLAs, using the product's alert capabilities. Alerts can be directed to the appropriate infrastructure framework, organization, or person based on what was detected.

Depending on the issue detected, the SAP Basis administrator can view the application, end-to-end, and isolate the problematic tier and application component that are the source of the degradation. Problems could be caused by network delays, long-running servlets, RFC calls, long-running transactions on an ABAP application server, or long database access times. The process of finding the problematic component is end-user focused, so that we actually follow the end-user transaction from the time it was activated by the user.

After the problematic component is found, an in-depth analysis of that component is done in order to focus on the root-cause of the problem. For example, after finding out that a particular ABAP application server is the problematic component, we would like to identify the top users and transactions, and determine whether the problem is due to a long queue wait time for a work process or application processing time, or to a long database call. As another example, in the case of Java issues, we would look at the different methods that are called and understand whether the issue is due to a specific method or an expensive JDBC call

After focusing on the problem's root cause comes the actual fixing of the problem. For example, allocating additional work processes fixes a long queue time waiting for a work process to complete; adding an index to a database table fixes a long-running SQL statement problem.

Once the fix has been applied, it is vital to confirm that the problem is indeed fixed and that it will not reappear. Utilizing long-term information kept in the Precise for SAP Performance Warehouse, we can compare service times before and after the fix was applied. Doing this shows whether or not we fixed the problem and if service times are as expected.

Precise for SAP solution set

Precise for SAP focuses on providing your organization with the ability to completely manage your application performance end to end—including the browser, the Portal, SAP Web AS (which includes J2EE and ABAP execution stacks), database, and even the physical storage.

At the highest level, Precise for SAP provides:

- agents and logic required to enable your IT organization to see the end-to-end response time contributions across the client, network, application server, and database server and to isolate those components that are responsible for slowdowns. The process starts by measuring the actual end-user response time at the application, transaction, or Web-page level. Then, upon detection of a response-time objective (RTO) or baseline breach, the problematic tier and component are found, as described earlier in the methodology section.
- in-depth silo-oriented drill-down capability to identify the root cause of problems by collecting and correlating detailed component information (e.g., application server utilization and workload, top-heavy transactions, J2EE specific information, methods, Oracle resource consumption breakdown, slowest SQL statements, etc.).
- real- and near-time alerts that are driven by exceptions to the baselines and thresholds defined. It also includes the reporting components of Precise for SAP. This rich report capability enables the presentation of ad hoc and scheduled reports. These reports are useful for setting or reviewing service levels, trends, and exceptions.

The Precise Performance Warehouse

Precise for SAP includes the Precise Performance Warehouse, which provides the common repository for long-term history, collected by the different Precise agents along the SAP application path. The collected history facilitates trend analysis, long-term capacity planning, baseline calculations using historical data, and correlated reports over time. Precise for SAP includes all necessary functionality to see the actual user's response time and analyze the correlated contributors from end to end.

These include:

- The actual service delivered to any SAP user over any given time period
- Discovery and monitoring of all SAP users and the performance of their transactions
- Enterprise Portal URLs
- Java method invocations, response times, and throughput
- SQL statements activated by specific SAP transactions
- Database resource consumption breakdown and linking of logical database access to physical storage
- SAP ABAP application server metrics such as CPU usage, load average, page faults, connected users, and active users

The Web browser component

The best way to measure service-level objectives (SLOs) is from the end-user point of view, at the browser level, measuring real SAP activity response times. Precise has developed a unique technology that sends a tiny piece of code that is attached to each Web page and monitors the end-user performance from the end-user browser—collecting performance metrics 24x7 from all users. No installation is required at the end-user desktop. Main data entities collected by this component include:

- Response time—the time from first byte through rendering time
- SLOs—both warning and critical

Other data entities are collected as well, including connection type (LAN vs. dial-up), protocol type (HTTP vs. HTTPS), http method, and browser type.

The network component

Precise for SAP monitors the network response times for SAP clients at multiple geographical locations. This enables problem detection of remote users and sites as well as differentiation between front-end network time and back-end time. (Back-end time refers to the components from the portal server to the database.) Main data entities collected by this component include:

- Client IP network addresses
- Request service times
- Front-end network time vs. back-end time differentiation
- Number of requests and throughput
- Number of bytes sent/received
- Response time to remote geographical locations

The Enterprise Portal Web component

Precise for SAP measures URL response times at the Enterprise Portal Web server tier. It is important to understand which URLs are the heaviest from a response-time perspective, as well as the top URLs from a resource-consumption perspective. Starting from SAP Web AS 6.20, the Web server component comes as part of the Web AS. Main data entities collected by this component include:

- URL service times (time to retrieve a specific URL by the Web server and the back-end system)
- Web server machines and Web server instances
- Domains
- URL file types
- Client IP address that requested the URL
- Response time to remote geographical locations

The Web AS Java component

SAP runs various J2EE components in Web AS Java application servers. It is important to analyze that activity to find potential slowdowns. The main data entities that Precise for SAP collects from this component include:

