An Oracle White Paper

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Managing Oracle Fusion Middleware with Oracle Enterprise Manager 11g

Introduction

Organizations have to be agile in order to compete globally and adapt to changes in business and technology. To achieve this objective, many large IT organizations have implemented complex integration solutions that include Java EE application servers, Service Oriented Architecture (SOA) and business process management, Identity Management, and Business Intelligence platforms. These technologies form an enterprise architecture that supports distributed applications and orchestration of complex end-to-end business processes and services.

These integration environments enable new business applications and services to be developed in a much shorter time and with fewer resources. These applications tend to run the business processes that are the most critical to the enterprise, usually requiring reliable support for numerous users and always with hefty service-level requirements.

Increasingly, the productivity and financial benefits delivered by these applications are making them an indispensable part of their owners' day-to-day business operations. These mission-critical applications handle complex business processes, ranging from processes that orchestrate financial transactions to processes that prepare insurance quotes. Maintaining high application availability and performance is vital to the owners of these applications. Unfortunately, managing this class of applications is no simple task.

Oracle Fusion Middleware 11g provides the runtime engine for mission-critical Java EE, SOA and middleware applications. This white paper outlines some common challenges faced by IT administrators running enterprise applications deployed on Oracle Fusion Middleware 11g, and describes how Oracle Enterprise Manager enables customers to reduce the cost of management by providing a single management console to manage the end-to-end application environment.

Top Challenges for Administrators

To compete and survive in the midst of the current economic situation, organizations are trying to keep their costs low. IT administrators have more responsibilities and fewer resources for keeping their infrastructure running and maintaining the service levels of their applications. Oracle Fusion Middleware administrators in particular are faced with a number of challenges that arise while managing their complex application architecture.

Performance and Diagnostics

Most administrators are responsible for numerous Oracle WebLogic Server domains. For example, a typical administrator may be responsible for domains that host development, quality assurance, and production servers for an application family. Most tools, such as the WebLogic Server Administration Console, are effective for managing a single WebLogic Server domain but cannot be used to manage multiple domains. Hence administrators must monitor and manage each domain individually which becomes very time intensive and expensive.

Managing application performance and maintaining service levels for applications is another significant challenge for administrators. Often, administrators come to know about application performance issues from end-user complaints rather than from proactively monitoring the application and its underlying infrastructure. Compounding this problem further is that most operations teams end up taking ownership of "black boxes" when they accept an application for production. So when a performance issue occurs, administrators do not understand the internal workings of the application and consequently cannot diagnose and resolve the problem.

In such scenarios, they rely on a combination of application-specific support personnel (such as senior developers or architects) and silo-based performance tools. However, the application performance issue may be due to something outside the silo, such as other slow application components, a slow running SQL query or host machine. In addition, most application performance issues are hard to reproduce in a test environment, and many application diagnostics tools cannot be deployed in a production environment due to their performance overhead and restart requirements.

Business Transaction Management

Organizations are increasingly turning to composite applications to implement critical business transactions. These composite applications serve a single purpose—to execute business transactions such as operations and business support services (OSS/BSS), account provisioning and activation, and insurance claims processing. The rise of SOA and composite applications means that these business-critical transactions can be obscured by integrations, by components that are widely distributed across both internal and external systems, and by infrastructure, such as acceleration and security technologies and appliances.

Business transactions are often executed by arranging or "orchestrating" existing applications and infrastructure to implement business processes. They incorporate a wide variety of technologies, deployed across many platforms and organizational boundaries. Common technologies include

intermediaries such as Enterprise Service Buses (ESBs), Process Engines, legacy and packaged applications. Composite applications incorporate a range of shared components, such as SOAP services, packaged applications, Portals, EJBs, POJOs, and databases. However, despite the complexity of such processes, they must behave as a single, seamless transaction from the point of view of the business user.

Operations and application support staff responsible for these business systems therefore face a variety of challenges, such as:

- Monitoring health and availability of services and business transactions

- Securing application environments end-to-end

- Tracking usage of services

- Managing transaction errors and fallout

Neither IT nor business teams have traditionally had the visibility and control needed to efficiently manage these composite applications. IT and business staff usually first discover transaction issues through cryptic log entries or calls from vexed customers. What commonly follows are resource-intensive fire drills and finger pointing across various teams, increasing the maintenance overheads incurred by IT.

Configuration and Change Management

As IT infrastructures continue to expand, managing configurations and configuration change has become one of the most critical tasks in day-to-day IT operations. If administrators are unable to manage their configurations they can significantly and negatively impact their business' bottom line by not preventing unplanned downtime.

At the forefront of various challenges in the configuration and change management space is knowing what assets exist in a datacenter. Often, administrators simply do not have a clear understanding of what is installed and running in their enterprise. They are unable to answer - with conviction - simple questions such as the following:

- Which WebLogic Servers do not have a particular patch applied?

- How many WebLogic Servers use the JRockit JVM?

- Which WebLogic Servers are listening on port 8001?

- Which WebLogic Servers rely on a particular JDBC data source?

If by chance they do have this data, the information was gathered in a time-consuming, error-prone fashion, and is maintained manually in cumbersome spreadsheets. Consequently, being able to efficiently analyze data across multiple WebLogic Server domains in the enterprise is close to impossible. For instance, if a production application is not performing as well as the same application in the QA environment – and the two underlying infrastructures are supposedly configured identically – administrators do not have the means to quickly compare the two environments end-to-end in hopes of pinpointing the differences in configuration and, therefore, the potential cause of poor performance.

More and more organizations are implementing compliance frameworks such as Sarbanes-Oxley (SOX), Information Technology Infrastructure Library (ITIL), and Payment Card Industry (PCI) data security standards – as well as unique business standards. Because of this it has become increasingly more critical to efficiently monitor the configuration of the enterprise. IT staff lacks an effective method for ensuring and tracking compliance with these frameworks and standards. Consequently, being audited becomes a very stressful and costly experience for the IT organization.

When administrators are unable to ensure compliance with standards, down time is likely to occur. In such situations, one of the first things that administrators look at in order to troubleshoot the problem is the configuration of the environment. More specifically, they look for configuration items that recently changed that could have impacted availability, and whether the configuration change was an authorized change. Typically, IT organizations do not possess this level of historical insight, nor are they immediately alerted when configuration changes occur which are outside of any approved request for change.

These challenges in configuration and change management are substantial. When they are not addressed, there is more downtime and significantly higher IT costs – both of which affect a business' bottom line. Oracle Enterprise Manager offers a solution to these configuration and change management challenges. Specific features which address these challenges will be described in detail later in this white paper.

Application Lifecycle Management

In today's data center, proliferation of low cost servers and numerous software deployments on those servers have brought in a fresh set of lifecycle management challenges. One well-known challenge is deployment of software which supports the business. Such software spans from the application to the middleware to the database, and on down to the underlying operating system. Installing, configuring, and patching all these tiers is time consuming and error prone. Another common problem is administrators' difficulty in managing capacity to changing workload patterns. When there is an increased demand for services, there is no efficient nor automated way to adjust the underlying infrastructure – by adding capacity - to improve application performance. Manual, error-prone methods are most often relied upon. Such lifecycle management challenges eventually result in administrators spending a significant amount of time in software provisioning and maintenance operations.

Comprehensive Management of Oracle Fusion Middleware

The challenges in managing complex enterprise applications and their underlying infrastructure are substantial. When they are not addressed, there is more down time and significantly higher IT costs – both of which affect a business' bottom line. To address the challenges outlined above, IT organizations can rely on Oracle Enterprise Manager. Oracle Enterprise Manager is a next-generation application management solution designed specifically for this new class of distributed applications built on Oracle Fusion Middleware 11g. Using Oracle Enterprise Manager, administrators can manage each middleware component of Oracle Fusion Middleware more effectively and efficiently.

Oracle WebLogic Server Management

Managing Oracle WebLogic Server requires a broad end-to-end management perspective as these application servers routinely are not only providing the external face of applications, but also handling the majority of the business logic. Commonly, this means multiple clusters of managed servers that handle both presentation and business logic and communicate with each other via RMI, Web Services, and other remote invocations in order to complete transactions for front-end processes. In order to properly manage these WebLogic Servers - whether there are multiple large-scale deployments or just a couple clusters - administrators need to keep track of performance, service levels, configurations, error/exception handling, and the general application life cycle. The following sections provide details into Oracle Enterprise Manager's comprehensive management solution for Oracle WebLogic Server – the core of your Oracle Fusion Middleware deployments.

