SIEBEL eBusiness 7

PERFORMANCE TUNING GUIDE

VERSION 7.5.3, REV. A

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Contents

Introduction

This guide describes a variety of approaches to optimize the performance of Siebel eBusiness Applications.

NOTE: Every implementation of Siebel applications is unique. Recommendations are advisory in nature and may not be suitable for your deployment. Customers are strongly encouraged to test, continually monitor, and tune the Siebel application to achieve optimal performance and throughput. Features and recommendations described in this book apply *only* to version 7.5.3 of Siebel eBusiness Applications. Readers are encouraged to check Siebel SupportWeb for updated information or information that is not included in this book.

No attempt is made to detail all factors or variables that will affect tuning at specific customer sites. This book is not a substitute for specific tuning recommendations made by Siebel Expert Services or Siebel Professional Services.

It is assumed that the reader is highly technical and is familiar with the Siebel architecture, Siebel application components, Siebel Data Model, Siebel application deployment options, and related concepts.

Consult the *Siebel Bookshelf* and check all available Technical Notes, Alerts, FAQs, and related materials on Siebel SupportWeb.

Although job titles and duties at your company may differ from those listed in the following table, the audience for this guide consists primarily of employees in these categories:

Call Center Administrators	Administrators who set up and maintain a call center. Duties include designing and managing Computer Telephony Integration (CTI), SmartScripts, and message broadcasts.

Database Administrators	Administrators who administer the database system, including data loading, system monitoring, backup and recovery, space allocation and sizing, and user account management.
Siebel Application Administrators	Administrators who plan, set up, and maintain Siebel applications.
Siebel Application Developers	Developers who plan, implement, and configure Siebel applications, possibly adding new functionality.
Siebel System Administrators	Administrators responsible for the whole system, including installing, maintaining, and upgrading Siebel applications.

Product Modules and Options

This guide contains descriptions of modules that are optional and for which you may not have purchased a license. Siebel's Sample Database also includes data related to these optional modules. As a result, your software implementation may differ from descriptions in this Bookshelf. To find out more about the modules your organization has purchased, see your corporate purchasing agent or your Siebel sales representative.

How This Guide Is Organized

This guide presents performance tuning information for a variety of Siebel modules.

- The first chapter provides an overview of the Siebel architecture and infrastructure, particularly as it relates to performance considerations.
- Subsequent chapters present performance tuning information applicable to Siebel deployments using Application Object Manager components and the Siebel Web Client.
- These are followed by chapters about specific modules, including Siebel Communications Server (Siebel CTI and Siebel eMail Response), Siebel Workflow, Siebel eConfigurator (server-based), and Siebel eAI.
- Then, tuning information is presented about customer configurations performed using Siebel Tools or Siebel scripting languages.
- The final chapter provides information about monitoring Siebel application performance using Siebel Application Response Monitoring (Siebel ARM).

Additional Resources

This section lists relevant documentation and other resources.

Additional Documentation

Some relevant documentation on the *Siebel Bookshelf* and Siebel SupportWeb includes:

- *Siebel Server Installation Guide* for the operating system you are using
- *Upgrade Guide* for the operating system you are using
- *Planning a Siebel Upgrade*
- *Planning a Successful Siebel Implementation*
- *Siebel Server Administration Guide*
- *Siebel Web Client Administration Guide*
- *Applications Administration Guide*
- *Siebel Communications Server Administration Guide*
- *Siebel eMail Response Administration Guide*
- *Siebel Business Process Designer Administration Guide*
- *Product Administration Guide*
- *Overview: Siebel eBusiness Application Integration Volume I*
- *Siebel Tools Reference*
- *Configuration Guidelines*
- *Siebel eScript Language Reference*
- *Siebel VB Language Reference*
- *Siebel Release Notes* (available on Siebel SupportWeb)
- *System Requirements and Supported Platforms* (available on Siebel SupportWeb)

Other Resources

- Siebel Global Services
- Siebel Expert Services
- Siebel Professional Services

Revision History

Performance Tuning Guide

Version 7.5.3, Rev. A

Table 1. Changes Made in Version 7.5.3, Rev. A

Topic	Revision
"Tuning AOM Components for CPU and Memory Utilization" on page 34	Updated section.
"Configuring Shared Database Connection Pooling" on page 44	Updated section.
"General Best Practices for Customer Configurations" on page 154	Added item about case-insensitivity.
"Enabling and Configuring Siebel ARM on Siebel Server" on page 188	Created separate subsections for enabling Siebel ARM at Siebel Server level and at server component level.
Index	A book index is provided for this revision.

