Computer Associates™

White Paper

Managing SAP for Optimum Performance and Availability

Executive Overview

Enterprise Resource Planning (ERP) applications, such as SAP, are systems that help keep today's businesses running. Many companies that have multiple business functions employ ERP solutions — and have spent considerable time, money and effort in implementing these vital, yet complex business applications. Most ERP solutions span business functions such as purchasing, inventory/stock control, manufacturing and finance. Once successfully implemented, ERP solutions can have a profound business effect on all of a company's business stakeholders, including: its employees, divisions, business partners, co-producers, buyers and suppliers.

While much has been written about making ERP implementations successful, little material is available that covers management of the technologies supporting the application. Complex, multi-module applications such as SAP must be continually monitored and adjusted to meet the performance and capacity demands as the system changes and grows. Intrinsically transactional by nature, ERP applications are dependent on the performance and reliability of many technologies, including the SAP application and the network infrastructure that supports integrated process workflows — both within the company and externally across supply chains.

This white paper reviews the issues and challenges of managing SAP application solutions, and the technology that supports them. It also includes information about Computer Associates International, Inc. (CA) technology, which helps improve the operational efficiencies associated with managing SAP applications, including SAP R/3 and **mySAP.com**. CA solutions help minimize enterprise business risk and exposure, and enhance the value of ERP processes, information and knowledge across the enterprise.

Introduction

Despite the difficulties of many SAP implementations, the competitive edge that an ERP application offers often drives organizations to undertake the business process reorganization and customization of the SAP application. Too often, however, management of the live application is regarded as an afterthought or "IT Operations will take care of it." SAP management should be an integral part of the ERP planning and implementation process. Without the proper management, the competitive advantage offered by ERP applications may never be fully realized.

Once organizations have implemented SAP, if the applications go down, so do business operations. Availability, reliability and performance of the SAP application are essential to the health and prosperity of the business.

Managing SAP

Why an Enterprise Management Solution?

There are two types of management for the SAP environment: point product management, such as SAP's Computing Center Management System (CCMS), or an enterprise management solution. CCMS is an excellent data collector, but it is not intuitively easy-to-use. In addition, CCMS shares a problem common to all point products — with individual products there is no ability to look at the enterprise as a whole and quickly identify and resolve problems. If an end user complains that SAP R/3 is slow, CCMS can eventually identify where the problem is occurring — if it is with the SAP application. However, suppose that the problem is insufficient memory in the application server, or a problem with the network between the client and the application or database server. Valuable time can be lost trying to solve a SAP R/3 problem when the real problem lies elsewhere. An enterprise management solution allows the BASIS team to quickly identify where the problem exists and resolve it.

R/3-Specific Management

An enterprise management solution is able to provide an in-depth look at the SAP application, as well as the big picture. In addition to this white paper, a good source for information that can help determine what an enterprise management solution should monitor for SAP is SAP's book, *R/3 System Administration Made Easy: Oracle on UNIX and Windows NT*, Chapter 4 "Scheduled Daily Tasks." Additional requirements are covered in other chapters, for example, "Backup and Restore" in Chapter 3.

Installing SAP

SAP installation is very time consuming. The installation can take almost a full day and usually involves installing the database portion overnight. Electronic software delivery is not recommended. However, electronic software delivery and installation is extremely useful when it comes to installing the SAP GUI. This client software can be easily installed anywhere in the world from a central site, saving time and travel expenses.

Monitoring SAP

CA's Unicenter® Management for SAP R/3 provides detailed information and protective monitoring for SAP, including monitoring ABAP (Advanced Business Application Programming) dumps, processes, availability, enqueue locks, users and spool problems. It also monitors jobs, backups and databases, all of which will be discussed in detail in this paper.

ABAP Dumps

ABAP or short dumps occur when a report or transaction does not complete successfully due to incorrect programming or erroneous data. Although called short dumps, these snapshots of the termination can be quite long, up to 75 pages. Analyzing the dump is useful in determining what went wrong, so that it can be corrected. When the number of dumps exceeds either the warning or critical thresholds, it can trigger an automated action. The threshold can be set to zero, so that any short dump triggers a message on the Event Console and can automatically trigger a responsive action, such as paging a member of the BASIS team.

Alerts

The CCMS Central Alert Monitor collects and displays several potentially serious problems, but not all. Alerts allow users to monitor multiple servers from one centralized site. Unicenter Management for SAP R/3 monitors all alerts, provides for threshold setting and automated actions to proactively manage the R/3 environment. It also enables users to centrally monitor all instances of R/3, including all R/3 systems.