Predefined and Proactive Monitoring

After adding Oracle Fusion Middleware and its underlying WebLogic Server domain to Oracle Enterprise Manager, Oracle Enterprise Manager immediately starts monitoring the environment with a predefined set of status and performance metrics. These metrics span WebLogic Servers, their deployed applications, and resources such as JDBC connection pools and data sources. Administrators monitor all of these metrics in real-time or historically from various customizable performance summary pages within the console. In addition, administrators can define a WebLogic Domain Group that contains several domains and monitor availability, performance, configuration, and potential problem areas more cohesively and with fewer clicks.
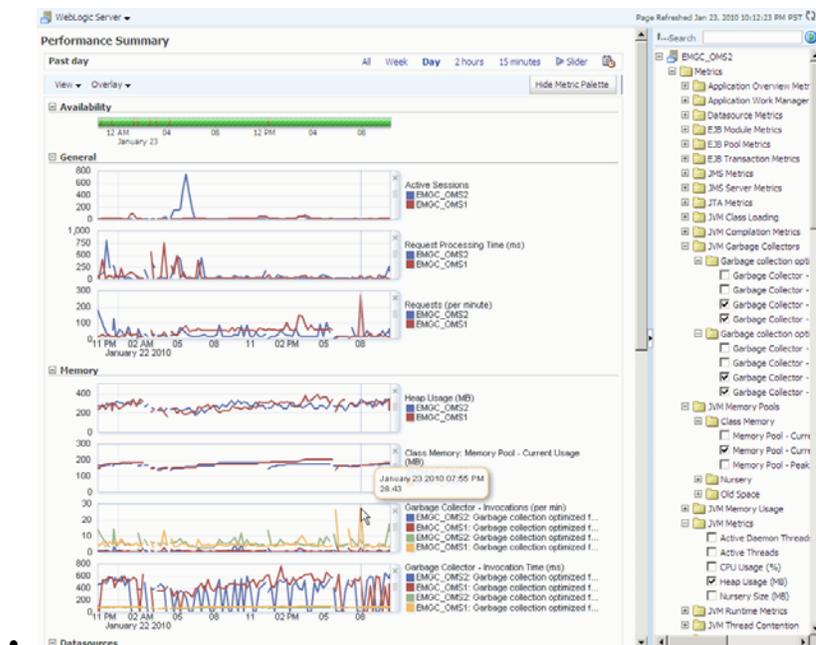

Figure 1 - Customizable performance summary pages let administrators create their own dashboards

For key performance indicators, administrators can specify warning and/or critical thresholds. To simplify specifying thresholds across all of Oracle Fusion Middleware and to ensure consistent monitoring across the environment, administrators can create a monitoring template; specify thresholds once, and apply the template across their Oracle Fusion Middleware targets. For instance, the WebLogic Servers in production could rely on one monitoring template, while those servers in QA could rely on another. Regardless of how thresholds are defined, whenever they are crossed, alerts are raised in the Oracle Enterprise Manager console. Administrators can also receive email and/or page notifications for the same alerts so no matter where they are or what they are doing, they will be notified of potential problems.

Request Monitoring

In modern day applications, monitoring web application performance across multiple tiers and having visibility into the distribution of the load for requests is absolutely critical. Oracle Enterprise Manager automatically discovers these business transaction request call paths and provides visibility into these dynamic and flexible application infrastructures providing everything from aggregated request monitoring metrics with call path topology details to instance level transaction tracing across web service infrastructures. Administrators can easily set service level thresholds at any level and have violations provide operations and application support with the instantaneous alerting that they require to ensure the health and service level of these applications.

Oracle Enterprise Manager provides a dashboard for all requests displaying vital performance metrics and key statistics. The request dashboard identifies the worst performing requests based on response time in order to immediately alert administrators of potential bottlenecks. Administrators can also quickly compare the performance and throughput of two time periods for a particular request side by side. For each transaction, administrators can see the topology view of the flow in order to identify bottlenecks within the context of the call path. The topology call path is dynamically generated using runtime transaction metrics collected from the middleware as well as database tiers. This greatly enhances an administrator's ability to visualize the overall picture of request traffic between associated system components and to drill down further into the component model dependent on the metrics that they identify. In absence of such a tool, administrators have to rely on ad-hoc manual and error prone techniques to identify entry points and diagnose the bottlenecks within their key requests which may lead to loss of business services to the customers.
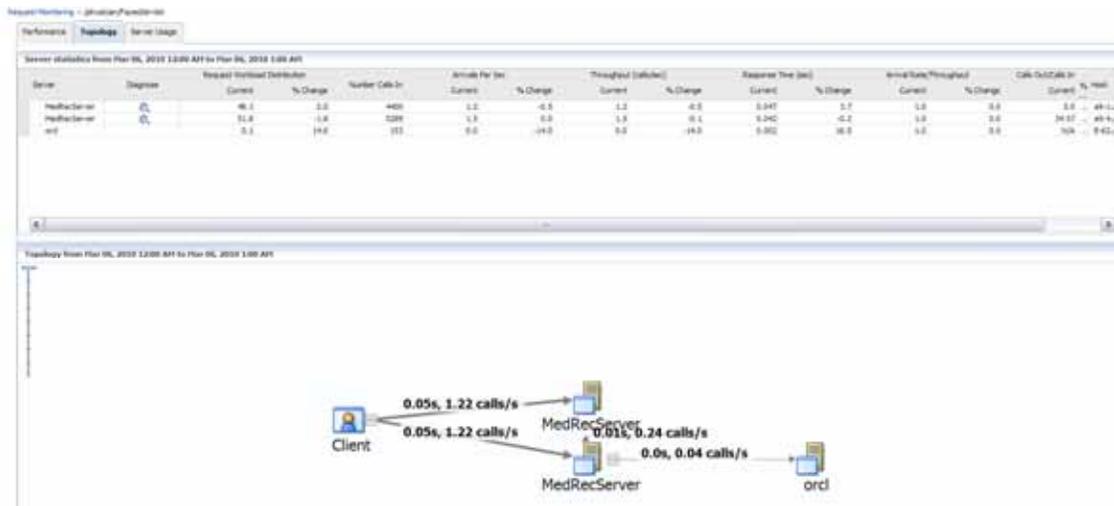
Figure 2 - Automatically discover transaction request topologies to pinpoint bottlenecks within the request call path

Business Transaction Management for WebLogic Applications and Services

If administrators do not know what is deployed in their environment, how applications and services are interconnected, and how business is flowing through the system, they lack the basic information required for management. To help bootstrap management, Oracle Enterprise Manager discovers application components and the dependencies between them, providing a comprehensive bird's-eye-view across composite applications that span multiple servers across different platforms. The application map provided by the business transaction management features within Oracle Enterprise Manager makes critical information available at a glance, enabling operations staff to identify their application topology, key components, network hot spots, and rogue applications — the information they need to make informed decisions when managing change within their environments.
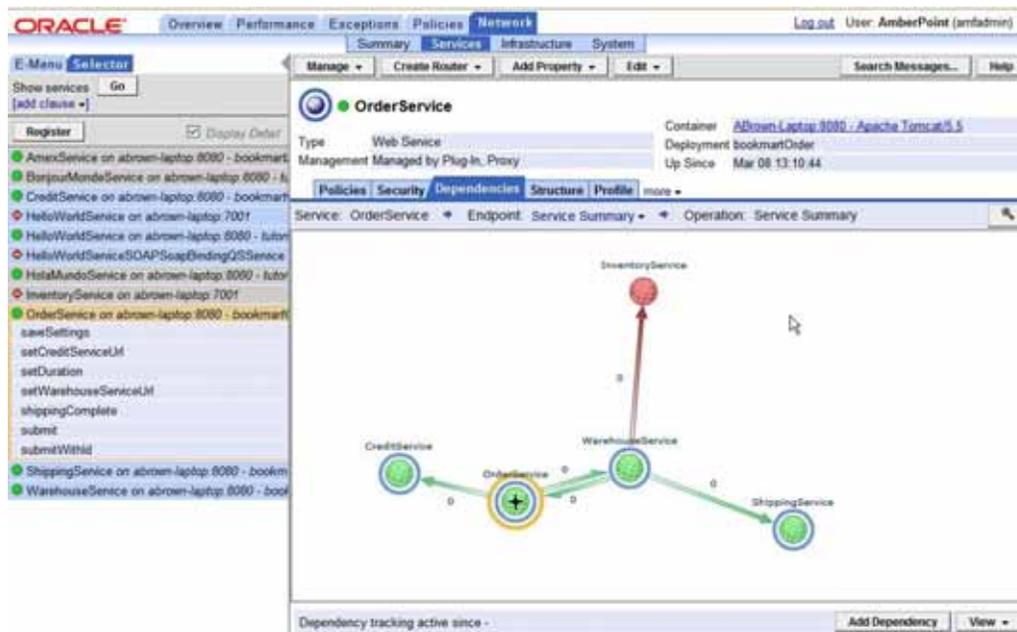
Figure 3 – Service-level relationships are identified and tracked at the individual transaction level for web services