- Java Virtual Machine (JVM) health data
- Top HTTP service requests
- Servlet response time and throughput
- Drill-down and correlation of called methods
- JDBC request response-time and SQL statements in case of direct database access
- CPU time, JVM memory, and garbage collection information as well as Java Management Extensions (JMX) metrics

The Web AS ABAP component

The Web AS ABAP application server, where SAP transactions are executed, plays a key role in the SAP architecture. A transaction being executed can have several potential performance problems at the application server tier, starting from waiting for the dispatcher and work process, continuing with internal enqueue waits, and ending with long database access times. It is important to monitor the system continuously for performance degradations. Main data entities collected by this component include:

- SAP users and transactions
- Work types—dialogs and batch
- Transaction processing times, wait times, and database access times
- ABAP application modules
- ABAP programs and functions

It is possible to view the information and performance by several different categories, such as SAP systems, organizational business units, locations, and application servers.

The database component

SAP Web AS (ABAP and Java) uses the database to access required business information. An untuned database could cause many performance problems. It is important to monitor the database continuously and collect the right performance metrics. It is equally important to analyze the database access and see if we can improve its performance. Main data entities collected by this component include:

- Database resource consumption breakdown (CPU, I/O, buffer waits, etc)
- Database users, programs, and objects
- Executed SQL statements

- Database objects, internal locks, and events as accessed by ABAP/SQL statements, as well as their performance
- SAP users and transactions issuing the SQL requests

It is important to emphasize the link between problematic SQL statements and their initiating SAP users and transactions. This enables us to map SAP users and transactions to resource-consuming SQL activities at the database level, which can dramatically accelerate root cause analysis.

The storage devices component

One of the primary reasons for performance issues has always been inefficient physical device access. Problems could be of several types—for example, poor balance of files on devices and contention between files on the same device, among others.

It is beneficial to be able to map logical database objects access to physical devices in order to understand I/O device access problems. Mapping logical Oracle I/O requests to physical storage devices becomes more crucial in RAID-based architectures where a file can spread over multiple physical devices, using striping techniques.

Precise provides deep visibility into EMC Symmetrix® and CLARiiON®, IBM® TotalStorage, HP® StorageWorks XP, and Hitachi Data Systems Lightning, Thunder, and TagmaStore® Universal Storage Platform systems.

Precise for SAP features

Precise for SAP provides your IT or SAP Basis team a full end-to-end view of all applications tiers in the SAP environment and provides an alert overview of the various components by category, in a simplified way so as to facilitate communication by team members—for example, performance or load alerts at the database. From here, it is easy to find additional information when problems occur.



Precise UI showing an SAP Environment

Proactive management through exceptions

Managing a large SAP application infrastructure with hundreds or thousands of users is difficult, to say the least. The only way to do so effectively is to work proactively rather than reactively. Precise for SAP provides the way to do this through the use of exceptions, based on automatically computed SLAs and baselines.

When an exception is detected by Precise for SAP, an alert is raised. In addition, Precise for SAP provides capacity trending that will alert the user should future unforeseen loads and performance issues impact the overall SLA and performance.

End-user experience and SLAs

End-user satisfaction is extremely important: If end users are satisfied, application managers are satisfied. Precise for SAP provides a way to measure response times as experienced by end users and to define SLA thresholds on those metrics.



Precise correlates user transactions (VA01) with the infrastructure supporting them.

Correlated end-to-end view

Precise for SAP provides an end-to-end overview of the different tiers and components. This view is correlated across components, which means you can view, for example, the J2EE components invoked by a specific URL or the SQL statements executed by a specific user or transaction.

Investigating the SAP ABAP application tier

Precise for SAP provides detailed information on the SAP ABAP application tier. Key performance metrics such as SAP application server load, availability, and response times can be reported in aggregate, or broken by systems, locations, organization units, users, transactions, SAP application modules (e.g., SD, FI, etc.), program names, screen numbers, and more. Information on additional application server resources, as well as recommended values for important metrics, can be obtained in a similar way.

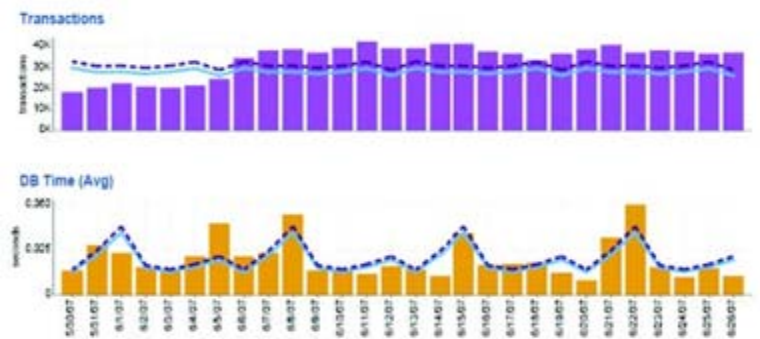
Investigating the SAP database tier

At the database level, detailed resource consumption breakdowns, SQL statements, users, and programs are provided. Moreover Precise for SAP allows for direct correlation of the SAP workload from a high-level SLA view all the way down to a SQL statement that was executed in the database and even into the underlying storage where the data file exists, if Precise for Storage is installed. This gives us an understanding of which organization or location is responsible for the poor response time.