Users

ERP applications are intended for use throughout the organization. However, if too many users log on simultaneously, performance can be adversely affected. Unicenter Management for SAP R/3 monitors the number of users and sets warning and critical thresholds, so that if too many people are logged on, immediate action can be taken. In addition, Unicenter Management for SAP R/3 displays the users that are logged on along with details about the users' sessions, enabling the identification of any new users.

Processes

SAP advises administrators to check processes daily to determine all processes with a "running" or "waiting" status. Unicenter Management for SAP R/3 will do that automatically and allows users to set warning and critical thresholds for Free Processes or Elapsed Time.

In addition, Unicenter Management for SAP R/3 can be configured to generate alerts for long running processes, such as spooling. Thus an alert could be generated if the spool process runs too long. Also, the agent detects any SAP generated alerts, including those related to the system logs and buffers.

In addition to the agent, Unicenter Management for SAP R/3 can route all SAP system log messages to its console. This provides a central viewpoint of all messages, as well as the ability to automate actions based on the occurrence of SAP and other messages. One way of handling SAP messages is to use the Event Console to provide a translation of the R/3 error messages.

Updates

Updates run in the background — thus problems can easily go undetected. If an update is cancelled, either due to an error or from operator intervention, users need to be able to quickly and easily identify the problem. Also, if the backlog of pending updates becomes too great, it could be an indication of a problem. An update program could be running too long, thus preventing others from being scheduled. Or perhaps, the update subsystem is configured inadequately for the amount of work the user is attempting to run.

Unicenter Management for SAP R/3 monitors the SAP update subsystem. Within the update subsystem, it monitors the activation status, as well as all cancelled and all pending updates. Thresholds can be set for the polling interval and daily intervals using warning and critical counts for both cancelled and pending updates. The interval and daily threshold settings allow transient and persistent problems to be discerned.

The activation status also needs to be monitored because if an authorized SAP user disables the subsystem, which would be extremely abnormal, no background updates will take place. Unicenter Management for SAP R/3 interprets this as a critical situation.

Enqueue Locks

Enqueue locks are used to prevent anyone from modifying a resource that is presently being modified by another person. Locks need to be monitored to ensure that there are no old locks that were not released and to determine the number of locks. Too many locks can indicate a problem — either locks are not being released or the workload is too high. Unicenter Management for SAP R/3 monitors for the number and age of enqueue locks.

Performance

There are a number of aspects to performance: performance monitoring, historical performance and performance from the end-users' perspective. Unicenter Management for SAP R/3 allows organizations to monitor all of these aspects — plus numerous parameters that directly or indirectly contribute to the performance of the application and database. Performance of the database will be covered later in this white paper.

Performance Monitoring

Performance data is collected from the R/3 system. A wealth of R/3 performance metrics can be monitored for both real-time and historical reporting. Both non-SAP and SAP resources can be correlated to create powerful views into the entire enterprise resource utilization. Threshold levels can be set to generate alerts for proactive management, thus preventing small problems from becoming much larger.

Historical Performance

Following the performance trends of the R/3 and mySAP environment allows users to determine if they are in need of additional resources. In addition, it helps detect periods of high usage, thus enabling users to redirect certain activities to different times — in order to better balance usage. Historical performance data is collected and sent to the Performance Trend and Scope Application within the Unicenter Management for SAP R/3.

End-User Perspective on Performance

End users are the final aspect of performance. If they perceive performance to be slow, productivity drops. Being able to measure performance from the end-users perspective helps ensure that performance issues are quickly identified. In addition, having warning and critical thresholds on end user response times helps meet Service Level Agreements (SLAs).

Job Scheduling

Job scheduling is done within R/3. Scheduling non-SAP jobs that are dependent upon SAP jobs must be done manually. Since SAP recognizes this as an issue for many customers, SAP provides a Business Application Programming Interface (BAPI), which allows third-party solutions to interface with the SAP job scheduler. Utilizing this BAPI, Unicenter Management for SAP R/3 can schedule both SAP and non-SAP jobs from a centralized scheduling manager, allowing dependencies to be monitored and automatically executed. All scheduling can be done using a single interface, thus saving time and reducing human error.