These "always on" discovery capabilities reflect ongoing changes and updates in the runtime environment. The system auto-discovers service components in every container, the deployments and associated metadata, and continuously tracks changes as service components are updated.
Oracle Enterprise Manager also provides end-to-end insight into applications to help manage dependencies, by continuously discovering service dependencies and relationships. These dependencies are mapped using the live interactions of application components. The global dependency map across all services is complemented by a local dependency map for individual services. Administrators can view the entire service networks of multiple composite applications, or individual component or operation-level dependencies. Since Oracle Enterprise Manager provides the real-time view of application interaction, it is useful for reconciling design objectives with the reality of the applications at runtime.

Tracking End-to-end Performance, Availability and Service Level Management

Oracle Enterprise Manager monitors system traffic in real time, providing live views of in-flight transactions, keeping administrators apprised of the behavior of each application component. It provides a rich snapshot of vital runtime data—such as throughput, availability, response times and faults—across a range of time intervals and within the context of the business transaction and the business user.

Oracle Enterprise Manager brings predictability, visibility and control to applications by delivering comprehensive service level management for services, transactions and business processes across heterogeneous environments. It monitors all flavors of application services, ranging from SOAP and XML services to virtually any application service or legacy component—such as EJBs and Plain Old

Java Objects (POJOs). Oracle Enterprise Manager can instrument virtually any distributed application service.

Oracle Enterprise Manager continuously monitors message exchange and application invocations—both synchronous and asynchronous--to collect data on the operational health of application components and to relate that behavior to the higher level construct of the associated business transactions. Oracle Enterprise Manager extends visibility to primary application services, such as SOAP and REST web services, to underlying implementation components such as EJBs, POJOs, and JMS queues components, right down to database queries.

With Oracle Enterprise Manager, users can:

- Define different SLAs for discrete business segments

- Prioritize service use by any business criteria

- Focus on the most valuable users (e.g. customers and partners)

- Deliver the best quality of service during peak hours

- Set and monitor SLAs for individual services as well as composites such as processes and transactions

Knowing the business user is a critical aspect of understanding and controlling systems that execute business transactions. Oracle Enterprise Manager shows who is consuming the services and segments these consumers for SLA-driven quality of service. Its support for detailed usage analysis and reporting over time helps organizations to identify trends and revenue opportunities.

Transaction Diagnostics and Root-cause Analysis

Oracle Enterprise Manager provides sophisticated instrumentation for real-time detection, alerting, and remediation of various types of unexpected technical exceptions or business conditions. Using Oracle Enterprise Manager, application support personnel can quickly search transactions based on message content and context—such as time of arrival, message type, customer ID, or part number—to locate the transaction in question and rapidly nail down the root cause of a problem. They can examine the full set of messages or correlated application invocations to understand the full context of any anomaly. These capabilities mean that Oracle Enterprise Manager slashes the time it takes to diagnose runtime issues from hours to minutes.
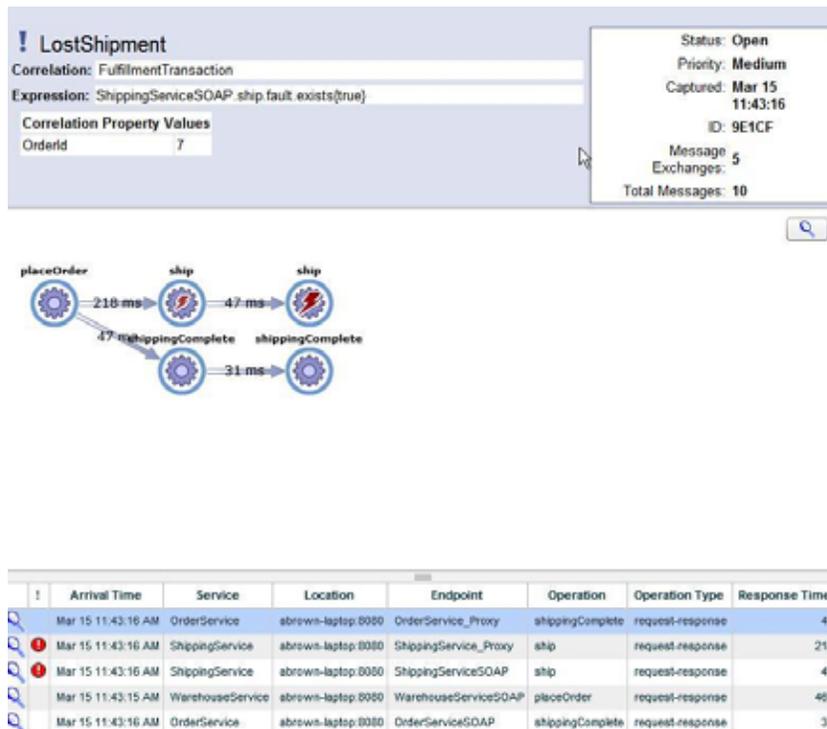
Figure 4 – Root cause analysis is simple via Oracle Enterprise Manager's ability to trace transactions for web services and other key entities within an application ensuring full visibility from a business transaction perspective

Users can quickly drill down to find the root cause of transaction failures and other unexpected conditions—significantly reducing mean time to repair.

Oracle Enterprise Manager's root-cause analysis capabilities address a range of issues common in business transactions, such stalled transactions, missing steps, faults, and application exceptions, as well as low-level issues such as incorrect data values, boundary conditions, and so on. It does this flexibly, enabling users to define the conditions of interest. Oracle Enterprise Manager then monitors all the traffic flowing across the system, waiting for the moment an exceptional event occurs.

In complex transactions, such an exercise can be difficult. Usually, application teams have little choice but to cull information from widely dispersed log files. Oracle Enterprise Manager solves this problem by automatically aggregating and organizing messages from all participating components, while automatically tagging faults or exceptional conditions. This contextualized, real-time visibility into transactions makes it easy for operations personnel to rapidly locate offending components, while providing application support teams with detailed information useful for reproducing, analyzing, and repairing the problem, thus slashing mean time to repair.

Mapping Services and Associated System Components

Administrators have to ensure that critical applications they are responsible for are meeting the expected service levels and if they are not, they are required to quickly remedy the situations in a very short timeframe. Application monitoring tools must be able to monitor the availability and performance of the underlying infrastructure components such as application servers, databases, virtual

machines, and hosts. Oracle Enterprise Manager solves this problem by providing a comprehensive system and service monitoring solution which covers all tiers within the application infrastructure.

Oracle Enterprise Manager proactively alerts administrators of any service level violations ensuring that critical environments are monitored and tracked around the clock. Administrators can group related system components together to form a system and associate that with a particular service. By looking at system metrics, IT operations and administrators can quickly predict which business services might be impacted so that they can take corrective measures before actual service levels are affected. For example, if a particular managed WebLogic Server is consuming too much CPU, there may be a need to expand the cluster in order to accommodate the load of the system. Similarly, if business users report an issue with service levels such as a performance delay of a key service, IT teams can quickly identify whether the root cause of the problem is a particular system component within the overall infrastructure.