Siebel Architecture and Infrastructure 1

This chapter highlights areas of the Siebel eBusiness Applications architecture and infrastructure and provides an introduction to the approach of tuning the Siebel application for performance and scalability.

Cross-references are provided to other chapters of this guide on how to configure specific areas of Siebel eBusiness Applications. Optimally tuning these areas achieves a balance between performance and scalability.

For more information and details about the Siebel eBusiness Applications architecture and infrastructure, refer to the following documentation on the *Siebel Bookshelf*:

- *Siebel Server Installation Guide* for the operating system you are using
- *Siebel Server Administration Guide*
- *Siebel Tools Reference*
- *Siebel Web Client Administration Guide*

NOTE: Every implementation of Siebel eBusiness Applications is unique. Your Siebel application architecture, infrastructure, and configurations may differ depending on your business model.

See the following sections for an overview of performance and scalability and the architecture and infrastructure of Siebel eBusiness Applications:

- "About Performance and Scalability" on page 16
- "About Siebel Architecture and Infrastructure" on page 17
- "About Siebel User Request Flow" on page 21
- "Performance Tuning Terminology" on page 24

About Performance and Scalability

Performance and scalability are defined as follows in the context of this guide:

- **Performance.** A Siebel application's ability to function, generally measured in response time or throughput.

  For example, measures of performance may include the time required to log into the Siebel application or to display a Siebel view, or the volume of transactions (sometimes referred to as requests) that a server component can process in a given time period.

  Some typical inhibitors of performance are inadequate hardware, excessive application round trips, heavy customizations, and poor networking infrastructure.

- **Scalability.** A Siebel application's ability to continue to perform well as volumes increase.

  Scalability is generally measured in hardware terms—for example, maintaining acceptable performance after adding new processors on existing machines (vertical scalability) or new Siebel Server machines (horizontal scalability) to process an increased number of users.

  Some typical inhibitors of scalability are an inflexible application module structure and an inability to run parallel processes.

For further definitions of terminology related to performance and scalability, see "Performance Tuning Terminology" on page 24.

About Siebel Architecture and Infrastructure

Figure 1 shows a generic representation of the architecture and infrastructure of a Siebel eBusiness Applications deployment. Your Siebel applications might be deployed differently. For descriptions of the individual entities included in this illustration, refer to *Siebel Server Administration Guide* and the *Siebel Server Installation Guide* for the operating system you are using.