Backup and Restore for R/3 Databases

SAP R/3 utilizes a full-featured three-tier client/server architecture and supports a back-end database. For example, this database might be Oracle (this could be a parallel server database), Informix, SQL Server or DB2. The database is installed as part of the R/3 install and the R/3 installation adds specific tables to the standard database. This means that a normal Oracle back-up agent, for example, will not do a complete backup of the R/3 database because it is unaware of the R/3-specific tables. A complete backup requires a storage product that has a specific agent for R/3. Because SAP provides a BAPI for backup, the safest choice is to select an SAP-certified solution. BrightStor™ ARCserve® Enterprise Backup is certified by SAP for backup and restore and provides hot or online backup for an R/3 database — helping to ensure that backup and restore is complete and eliminating downtime.

Database Management

Both SAP R/3 and mySAP support back-end databases. The following example focuses on using Oracle as the database.

SAP R/3 consists of thousands of tables, indexes and programs — standard and custom written. R/3 must send SQL statements to Oracle for processing, like any other Oracle application. General Oracle tuning principles such as hit ratios, SQL performance, resource contention and space management still apply. However, these tuning principles must also be combined with SAP architecture tuning.

The Unicenter® Database Management solutions monitor any SAP database, manage performance and perform tablespace reorganization. In fact, the Unicenter® TSreorg™ for Oracle product is the first,

and as of this writing, the only tablespace reorganization product, validated by SAP. (Validation means that SAP has tested the product in their lab and validated it as working with their product. Certification is not available in this category, as SAP has not created a BAPI in this area.)

Output Management

CA's Unicenter® Output Management and Document Management products provide a complete solution for both mainframe report output and documents from the distributed environment. Entire reports or sections of reports can be distributed, printed anywhere in the environment, viewed online — in a Windows, web browser, or mainframe environment — and archived for long-term storage and subsequent retrieval.

All of CA's Unicenter Output Management products are tightly integrated with Unicenter® CA-Spool™ Print Management (Unicenter CA-Spool), the enterprise-wide spooling and print management solution. Unicenter CA-Spool is an independent spooling and print management system for all 3270-type, AFP-type, PCL-type, PostScript-type and TCP/IP-connected-type printers that provide the facilities necessary to manage all remote printing in a z/OS or OS/390 environment. This solution offers powerful facilities for exchanging data between programs and for spooling and printing in a multi-CPU environment. It provides enterprise-wide spooling and print capabilities to clients using VTAM, CICS and IMS. Unicenter CA-Spool provides non-stop operation to relieve the JES workload, and collects reports from all platforms for printing, viewing and storage into a single, centralized, secure report repository. It can collect reports from multiple sources, including non-OS/390 platforms (DOS/VSE, VM/CMS, AS/400 and eServer(s).

In addition, CA and Hyland Software, Inc. have developed seamless integration between Hyland's OnBase suite of products and CA's Output Management solutions. For example if an organization already has Unicenter® CA-View® Output Archival and Viewing and Unicenter® CA-Deliver™ Output Management it can link to OnBase's products for Imaging, Document Management, Workflow, COLD, Web Delivery and Forms Processing without having to perform an import or conversion. Users are able to access the output management documents from within the OnBase system, along with any documents or files that are in the OnBase repositories. No other Output Management solution vendor currently offers this functionality. For more information on the OnBase Suite of Products, go to **onbase.com**.

Working with SAP and Legacy Data

Although business processes may be enhanced and costs can be significantly reduced as a result of implementing SAP, vast amounts of corporate data lie dormant in SAP databases — unusable for business analysis and reporting purposes. Intensive efforts have been made to find an economical and efficient data access solution. Third-party decision-support tools and generic business and data models have proven inadequate. They are not suited to the complexity of SAP data structures, or to the often-revised SAP-compliant business practices adopted by most users. SAP systems can present difficult and expensive challenges for IT managers struggling to retrieve data for use in management decision making. R/3 databases offer a number of challenges:
• Extremely complex data schema
• Upward of 10,000 tables many with unknown relationships
• Table names hard-coded with meaningless, cryptic German mnemonics
• Tremendous variation from installation to installation
• Lack of knowledgeable SAP-consulting resources

Within the R/3 database, information is stored in different ways:

Transparent Tables — a standard relational database table that can be accessed by SQL. There are no special requirements involved in accessing these tables except an understanding of abbreviated table and fieldnames. There are over 9000 transparent tables in a typical SAP R/3 install.

Clustered/Pooled Tables — a database table containing columns from many related tables. These tables often have fields that are stored in an encrypted format. The majority of data stored in such tables also resides in the underlying transparent tables.