Application Components Dependency and Contextual Performance

Java EE metadata can be complex and abstract and this complexity keeps growing with the introduction of new frameworks. In order to map the interdependencies between various application components such as Servlets, JSPs, EJBs, and underlying SQL calls, it is important to understand the metadata defining those relationships. Oracle Enterprise Manager models Java EE applications based on metadata automatically gathered from the various containers within the infrastructure and builds views based on standard Java EE components as well as non-standard Java components such as portlets (WSRP, JSR-168) and BPEL. These metrics are organized on their URI mappings with multiple entry points provided for top-down context and at the lower levels based upon the method-level call graph as well as from a component hierarchical perspective.

Using Oracle Enterprise Manager, administrators can quickly see the dependencies and relationships between high-level components like JSPs, Servlets, Portlets, and Web Services and the underlying Java EE components that support those services such as EJBs and JDBC calls. The diagram below shows invocation count for a servlet and its underlying components giving an idea of the flow of context for that URI. Within the same screen, administrators can also check how much time is spent in each of the components via the delay analysis metrics provided in the associated pie chart and table. Administrators can then drill down deeper into each class or component to find out how it behaves based on the context from which it was originally called. This is particularly useful considering that many components in Java EE applications are considered shared components where context is critical.
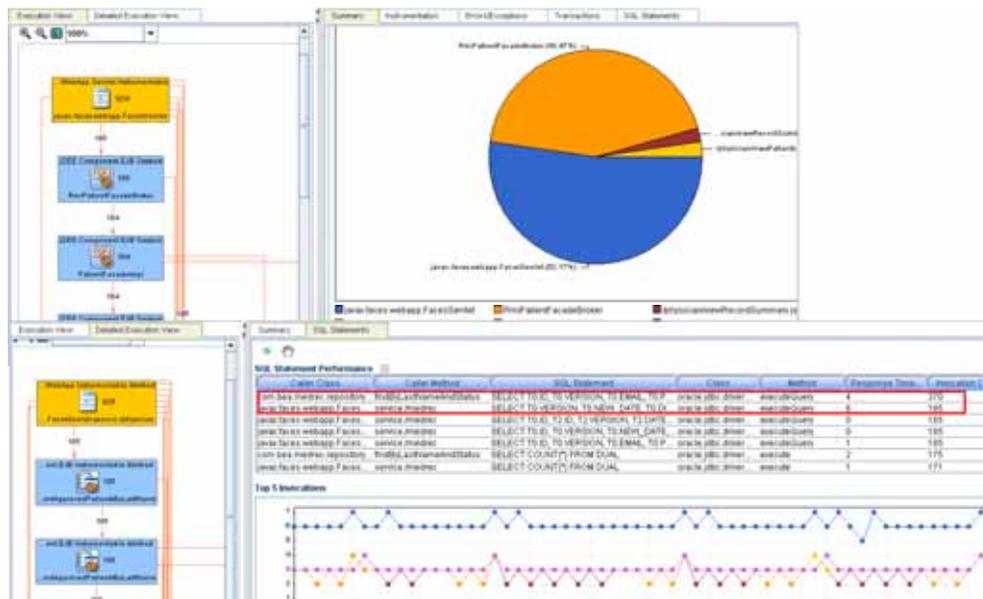
Figure 5 - Analyze component dependency, delay distribution, and SQL performance based on context

Administrators can literally trace down URI requests to SQL and stored procedures being invoked in context providing true end-to-end visibility from top-level components all the way down to the database. This performance data is crucial for determining the root cause of application performance issues by providing administrators with the ability to pinpoint the class or SQL that is responsible for the URI response time delay over the period of time being analyzed. This capability to immediately pinpoint a problem anywhere within a Java EE application can save considerable time in regards to diagnosing issues and resolving problems.

In spite of all the monitoring mechanisms in place there are certain scenarios where administrators must drill down to the object locks, DB table locks or actual heap usage of various classes. For example, a user request is getting stuck and tracing tools mentioned above may indicate that the transaction is getting stuck at a particular class because of a JDBC call. That routinely is not enough to determine why the thread is getting stuck in the JDBC call in the first place. Such confusion often leads to finger pointing between application administrators and database administrators, which may result in increased application down time and loss of business. In order to resolve this lack of visibility, administrators can dive a level deeper into JVM diagnostics in context of the component-level models being analyzed across the application infrastructure. The following section provides the in-context JVM diagnostics provided by such visibility.

JVM Diagnostics

Oracle Enterprise Manager provides deep diagnostics for any JVM within the application infrastructure providing immediate insight into actual thread stack or other common JVM issues. Oracle Enterprise Manager's deep diagnostic capability operates at a native level, which makes it possible to have

extremely low performance overhead (<1%) making it suitable for 24/7 real-time production diagnostics.

Cross-tier Diagnostics

Oracle Enterprise Manager also correlates the Java session to that of a database session making it possible to do cross-tier analysis. Administrators can find the status and call stack of all active threads in the JVM. They can also see the threads in context of a user request. If a particular thread is waiting for a database lock administrators can find the java code line the thread is stuck in, the SQL the thread is trying to run and the SQL that resulted in the table lock. Database administrators can take necessary steps to release the table lock and the stuck thread will continue to run. Without such native monitoring capability, it may take hours or days to figure out where exactly the problem is and by that time administrators would lose the execution context.
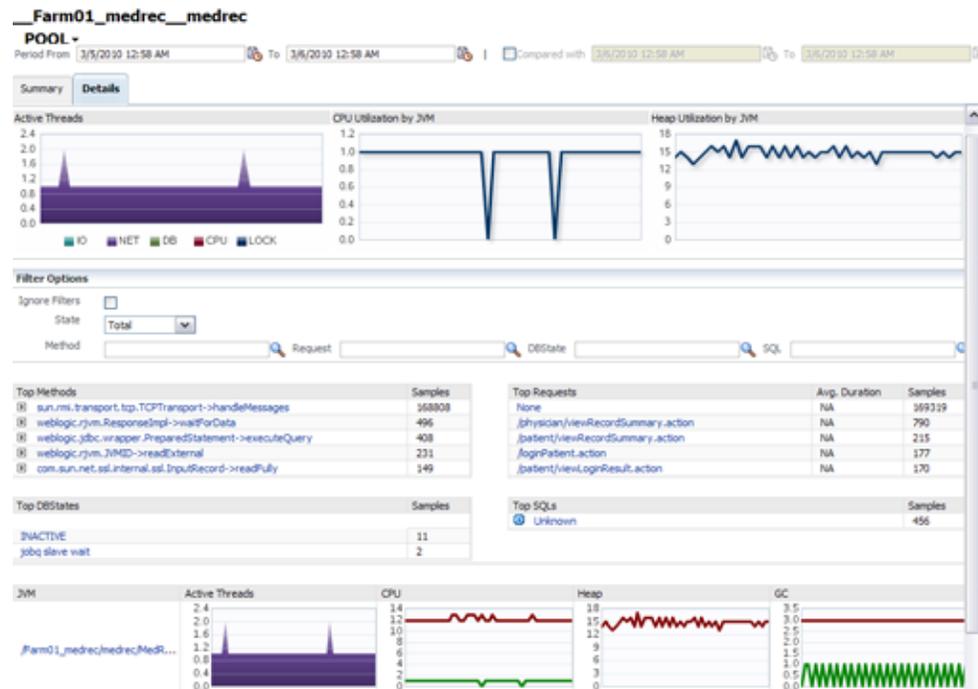

Figure 6 - Find cross-tier issues using Oracle Enterprise Manager's JVM diagnostics

Differential Heap Analysis

Using Oracle Enterprise Manager, administrators can take heap dumps and analyze the classes for memory consumption. Administrators can easily perform differential heap analysis of heap dumps taken at two different times. Oracle Enterprise Manager quickly pinpoints the cause of memory leaks by showing the classes and their fields that have grown in size. Without Oracle Enterprise Manager finding memory leaks could take several man-hours resulting in higher maintenance costs.

Configuration and Change Management

Most performance degradation issues in production application environments occur due to unauthorized configuration change. Many organizations using Oracle WebLogic Server struggle with managing configurations and enforcing compliance standards. Oracle Enterprise Manager provides comprehensive configuration management capabilities that help customers maximize value of their IT assets, increase the quality of IT services, reduce the cost of managing IT, and meet IT compliance requirements.