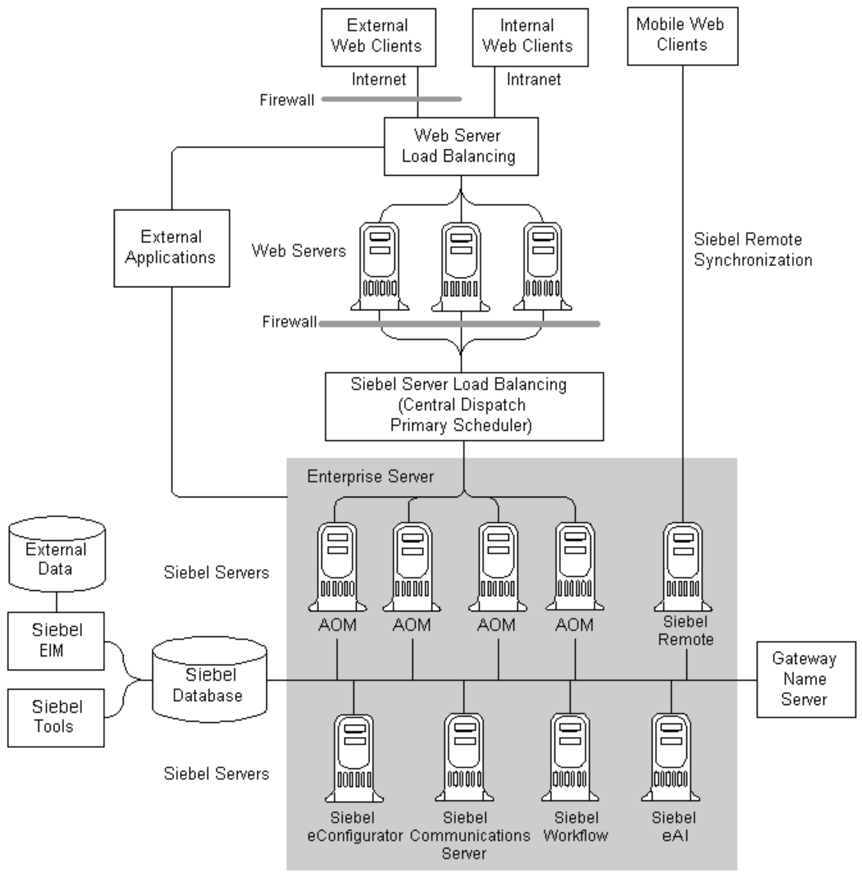


Figure 1. Generic Architecture of Siebel eBusiness Applications

The following list provides details on tuning specific areas of the Siebel applications architecture and infrastructure.

Performance in many of these areas can be monitored and analyzed using Siebel Application Response Measurement (Siebel ARM), which is described in Chapter 9, "Monitoring Siebel Application Performance."

- **Siebel Application Object Managers (AOM).** AOMs are Siebel Server components that reside on a Siebel Server and support users accessing Siebel applications through the Siebel Web Client and a Web server, or through external applications.

  Running AOM components has significant performance and scalability implications. In general, the goal for tuning an AOM is to maximize scalability with little or no performance degradation as more users use the system.

  Although AOM components can be tuned for optimal performance, capacity for this and all other Siebel Server components is ultimately limited by Siebel Server machine resources such as CPU and memory.

  For details on tuning this area, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

- **Siebel Web Client.** The means for end users to access Siebel application features and data. Siebel Web Client uses a Web browser.

  The response time experienced by the Siebel Web Client end user is subject to the configuration and tuning of Siebel Enterprise elements such as the AOM, network bandwidth and latency, Web server, Siebel Database, and the Siebel application configuration (represented in the Siebel repository file). It is also subject to local machine resources and settings, including browser settings such as those for caching.

  For details on tuning this area, see Chapter 3, "Tuning Siebel Web Client for Performance."

- **Siebel Communications Server.** Siebel Communications Server provides an infrastructure to support several kinds of communications activities for Siebel application users, including session communications (such as voice calls) and inbound and outbound communications (such as email).

  Siebel Communication Server processing may affect end user response time, and may demand additional AOM resources to support user sessions. Performance and scalability is subject to third-party server configuration and capacity and Siebel Server machine resources and configuration.

  For details on tuning this area, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

- **Siebel Workflow.** Siebel Workflow is an interactive environment that automates business processes such as automating escalation of events and notification of appropriate parties; routing and assigning work; processing work; and enforcing authorization and transition rules.

  Siebel Workflow processing may affect end user response time (for synchronous requests), and may demand additional AOM resources to support user sessions. Performance and scalability is subject to Siebel Server machine resources and configuration.

  For details on tuning this area, see Chapter 5, "Tuning Siebel Workflow for Performance."

- **Siebel eConfigurator.** Siebel eConfigurator supports order management and product configuration functions for Siebel applications.

  Siebel eConfigurator processing may affect end user response time (for configuration sessions), and may demand additional AOM resources to support user sessions. Performance and scalability is subject to Siebel Server machine resources and configuration.

  For details on tuning this area, see Chapter 6, "Tuning Siebel eConfigurator for Performance."

- **Siebel eBusiness Application Integration (Siebel eAI).** Siebel eAI provides components for integrating Siebel eBusiness Applications with external and internal applications, and provides inbound and outbound interfaces to and from a Siebel application.

  Siebel eAI processing may affect end user response time (for real-time interfaces), and may demand additional AOM resources to support user sessions. Performance and scalability is subject to Siebel Server machine resources and configuration.

  For details on tuning this area, see Chapter 7, "Tuning Siebel eAI for Performance."

- **Siebel Tools.** Siebel Tools is an integrated development environment for configuring aspects of a Siebel application, including elements in the data objects, business objects, and user interface objects layers. Siebel scripting languages are also managed in the Siebel Tools environment.