Structures — memory resident tables that exist only during processing within the SAP application.

SAP Reporting Tools

To access the transaction level data, SAP offers various options. The first is a significant set of fixed reports included with R/3. While these are typically adequate for certain needs, most customers require additional reports. Also, significant modifications and customization of the standard reports are often required, depending on how far the installation has strayed from the generic SAP installation.

There are also tools such as Report Writer and Report Painter within R/3. Although fairly sophisticated, these reporting tools operate against one module at a time, leaving the solution incomplete. In fact, one of the major shortcomings of the SAP reporting solution is the lack of cross-module, transaction reporting.

ABAP/4 Programming

Many SAP implementers are trained in ABAP programming. ABAP is the SAP programming language used to write reports that require data from various tables and modules. Due to the complexity and resource issues relating to ABAP programming, reports are often requested significantly faster than the ABAP programmers can write them, creating a significant reporting backlog. As more and more organizations are looking to empower users to create reports, ABAP programming becomes less attractive since only skilled programmers can be effective using it. In the long run, it becomes extremely difficult to cost-justify, and can create a significant performance drain on the database server.

SAP Data Staging Solutions

In addition to the transaction data that appears in the R/3 database, there are several other data sources available to SAP customers. For example, SAP offers Executive Information Systems (EIS), Logical Information Systems (LIS), and SIS modules. These add-on modules deliver summarized information that can be used for analysis purposes. However, there is no detail information included in these modules, and to change the information contained in them requires complex customized programming. SAP's current focus revolves around their data warehousing solution called the Business Information Warehouse (BW). The BW is designed to provide customers with a summarized, time-based subset of their R/3 data in a state-of-the-art warehouse for the purpose of Online Analytical Processing (OLAP).

The collection of InfoCubes that are stored in the BW can be manipulated to aid users in business analysis of their data to answer questions such as:
• What are the ten most profitable products this quarter?
• Who buys them?
• Who are our best customers?

• Which suppliers are the least reliable?
• What are our critical success factors?

These questions all indicate a need to analyze key business indicators, at a summarized level, over a certain period of time. A star schema data warehouse of this kind is perfect for this level of analysis; however, it is important to note that the BW is complementary to detail level, transaction reporting and in no way a substitution.

When looking towards the BW for reporting, the following questions arise:
• Will the data be sufficiently detailed to be effective for production reporting?
• Will it facilitate merging data from non-SAP applications into one InfoCube?
• Does having a data warehouse entirely alleviate the need for real-time transaction reporting against SAP?
• How long will it take to populate and how often will it refresh?
• How long will it take to implement?
• How much will it cost to maintain?

Third-Party Tools

The final choice involves the use of third-party products. Some customers have chosen to build their own data warehouses for the purpose of reporting. In doing so, they open up the data to be accessed by any SQL-compliant tool. The issue of creating a data warehouse from R/3, however, is very complex. The sheer amount of data, number of tables and cryptic nature of the table/column names make it quite challenging. Therefore, the real issue becomes simply accessing SAP data in an effective manner using a third-party tool, be it for the purpose of a data warehouse or direct transaction reporting.

Data Transformation and Data Warehousing Technology—Criteria for an Effective Solution

In order to provide an effective enterprise reporting solution for SAP and other data, a product set must:
• Present user-friendly names for all vital information, regardless of whether that information has been customized or is standard to R/3.
• Have a server-based component to handle the large volumes of data and the large number of users present in a typical SAP installation.

- Extract information to many different targets, including the Web — a major part of many SAP implementations.
- Combine and relate information across SAP modules.
- Combine and relate information from SAP and non-SAP applications.
- Handle on demand queries and multidimensional analysis of data, as well as complex, sophisticated production reports.
- Deploy security to prevent unauthorized users from accessing sensitive data.

Advantage™ Data Transformer Enterprise Metadata Edition (Advantage DT EME) and CleverPath™ Reporting and Analysis Product Portfolio — Meeting the Solution Criteria

To achieve the ultimate solution found in Advantage DT EME and CleverPath Reporting and Analysis solutions, many challenges had to be overcome. The goal was to create a solution that supports SAP R/3 as a data source while seamlessly integrating other enterprise data sources. All the criteria outlined above had to be achieved in a manner that is simple to implement and easy to use. The challenges also included:

- Implementation of an open data acquisition tool without major modifications to the SAP R/3 system itself.
- How to extract the data without interfering with the functionality of the SAP production system. Once the SAP system has been purchased, installed and made operational, no one wants to jeopardize the environment by making significant alterations to the SAP system for the data extraction process to operate.
- The wide variety in SAP installations. SAP lends itself to numerous versions and levels of customization. Indeed, no two SAP implementations are completely alike. Many SAP systems undergo constant change. Frequently, table structures are added or modified.