Automating Discovery and Tracking Assets

Traditionally, tracking assets and configuration items across the IT environment relies upon the knowledge of key individuals, time-consuming ad-hoc processes, and manual, error-prone spreadsheets. In contrast, Oracle Enterprise Manager automatically collects deep configuration information about Oracle WebLogic Server as well as its underlying hardware and operating system. Configuration templates or blueprints specifying what configuration items should be collected for Oracle WebLogic Server and its underlying operating system are available out-of-the-box and can be customized to collect only the relevant configuration items that IT personnel require. Examples of information collected at regular intervals include:

- Oracle WebLogic Server software installations, including applied patches

- Oracle WebLogic Server configuration parameters (e.g. ports, JVM information, JDBC and JMS resources, startup and shutdown classes) and configuration files

- Operating system patches, kernel parameter settings, and installed packages

- Hardware components including CPU, memory, storage, and network devices

Detecting Configuration Changes

Oracle Enterprise Manager also provides the ability to track configuration changes over time across the stack—from the application down to the hardware—allowing administrators to easily monitor all changes for a specific configuration between two points in time. This enables users to quickly see the changes applied to an environment that previously worked fine, but is suddenly not performing at an acceptable level.

In addition to tracking configuration changes historically, Oracle Enterprise Manager enables administrators to detect changes in real time as well. By integrating with a change management system, it can inform you if a configuration change was authorized or unauthorized. Detection of real-time change automates the audit trail and minimizes the time it takes to uncover compliance breaches.

Comparing and Provisioning Configurations

By keeping systems configured to a standard baseline and identifying any configuration changes that occur, Oracle Enterprise Manager helps organizations reduce "configuration drift" and confirm if and when a planned change takes place. Oracle Enterprise Manager provides a suite of comparison capabilities that allows administrators to quickly and easily pin point any configuration differences across the application life cycle – from development to test to production. In addition, administrators

can create a baseline from an existing configuration and use that gold standard configuration or a current system to perform an ad hoc or scheduled, one-to-one or one-to-many comparison.

When unexpected configuration differences across environments are detected, Oracle Enterprise Manager can be used to provision the configurations such that the environments are no longer different. This reduces the amount of time administrators need to devote to resolving configuration issues.

Ensuring Compliance with Standards

Ensuring compliance with standards such as SOX, ITIL, and PCI, as well as with unique business standards, is a challenge. Oracle Enterprise Manager ships with several predefined policies for Oracle WebLogic Server and also enables users to define their own specific policies and groups to quickly demonstrate compliance with various regulations and standards.

Oracle Enterprise Manager tracks violations of these policies in a manner similar to performance metrics, meaning notification rules can be applied and corrective actions can be assigned to violations. For example, if an open port is detected, a corrective action could be defined to automatically close that port.
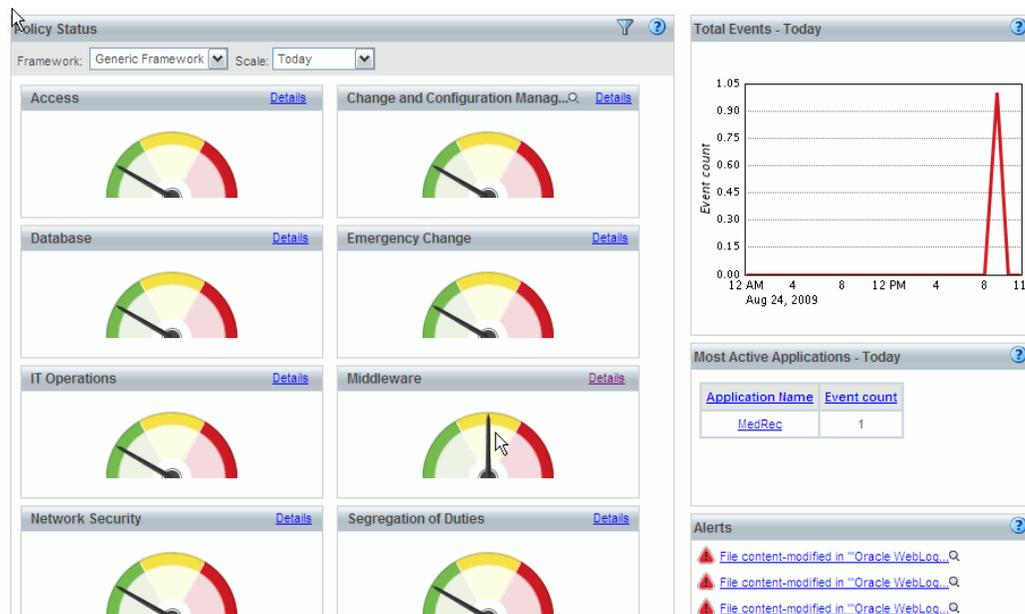

Figure 7 - Dashboard showing level of compliance to standards

Operations Automation

Rather than spend resources on manually installing and configuring Oracle Fusion Middleware software, administrators would rather spend time and money on more strategic initiatives. To help achieve this, Oracle Enterprise Manager has automated common provisioning operations such as cloning Oracle SOA Suite 11g and scaling out an Oracle WebLogic Domain, making such critical

datacenter operations easy, efficient and scalable results in lower operational risk and lower cost of ownership.

Clone from Test to Production

Typically, creating a new environment to support SOA applications entails several manual, error prone installation and configuration steps. With Oracle Enterprise Manager this can be accomplished with very little effort and time via predefined, customizable deployment procedures. Such deployment procedures clone an existing SOA Suite environment to a new set of hardware per a hierarchical series of steps. These predefined steps can be edited or disabled and new steps or custom scripts can be added to the deployment procedure to satisfy unique business needs. While running the deployment procedure, administrators can specify configuration settings such as the domain name, credentials for the administration console, port values, and JDBC data resources. After the cloning operation completes, the newly created SOA environment is discovered and automatically added to the console for centralized management and monitoring.

Scale Out the Domain

To address growing business demands, modern data centers must augment and relocate resources quickly. Using Oracle Enterprise Manager, administrators can rapidly scale out an Oracle WebLogic Server domain and cluster with additional managed servers to accommodate an increase in application load.

Support Workbench

When problems arise with Oracle Fusion Middleware that the IT organization cannot resolve on their own, they must reach out to Oracle Support for assistance. To help Oracle Support more quickly triage an issue, it is important to provide them with the necessary information to diagnose the problem. Oracle Enterprise Manager simplifies the process of collecting diagnostic data by providing the Support Workbench for Oracle Fusion Middleware. This facility provides a self-service means for administrators to gather first-failure diagnostic data; obtain a support request number, and upload diagnostic data to Oracle Support with a minimum amount of effort and in a very short time, thereby reducing time-to-resolution for Oracle WebLogic Server problems.

Oracle Coherence Management

Oracle Coherence is an in-memory data-grid that is used by enterprise applications to store application objects. It helps business critical applications to provide very high throughput, lower response time, predictable scalability, high availability and information reliability. Oracle Coherence achieves that by distributing objects to multiple JVMs running on the network.

While using Oracle Coherence immensely helps overall application performance, availability, scalability, and reliability, it also may become a point of failure if not managed properly. For example, application performance will be negatively impacted if the Coherence Caches are not providing enough throughputs or if Coherence data-grid or portions of the data-grid are down. Obviously, managing and monitoring Coherence is vital from application monitoring point of view. Oracle Enterprise Manager

is the only tool in the market today that addresses all areas in this regard including real-time and historical monitoring of Coherence caches, provisioning Coherence cluster or nodes, events management, life cycle management, and configuration management.

Figure 8- Oracle Coherence dashboard showing potential performance hot spots

Oracle WebCenter Management

With the addition of portal technology and the advances made of social networking, we have entered a world where websites can quickly be integrated together from de-coupled components written by other individuals and groups. This allows developers to quickly generate flexible websites full of rich components that can be personalized on the fly to meet the requirements and needs of the individual using the site. It also enriches the development process by introducing true shared components which can be called independently from each other. In WebCenter Suite, sites can easily be enriched using the WebCenter Services framework which includes wikis, forums, discussions, and many other components including content editors or perhaps the WebLogic Portal framework which provides a flexible hierarchy.