Precise for SAP also provides a complete index-tuning advisor that helps with index creation as well as simulation of the index's impact before the index is actually created.

Long-term analysis

Performance metrics collected from all SAP application tiers are kept in the Precise for SAP Performance Warehouse. These performance metrics are used for trend analysis and capacity planning. Precise for SAP includes a reporting feature called Foresight, which uses the Performance Warehouse to generate hundreds of out-of-the-box Adobe Acrobat reports. These reports range from exception reports showing specific service-level breaches to alert reports showing deviation from nominal behavior; profile reports, which enable you to analyze correlated performance data between tiers; availability reports for both application server types and remote locations; as well as many types of capacity-planning reports that will enable you to plan for the future, based on past and present trends.



Precise for SAP provides historical reporting and trending analysis

An SAP operations dashboard

The Application Service Dashboard (ASD) is a new way to access Precise for SAP through a portal-based GUI infrastructure. It relies on open standards and provides a highly customizable dashboard. It aggregates data from multiple sources (e.g., database, storage, and application server tools) across the Precise for SAP product suite to deliver next-generation performance-management capabilities on a single console. ASD comes with a set of predefined SAP portlets, which can be utilized to configure customized and personalized SAP landscape views, meeting the requirements of

the different roles involved in SAP management and operations, such as monitoring and Basis or database administration. The ASD helps everyone in the organization see what they need to see in the way they want to see it

Benefits of Precise for SAP

From a business perspective, using Precise for SAP can help organizations significantly reduce performance slowdowns, defer hardware investments, and, therefore, achieve rapid ROI while maintaining low TCO. Precise for SAP significantly helps organizations to:

- Understand who is using SAP, which applications and transactions they are using, and when and where they are using them
- Proactively detect potential problems before they can negatively impact end users
- Improve end-user satisfaction with the application
- Increase ROI
- Detect, find, and solve problems more quickly
- Defer hardware investments by fully leveraging existing hardware
- Reduce TCO—both by significantly reducing the amount of staff, time, and effort involved in the problem management process; and by allowing less experienced staff to participate in that process without negatively affecting the quick isolation and resolution of problems
- Verify adherence to business-level objectives
- Conduct organizational health checks through baselines and service-level exceptions
- Effectively communicate the service-level achievements and improvements to the organization
- Eliminate “blamestorming” between IT organizations
- Manage and tune the application to utilize system resources more effectively
- Use just-in-time capacity, deferring equipment and associated software licenses and support costs until they are actually needed
- Better understand future capacity requirements, based on current SAP usage and growth patterns

In summary, Precise for SAP is an excellent vehicle for measuring and improving performance objectives, and it provides the necessary mechanisms to realize significant savings in cost and effort while effectively managing application performance.

Summary

SAP has become an essential part of many organizations—and this trend continues to grow with the introduction of NetWeaver, incorporating new technologies such as Enterprise Portal for end-user access and the Web AS Java architecture. While this is a great advance for endusers—improving business efficiency, productivity, and satisfaction—it poses great challenges for SAP administrators and others who are responsible for the smooth management of these complex applications. More than ever before, managing SAP performance is a challenge.

Application Performance Management for SAP Environments

In this environment, delivering the right levels of service has become very challenging as well. Managing the new SAP architecture is fundamentally more difficult due to the inherent complexity introduced by its multiple tiers, its mixture of new and legacy technologies in the path, and its database calls and storage access.

Experience has shown a direct correlation between SAP service levels and its productivity/revenue generation. There is also a direct correlation between targeted service levels and the expense incurred to achieve those service levels. The penalty for not meeting the users' performance expectations may mean a loss of user productivity, loss of revenue, and the failure to realize an ROI on the SAP system investment.

Precise for SAP addresses the complexities of managing SAP performance, and simplifies the deployment and ongoing maintenance of SAP systems. Using Precise for SAP helps companies manage service levels, contain costs, and maximize the effectiveness of their operational investments.

Precise for SAP provides a way to quickly and efficiently capture and correlate SAP application metrics such as URLs, J2EE objects, RFC calls, ABAP transaction activity, and SQL statements across the SAP infrastructure. It presents these important metrics in a manner that enables crisp communication and rapid proactive or reactive detection, correction, and verification throughout the application lifecycle.

Precise for SAP sets a new milestone in SAP performance management by delivering a comprehensive integrated software solution that addresses the major challenges associated with the management of SAP multi-tier application components.

About Precise Software Solutions

Commitment, Focus, Experience

For over 15 years Precise Software Solutions has helped our Global 2000 customers manage business performance in complex, heterogeneous environments, assuring availability and business continuity. Precise offers a complete solution – from discovery through ongoing management – that allows our customers to focus on their core business. We offer the broadest platform support, in terms of enterprise application, operating system, database, and development environment coverage. Precise is the solution of choice for IT as an organization-wide standard for application management.

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