The hierarchical data structures in SAP systems further complicate data access requirements when compared to the way one might expect a relational database system to be designed. For example, the SAP "product hierarchy" is represented by the concatenation of a series of single-character "product key" fields. Even the way this field is parsed is dependent upon details of the specific installation.

SAP contains transparent and non-transparent tables. The transparent tables are normal tables, visible in the catalog of the underlying database system being used. The non-transparent tables (cluster and pool tables) are not visible in the normal database catalog without processing a level of indirection. The only way to access non-transparent tables is through the use of SAP's list processing language, ABAP. This SAP-proprietary language must be created in the ABAP editor of the SAP user interface.

The sheer number of tables involved in an SAP implementation presents an additional challenge. In a typical SAP installation, the number of tables can exceed 10,000. All of these tables use abbreviated German names, making it difficult, if not impossible, for a developer to trace what information is available, in which table it resides and how the tables are interconnected.

Tables in SAP are usually very large since they contain all the data necessary for the SAP operational data flow. In total, there are about 250,000 columns in an SAP environment. However, much of that data is not needed for typical decision-support purposes. Extracting all SAP data would result in the transport of many unnecessary columns and make subsequent analysis and reporting by business users much more complex. These and many other more technically detailed challenges presented the CA development team with a complex set of problems.

Advantage DT EME and CleverPath Reporting and Analysis Solutions — Immediate Benefits

CA's Advantage DT EME and CleverPath Reporting and Analysis software deliver innovative and complete solutions to the challenges of accessing, reporting and analyzing SAP data. Advantage DT EME masters and transforms the complexity of SAP data structures and delivers this information for a full range of business reporting and analysis.

CA's industry-leading operational intelligence, reporting and analysis solutions offer many significant features and benefits to SAP R/3 customers:

- Default metadata to provide instantaneous access to the most commonly used information in the SAP R/3 database.
- Automatic mapping of easy-to-understand table and column descriptions from the SAP data dictionary.
- The flexibility to make changes and/or additions to that metadata quickly, without having to redo all the work done previously.

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- A server-based enterprise architecture for UNIX and NT servers to handle a large number of reporting and analysis users, large amounts of data and the scheduling of production reports.
- The ability to create complex sophisticated reports with unsurpassed ease of use.
- The ability to combine and relate cross-module information in data warehouses and data marts.
- The ability to combine and relate SAP and non-SAP data in data warehouses and data marts.
- The ability to automatically disseminate reports and analyses to corporate intranets, extranets and websites, to printers, via email, to central servers or to the desktop.
- An advanced business intelligence portal, allowing users to create, view and execute reports — or any other business content — from an intranet or Internet portal.
- Support and full integration for other enterprise information sources.
- A fully scalable, customizable and cost-effective solution.

Data Access and Integration

Advantage DT EME can make use of SAP data as one data source among many. With Advantage™ Data Transformer, users can integrate and mobilize all their data in a very short time and create data warehouses, data marts and populate information systems running on any number of platforms and databases. Advantage DT EME can access Oracle, Informix, UDB, Sybase and most other RDBMSs and flat files. Hundreds of predefined functions are available. In addition, predefined business-specific routines, written in a variety of languages, can be incorporated into a SAP solution using a flexible transformation engine.

The ability to map data from multiple sources into multiple destination attributes and employ predefined functions and routines eliminates the need to create numerous new custom solutions for reports or extracts from multiple data sources. Advantage DT EME is integrated with the industry-leading Advantage Repository, offering the only data transformation tool that provides full support for enterprise metadata management.

Summary

CA's solutions complement the existing CCMS subsystem — adding value by extending the monitoring capabilities, providing a single, consolidated console view of the environment, quickly pinpointing threshold violations as they occur and providing granular metric information to solve problems. As CA's phased rollout for monitoring SAP R/3 progresses, we will continue to provide the in-depth monitoring and management capabilities, that differentiate us from competitors. CA is committed to providing the technically best-in-class tools that address both the business and technical needs of our customers.

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