However, while the introduction of portal technology and the social networks built on this technology have streamlined the workplace and made development teams more efficient when rolling out such technologies and evolving them, it has introduced challenges from a performance management perspective. These technologies have rich, shared components that can easily be coupled together across containers, but administrators need a performance monitoring product that can easily map the relationships between these components and find the "needle in the haystack" when performance problems arise. Oracle Enterprise Manager provides the infrastructure to easily monitor the performance of WebCenter applications in addition to the WebLogic Server in general as discussed in the previous sections.
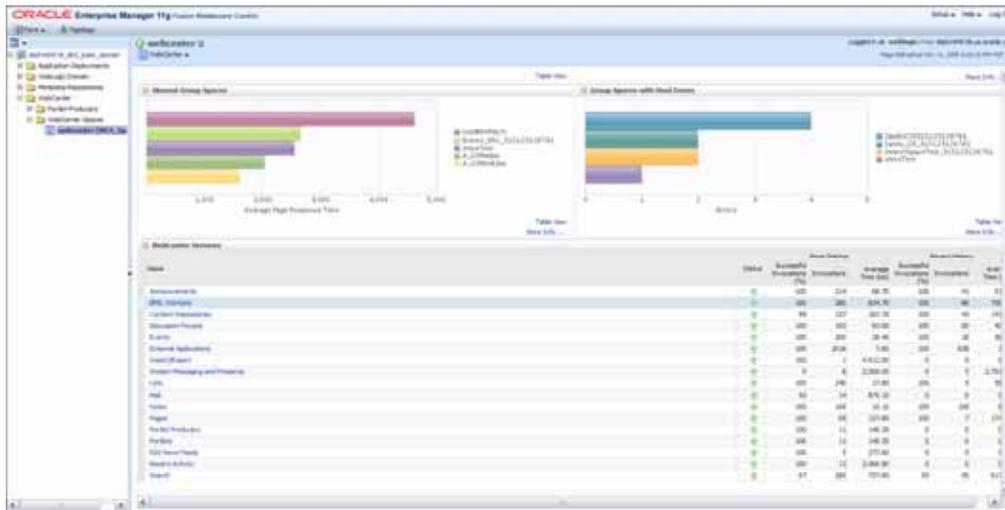
Figure 9 - Automatic discovery of WebCenter applications

Dependencies and Contextual Performance Analytics for WebCenter and WebLogic Portal

Oracle Enterprise Manager automatically discovers WebCenter Services and WebLogic Portal applications and provides full top-down visibility of the architecture of applications. This allows administrators to literally drill-down from top-level WebCenter Services and WebLogic Portal Desktops into the underlying components where bottlenecks usually reside when present. By providing this high level of visibility into the components that make up applications built on top of WebCenter Suite, administrators can ensure that they are not dealing with a "black box" application. They are ensured that any problem that arises can be resolved in a timely manner and through proactive performance management; they can identify potential problems before they impact the business.

Oracle Enterprise Manager provides visibility into the following WebCenter components:

- WebCenter Services
- ADF Task Flows
- Portlets
- JSF Pages
- Group Spaces
- WebLogic Portal Desktops, Books, Pages
- Underlying Java EE services and components that support your WebCenter applications such as EJBs and JDBC

Oracle SOA Management

Enterprises have adopted service oriented architectures to speed the time-to-market for new applications and reduce the cost of development. Use of Oracle SOA infrastructure, such as the Oracle SOA Suite and the Oracle Service Bus, allows businesses to flexibly create and compose new capabilities while maximizing the re-use of existing enterprise services. The increasingly powerful orchestrations that Oracle SOA infrastructure enables also bring certain complexities in the management of these services. Business transactions may now span many departmental, enterprise, and even 3rd party systems. Orchestration behavior may now be implemented using dynamic, tool-driven configuration rather than as Java code.

SOA Application Discovery

To help organizations maintain awareness of services in the runtime environment, Oracle Enterprise Manager automatically discovers deployed application components, as well as the dependencies among those components. It bootstraps governance processes by automatically publishing this information to registries or repositories, while periodically updating these stores to keep the data up to date. It provides an informative view of the service network and its dynamic relationships to help organizations manage the complex dependencies inherent to loosely-coupled business systems.

Oracle Enterprise Manager's runtime blueprint enables architects and managers to ensure that only approved application components are deployed within their environments. It also helps them to uncover "rogue" services and brings these unapproved components into the fold by submitting them to the appropriate governance processes. Runtime dependency information is particularly useful for service impact analysis, enabling architects to instantly identify downstream and upstream effects of any change to individual component with the SOA application.
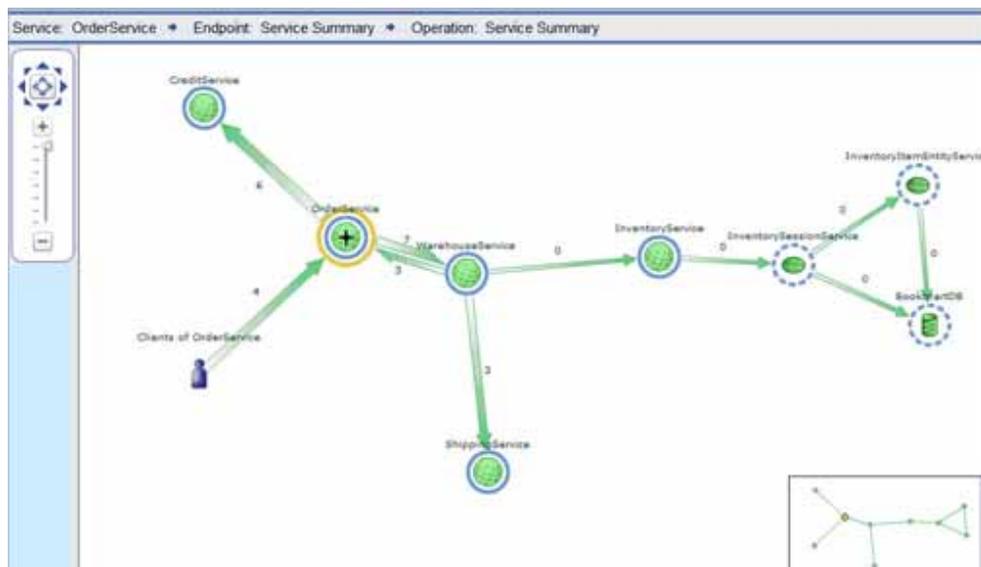

Figure 10 - Oracle Enterprise Manager discovers components and maps applications

Service Monitoring for Runtime Performance and Availability

Oracle Enterprise Manager brings predictability, visibility and control to service-oriented applications by delivering comprehensive service level management for services, transactions and business processes across heterogeneous environments.

Ensuring healthy and reliable composite applications requires that you monitor the service components underlying these applications — as well as the business transactions flowing across these services — for performance and availability. Oracle Enterprise Manager ensures composite application health by providing real-time visibility into key performance indicators such as throughput, availability and response times.

Oracle Enterprise Manager continuously monitors actual application traffic to collect data on the operational health of application components and their affiliated business transactions. Oracle Enterprise Manager extends this visibility to primary application services as well as their supporting implementation components such as EJBs, JMS services and POJOs on Java. Oracle SOA Management can monitor services that rely on literally any transport, including HTTP, JMS, RMI, and JDBC.

Oracle SOA management provides the end-to-end visibility necessary to operate SOA applications, providing:

- Real-time monitoring of individual service components and business transactions

- Key performance indicators visualized in charts and graphs for easy analysis

- Automated data archiving for historical reporting

Oracle Enterprise Manager generates a bird's-eye-view across your network of application components, making critical operational information available at a glance. It provides live, color-coded network graphs for rapid identification of operational issues, with rich filtering capabilities across operational and business information to evaluate specific components of interest. Once components are identified for analysis, contextual drill downs provide immediate access to information on specific issues, alerts and faults.

On top of real-time monitoring, Oracle Enterprise Manager enables users to apply service-level agreements to SOA applications and the business transactions that flow across them. It aggregates and analyzes performance data from components across the distributed environment, and enables administrators to define both internal targets as well formal SLA objectives. Administrators can set multiple thresholds for warnings and failures, and make use of realistic performance baselines, drawn from runtime data and historical trends. Once SLAs are have been applied to SOA applications, administrators can make use of detailed service level views by operations, services, processes/applications, customers or user-defined business context.