  Siebel Tools configurations and scripting play a critical role in the performance and scalability of a configured Siebel application. Customizations made through Siebel Tools partly determine the degree to which performance and scalability of a particular deployment differs from the original installation.

  Appropriate configuration optimizes operations in the Siebel Database and does not add unnecessary overhead to supporting user sessions. (Siebel Tools itself does not play a role in the Siebel applications at run-time.)

  For details on tuning this area, see Chapter 8, "Tuning Customer Configurations for Performance."

About Siebel User Request Flow

Figure 2 illustrates how a user request is processed within the Siebel eBusiness Applications architecture and infrastructure (generically presented), and shows potential areas for performance tuning. For a description of each portion of this data flow, refer to *Siebel Server Administration Guide* and other relevant documents on the *Siebel Bookshelf*.

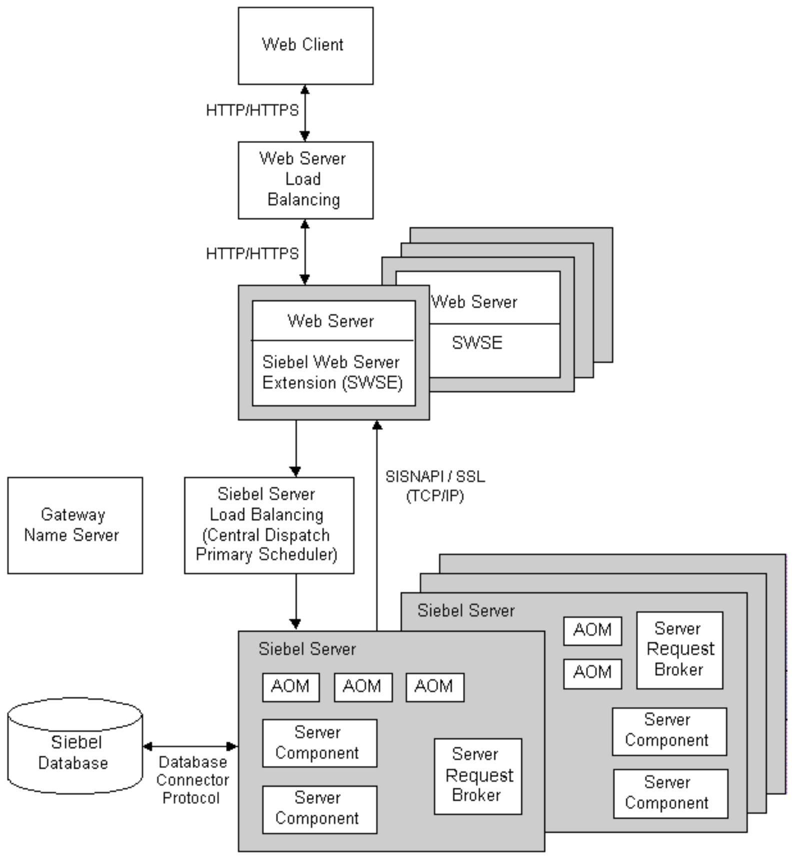


Figure 2. Generic User Request Flow in Siebel eBusiness Applications

A typical Siebel client request flows from the user's Siebel Web Client through the system, and back again, following the general flow outlined below.

1. A user performs an action that initiates a request. For example, the user clicks a link in the Site Map to navigate to a particular view. The Web browser and Siebel Web Client framework initiate the HTTP request containing the request as the body of the message.
2. The HTTP request goes through the networking infrastructure, using an existing or new HTTP connection. At this point, the request may go through a network router, proxy server, cache engine, or other mechanism.
3. If applicable, the Web Server load balancer evaluates the request and determines the best Web server to forward the request to. The request is then forwarded by the Web server load balancer through the network.
4. The Web Server receives the HTTP request, determines that it is a Siebel application request, and forwards the request to the Siebel Web Server Extension (SWSE), which is installed on the Web server.
5. SWSE parses the HTTP message and generates a SISNAPI message, based on the content of the HTTP message. SWSE also parses the incoming cookie or URL to obtain the user session ID.

   SISNAPI (Siebel Internet Session application programming interface), a messaging format that runs on top of the TCP/IP protocol, is used for network communication between AOM and SWSE.
6. SWSE forwards the request to the Siebel Server hosting the user session. The message either goes through an existing SISNAPI connection or SWSE opens a new SISNAPI connection to the server.