With Oracle Enterprise Manager administrators can target SLAs toward discrete business segments, such as gold customers, key business partners, or top-tier suppliers. The SLAs defined can prioritize service use by any business criteria—such as focusing on the most valuable users (customers, partners.) or providing the best QoS during peak hours. SLAs can be set and monitored for individual services as well as composites such as processes and transactions, and they are monitored continuously and in real time. Calendaring capabilities enable administrators to define when an SLA is and is not in effect, for

example, only during business hours from Monday to Friday, or during scheduled maintenance every Saturday. This prevents false-positive alerts from being sent to the operations teams.

For each SLA, administrators create a set of service level objectives (SLOs). To determine if an objective has been met (say, an average response time of less than 8 seconds) the Oracle Enterprise Manager evaluates the objective based on:

- Measurable data about a service — response time, throughput, availability, faults, average response time, etc.

- Performance during specified times — e.g., Monday through Friday from 8:00 AM to 5 PM

- Periodic evaluations — every ten seconds or every eight hours

- Consumers of the service – Platinum versus Bronze customers, for example

Ideally, an IT team would like to act before an SLA objective has been violated. Also, IT should be able to create multiple objectives (potentially for different user roles) for a single SOA application component. To meet these needs, Oracle Enterprise Manager enables administrators to set performance "targets" that function as the unofficial thresholds complementing formal "objectives". The "tripwires" can alert administrators to impending failures—before customers are impacted or contractual SLA objectives are violated—saving the enterprise from customer churn as well as penalties imposed for failed SLA compliance.

As the IT team manages their processes over time, historical knowledge will give them added insight— including the ability to identify bottlenecks, fine-tune service level objectives and observe changes in system health. Enterprises can build historical insight into these service-oriented applications and use this insight to clearly understand the business impact of varying service levels. Oracle Enterprise Manager provides historical reporting that covers all aspects of SOA application performance monitoring.

Operational availability and service level conformance often extends to periods when, due to variation in user patterns, there may be inadequate or no load on the particular component in question. For instance, a back-end service dependency may malfunction at 3AM when there is no traffic. It would be desirable to detect that the service endpoint is failing prior to the first traffic at 7AM when users begin to execute transactions. Additional infrastructure preconditions may exist, such has DNS or network availability that is not specific back-end service dependencies, but will cause service failures if they break down.

Oracle Enterprise Manager augments transaction and infrastructure monitoring with synthetic transaction monitoring that can be used to actively determine the functional behavior of a large variety of services and infrastructure components. Periodic tests can be executed against web service and HTTP endpoints to verify that they are behaving the way they are supposed to. ICMP pings and DNS lookups can be run against different network segments or DNS servers in order to ensure that basic infrastructure is working.

In addition to availability and performance conformance, Oracle Enterprise Manager also centralizes security policy conformance metrics generated by the Oracle Web Services Manager to give a view into all aspects of the SOA infrastructure summarized onto a single page.

Diagnostics and Root-cause Analysis

SOA applications introduce a new order of complexity in tracking down failures. One challenge for operations trying to identify transaction bottlenecks is that the problem could originate anywhere in the stack. It could result from components in the implementation layer of the service, or it might actually be located in one of many replicated services or in the infrastructure supporting the orchestrated services. Some SOA applications may support long-running or asynchronous transactions, involving human interaction and spanning multiple systems and several days. All of this makes it tremendously difficult to pinpoint the source of a failure.

Oracle Enterprise Manager gives administrators the ability to view composite application dependencies in real-time. Exceptions in SOA applications are often technical (such as invalid data in requests, transport-level errors, or inaccurate responses) but they can also be business events (like excessive weight of shipment, a credit rejection for a premier customer, or an exceptionally large order). Such business exceptions are rarely understood by existing application monitoring solutions running on an e-commerce website (such as "Sorry, unable to process request at this time"), delayed orders, lost packages, rejected insurance claims, and so on. However, with Oracle Enterprise Manager, these business exceptions can be brought to the forefront and analyzed within a business transaction.

When SOA applications are failing, proactive alerting is required to initiate the diagnostic process before the phone starts ringing. Administrators can configure alerts in Oracle Enterprise Manager to let them know when:

- A SOA application is approaching SLA limits

- Transactions fail to complete—e.g. order fallouts, missing packages, missing phone activations etc.

- SOA applications throw technical or business exceptions

- Business parameters are violated—for example, a purchase order exceeds a user's purchasing limit

Oracle SOA management offers end-to-end transaction tracking and recording to capture this context and the tools to sift through these transactions to isolate the problematic ones. Out-of-the-box search capabilities enable auditing and diagnostics of transactions after-the-fact, and script-based interfaces provide support for integration log-analysis tools, for highly customized diagnosis of transactions and application behavior.

Configuration and Lifecycle Management

SOA application environments are often complex with many components working together in tandem. Behind the scenes of a transaction flow are a complex assortment of configuration settings and deployment artifacts, whose presence and content are critical to the proper functioning of a system. By understanding these artifacts natively and automating their management, Oracle Enterprise Manager enables operators to save significant amounts of time and effort.

Configuration information about the applications and server infrastructure are continuously gathered and stored in a repository. Administrators can compare configurations over time and monitor drift. During critical outages (especially during QA where changes may occur frequently and costly test resources may sit idle when a system is down), administrators can compare current configuration settings to a known good set and quickly identify changes that could be the root cause. SOA application components (e.g. BPEL processes or SOA composites) can be cloned from staging servers into a software library. These "gold master" components can then be deployed centrally to rapidly scale out an application or quickly revert that application to a known good state.

Oracle Identity & Access Management

As more and more businesses rely on the Oracle Identity and Access Management Suite to control access to their mission-critical applications (both packaged applications and custom-built web applications) and to provision resources across their organizations, the need to achieve predictable performance and availability for Oracle Identity Management systems has become a top priority for many businesses. An outage or slow performance in access and identity services, for instance, can have negative impacts on the business bottom-line as end-users are unable to log in to mission-critical applications. To help administrators maximize the value of Oracle Identity Management systems, and to deliver a superior ownership experience while keeping a lid on the systems management costs, Oracle Enterprise Manager an integrated and top-down solution for your Oracle Identity Management environment.

Single-Step Discovery

A simple target discovery wizard is available for both Identity Management 10g and Identity Management 11g components. Single-step discovery enables administrators to quickly set up their monitoring environment. Upon completing target discovery, configuration settings that are defined in the monitored Oracle Identity Management targets will be automatically detected and stored in the Management Repository.

Configuration Management

With Oracle Enterprise Manager, administrators can perform key configuration management tasks like keeping track of configuration changes, taking snapshots to store configurations, and comparing component configurations. To ensure that the configurations of all critical Oracle Identity Management components in a production environment are consistent with staging or test environments, administrators can save working configurations into the Management Repository or into an external XML file and then compare the configuration in the production environment against the test or staging environments. Configuration comparison helps administrators ensure the consistency of configurations in their environment – thus reducing "configuration drift." To diagnose performance problems that may be related to system configuration changes, administrators can keep track of all configuration changes to locate the root cause of performance problems.

Performance Monitoring

With Oracle Enterprise Manager, administrators can proactively monitor their Oracle Identity Management environment from both systems & end-user perspectives. A wide range of out-of-box performance metrics are collected for monitored Oracle Identity Management targets allowing administrators to set up alerts based on warning and critical thresholds, view current and historical performance information using graphs and reports, and diagnose performance problems by identifying bottlenecks in any of the monitored Oracle Identity Management targets.

Using Oracle Enterprise Manager, \ administrators can monitor the health of all critical Identity Management components – including both Identity Management 10g and Identity Management 11g components. Thresholds may be defined against server and component statistics such as CPU utilization, the number of failed and successful authentications/authorizations, average response time, provisioning metrics (e.g. number of newly provisioned/created/deleted/disabled/locked users), Identity Provider and Service Provider metrics, and up/down status of servers and components.

In addition to relying on system performance metrics, administrators can record synthetic web transactions that include a combination of one or more navigation paths within the application to be used as the criteria for determining the service's availability. For example, Oracle Access Manager requires that a user be successfully authenticated and authorized against a certain WebGate for the service to be considered available. Oracle Enterprise Manager uses these logical tasks or 'transactions' to define the availability of the Identity Management environment. In addition to synthetic web transactions, Oracle Enterprise Manager also supports LDAP tests that allow administrators to record LDAP operations against a specific LDAP server (including Oracle Virtual Directory). With the LDAP tests, administrators can specify the username/password, Search Filter, Search Base, and Compare Attribute Name/Value. These synthetic web transactions are recorded, and the stored transaction or 'service test' can be launched at a user-defined interval from strategic locations across the user-base.

Service Level Management

A common dilemma in organizations is balancing business needs with IT spending. Since Identity Management services address how organizations authenticate people, manage their access to confidential information, and audit the transactions that flow between the various systems, Identity Management administrators constantly need to satisfy application owners while keeping a lid on spending and increasing IT efficiency. Key questions that need to be answered include:

- What is the impact of Identity Management on business applications?

- How do we prioritize Identity Management activities according to business needs?

- When changes are made to the Identity Management environment, what is the potential impact on the business?

Some key performance indicators (KPI) needed to answer these questions may be traditional system-based indicators while others may need to be derived from the business applications that depend on the Identity Management infrastructure for access control and user provisioning. Oracle Enterprise Manager's service level management capabilities help administrators define service level objectives (SLO) based on business requirements, model the end-to-end Identity Management service down to

the system components it depends on, monitor performance against these goals, and report on service level agreement (SLA) (or operational level agreement (OLA)) to key stakeholders.

With Oracle Enterprise Manager, administrators can model services for Oracle Identity Management allowing them to view information on the availability of the service based on the underlying Identity Management components that host the service or based on service tests that most closely match the critical functionality of your Identity Management process. Aggregated information on the status of the service and underlying components are summarized on the Identity Management Service home page allowing you to obtain an overall perspective on the environment and monitor service level agreements (SLAs) in real-time. Additionally, administrators can create customized reports to communicate SLA compliance to the application owners.
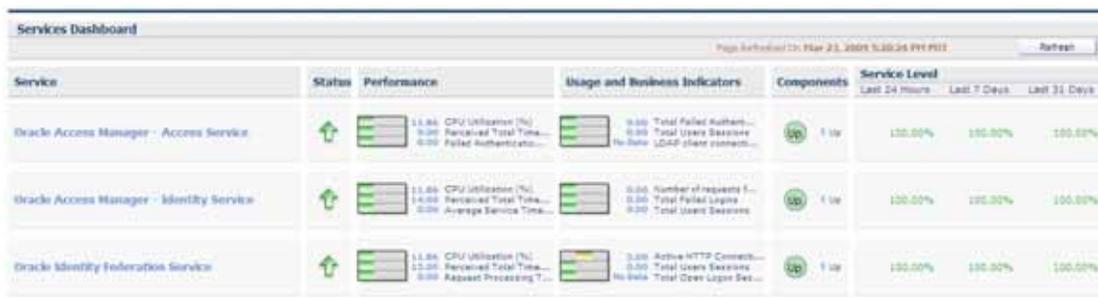
Figure 11 - Oracle Identity Management Services Dashboard

Oracle Business Intelligence Management

A key requirement for managing Oracle BI EE and Oracle BI Applications is the ability to manage BI-specific components such as Oracle BI Server, Oracle BI Presentation Server, Oracle BI Scheduler, Oracle BI Cluster Controller and Oracle BI DAC Server, as well as infrastructure components such as databases and operating systems. All these components must work optimally together in order to deliver the required availability and performance targets. Oracle Enterprise Manager's capabilities in configuration management, application performance management, and service level management provide a centralized systems management solution for Oracle BI EE and Oracle BI Applications. Through the service level management (SLM) capabilities, administrators can define the availability and performance requirements of an end-to-end Oracle BI environment, and then monitor the application environment according to these requirements. This approach helps administrators focus resources on issues that are truly important – those that actually impact business.

Single-Step Discovery

A simple target discovery wizard for Oracle BI middleware components allows administrators to quickly set up their monitoring environment. Upon completing target discovery, configuration settings that are defined in the monitored Oracle BI targets will be automatically detected and stored in the Management Repository.

Configuration Management

With Oracle Enterprise Manager, administrators can perform key configuration management tasks like keeping track of configuration changes, taking snapshots to store configurations, and comparing component configurations. To ensure that the configurations of all critical Oracle BI components in the production environment are consistent with the staging or test environments, administrators can save working configurations into the Management Repository or into an external XML file and then compare the configuration in the production environment against the test or staging environments. Configuration comparison helps administrators ensure the consistency of configurations in the application environment – thus reducing "configuration drift." Configuration comparisons also simplify investigations into why components that are presumed to be identical are behaving differently. To diagnose performance problems that may be related to system configuration changes, administrators can keep track of all configuration changes to locate the root cause of performance problems. Administrators may query against Oracle Enterprise Manager's Management Repository to find out whether any Oracle BI component parameter has changed.

Figure 12 - Configuration Comparison Performance Monitoring

With Oracle Enterprise Manager, administrators can proactively monitor their Oracle BI environment from both systems & end-user perspectives. A wide range of out-of-box performance metrics are collected for monitored Oracle BI targets allowing administrators to set up alerts based on warning and critical thresholds, view current and historical performance information using graphs and reports, and diagnose performance problems by identifying bottlenecks in any of the monitored Oracle BI targets.

You can also monitor the Oracle BI environment from an end-user perspective using synthetic service tests and out-of-box dashboard usage reports. Service tests can be recorded to simulate key end user activities such as logging in and navigating through critical pages of Oracle BI Dashboards. The tests are run via beacons from locations within your network to actively measure the performance and availability of your Oracle BI application. Because these tests are played back automatically via beacons and do not rely on actual end users being present, they can be used for accurate performance trending analysis and for proactive monitoring.

In addition to synthetic service tests, you can view detailed information about dashboard usage through Dashboard Reports that summarize key query statistics. Dashboard Reports enable administrators to maximize the value of their application by delivering insight into real end user experiences. They provide key statistics for usage trending analysis – allowing administrators to view detailed information about the top dashboards by resource usage as well as top users by resource usage. In addition to usage trending, these reports can help administrators diagnose performance problems by showing a complete listing of failed dashboards along with the error code/message and SQL statements associated with the failed queries and a breakdown of dashboard response time based on database time, compile time and overall time for end-user queries.

Figure 20 - Oracle BI Server Dashboard Reports

Service Level Management

A common dilemma in organizations is balancing business needs with IT spending. IT management constantly needs to satisfy business owners while keeping a lid on spending and increasing IT efficiency. Oracle Enterprise Manager's service level management capabilities help administrators define service level objectives (SLO) based on business requirements, model the end-to-end service down to the system components it depends on, monitor performance against these goals, and report on service level agreement (SLA) compliance to key stakeholders.

Service Level Objectives can be specified not only in terms of the system-level metrics for the components supporting the service, but also in terms of end user experience metrics. Oracle Enterprise Manager is unique in allowing all these classes of metrics to be used in measuring service levels. The basis for the service level management capability is a modeling facility that allows administrators to define a business service to be composed of component services and supporting infrastructure.

With Oracle Enterprise Manager, a service modeled with all the Oracle BI components is provided out-of-box – allowing administrators to view information on the availability of the service based on the underlying Oracle BI components that host the service or based on service tests that most closely match the critical functionality of your business process. Aggregated information on the status of the service and underlying components are summarized on the Oracle BI Service home page allowing you to obtain an overall perspective on the environment and monitor service level agreements (SLAs) in real-time. Additionally, Oracle Enterprise Manager allows administrators to create customized reports that can be used to communicate SLA compliance to the line-of-business (LOB).

Conclusion

Today's IT organizations are increasingly adopting SOA, BPM, and Java EE technologies that enable them to quickly connect disparate applications and fulfill ever-changing business needs. Although these applications offer unprecedented flexibility and agility, they now are more challenging to manage. To effectively manage this new breed of applications, IT organizations need a new breed of management solutions. Oracle Enterprise Manager provides a new approach that enables Oracle Fusion Middleware administrators to stay focused on business priorities, using the most comprehensive management solutions that reduce the effort and cost of managing sophisticated applications built on Oracle Fusion Middleware.

ORACLE

Oracle is committed to developing practices and products that help protect the environment