   Typically, the TCP/IP packets carrying the SISNAPI message have a virtual IP address and port as the destination. The message may also be passed through a DMZ firewall.
7. The SISNAPI message is received by the primary scheduler using either a new TCP/IP (SISNAPI) connection or an existing connection.

   - For a new TCP/IP connection request, the scheduler forwards the connection to one of the Siebel Servers.

    - If this request is a new login request, the scheduler routes it to the least-loaded server.
    - If the request is from an existing session, the scheduler routes it to the server hosting that user session.

  - For an existing TCP/IP connection, the scheduler forwards the request to the server currently hosting this TCP/IP connection.

8. The request goes through the back-end TCP/IP connection of the scheduler to the Siebel Server.
9. On the Siebel Server, the AOM component receives and processes the SISNAPI message. If a database query is needed to retrieve the information, the AOM formulates the SQL statement and sends the request to the Siebel Database over a database connection.
10. The database request goes through the database connection, using a protocol format that is specific to the database connector.
11. The database executes the SQL statement and returns data back to the AOM.
12. The data is forwarded back to the AOM.
13. Through a Central Dispatch network driver on the Siebel Server, the returning SISNAPI message bypasses the scheduler and goes directly to the Web server.
14. The SWSE receives the SISNAPI message, and translates it back to HTTP. It then forwards the returning HTTP message to the Web server.
15. The Web server load balancer then forwards this request through the original HTTP connection. The message is forwarded back through the networking infrastructure to the end user’s Web browser.
16. The Web browser and the Siebel Web Client framework process the return message and update the user’s application accordingly. The user now sees the requested information displayed on the screen.

Performance Tuning Terminology

Table 2 provides definitions of specific terms related to performance and tuning Siebel eBusiness Applications. For definitions of *performance* and *scalability*, see "About Performance and Scalability" on page 16.

For definitions of terms used commonly with Siebel eBusiness Applications, refer to the *Glossary*.

Table 2. Performance Tuning Terminology

Term	Definition
Concurrent users	The number of application users actively using and accessing the Siebel application, or a particular element such as an AOM process, at a particular time.
Latency	Delay experienced in network transmissions as network packets traverse the network infrastructure.
Think time	The wait time between user operations. For example, a user brings up the Account screen and spends 10 seconds reviewing the data for an account. This 10 seconds is the think time for this operation. Think time is a critical element in performance and scalability tuning, particularly for AOM. When think time values are correctly forecasted, then actual load levels will be close to anticipated loads.
Process	An operating system (OS) process. For example, a Siebel Server component such as AOM consists of multiple OS processes, referred to as multithreaded processes.
Multithreaded process (or MT server)	A process running on a multithreaded Siebel Server component that supports multiple threads (tasks) per process. AOM components run multithreaded processes that support threads.
Task	A concept for Siebel applications of a unit of work that can be done by a Siebel Server component. Siebel tasks are typically implemented as threads.

Table 2. Performance Tuning Terminology

Term	Definition
Thread	An operating system feature for performing a given unit of work. Threads are used to implement tasks for most Siebel Server components. A multithreaded process supports running multiple threads to perform work such as to support user sessions.
Response time	Amount of time the Siebel application takes to complete an operation. Therefore, it is an aggregate of time incurred by all server processing and transmission latency for an operation. Response time may be as experienced by an application end user, or may be the amount of time needed for some other operation that is unrelated or indirectly related to end user sessions.
Throughput	Typically expressed in transactions per second (TPS), expresses how many operations or transactions can be processed in a set amount of time.

Tuning the Siebel Application Object Manager for Performance 2

This chapter describes the structure and operation of Siebel Application Object Manager (AOM) components and the tuning that might be required for optimal operation.

For more information about the Siebel Server and AOM infrastructure, and about the Siebel Web Client, refer to the following documents on the *Siebel Bookshelf*:

- *Siebel Server Administration Guide*
- *Siebel Server Installation Guide* for the operating system you are using
- *Siebel Web Client Administration Guide*

About the Application Object Manager

The term *Application Object Manager* refers to any of several Siebel Server components that support users accessing Siebel applications through the Siebel Web Client and a Web server.

A different AOM component is provided for each base application among the Siebel eBusiness Applications. For example:

- The AOM for Siebel Call Center is Call Center Object Manager (SCCObjMgr).
- The AOM for Siebel Sales is Sales Object Manager (SSEObjMgr).
- The AOM for Siebel eService is eService Object Manager (eServiceObjMgr).

In addition, separate AOMs are provided for each installed language in which you may run your Siebel applications.

When configured appropriately, AOM components on your Siebel Servers can use memory and CPU resources efficiently. You also configure AOMs for efficient communication with the Siebel Database, the Web server, and other components in the Siebel Enterprise.

The multiprocess, multithreaded model for AOM components provides scalability to support deployments with a wide range of concurrent Siebel application users.

The overall performance of the AOM contributes significantly to the response time as experienced by your end users.

AOM Infrastructure

An AOM component is implemented as a multithreaded process on the Siebel Server. At runtime, a parent process starts one or more multithreaded processes, according to the AOM configuration.

Each process can host multiple user sessions (as tasks), which in turn are implemented as threads within the process. These threads may be dedicated to particular user sessions, or they may serve as a pool that can be shared by multiple user sessions. (For each process, a few threads also start that are dedicated to performing core functions for the process.)

As more users log into the system, additional processes may be instantiated to host these users.

- In this chapter, the term *thread* is often used interchangeably with *task*, except when you are using thread pooling. For details, see “Using Thread Pooling for AOM” on page 52.
- The terms *multithreaded server* or *MT server* are alternative terms for multithreaded process (a process that supports multiple threads). For example, the names of the AOM parameters MaxMTServers and MinMTServers refer to multithreaded processes.

AOM components, which run in interactive mode, handle processing for Siebel Web Client sessions, in which the application user interface (UI) resides. The AOM task manages Siebel business objects and data objects and performs business logic for the client session.

Generally, each AOM task starts in response to a request from a Siebel Web Client running in a Web browser, and ends when the client disconnects. Threads that handle login sessions based on the *anonymous user* may be reused for other login requests. The anonymous user is discussed later in this chapter.

AOM Communications with Other Modules

Each AOM task uses Siebel Server infrastructure capabilities to communicate with the Siebel Database, the Web server (through the SWSE), and other Siebel Enterprise Server components.

- Communication with the Siebel Database uses database connections. Database connections can also be managed and tuned for optimal performance. You can optionally configure connection pooling for database connections.
- Communication with the Siebel Web Server Extension uses SISNAPI (Siebel Internet Session API), a messaging format that runs on top of the TCP/IP protocol. SISNAPI connections can be configured to use encryption and authentication based on Secure Sockets Layer (SSL).

  For details on tuning SISNAPI communications, see "Configuring SISNAPI Connection Pooling for AOM" on page 51.
- Communication with other Siebel Enterprise Server components (including other Siebel Servers) also uses SISNAPI, going through Server Request Broker (SRB).

  For details on tuning SRB, see "Tuning Server Request Broker (SRB)" on page 54.

About Tuning the AOM

Tuning activities directly or indirectly applicable to AOM components may involve any or all of the following:

- Configuring parts of your system using the Siebel Enterprise Server Configuration Utility.
- Using the Siebel Server Manager to tune parameters for the Enterprise Server, the Siebel Server, or the AOM component. These parameters are stored in the siebns.dat file in a directory on the Siebel Gateway Name Server.

- Selectively enabling component groups and components on each Siebel Server. Only enable the component groups and components you need.
- Tuning parameters in the eapps.cfg file on the Siebel Web Server Extension. This file is located in the bin subdirectory of the Siebel Web Server Extension installation directory, on the Web server machine.
- Tuning parameters in the application configuration file, such as uagent.cfg for Siebel Call Center. This file is located in the bin/*language* subdirectory of the Siebel Server installation directory. Parameters in certain sections of this file, such as [SWE], are read by the relevant AOM, such as SCCObjMgr for Siebel Call Center.

Some other chapters in this book discuss AOM tuning that relates to using other modules, such as Siebel Communications Server or Siebel eConfigurator.

Performance Factors for AOM Deployments

In planning to deploy AOMs, or in troubleshooting performance for existing AOM deployments, you must consider several factors that determine or influence performance.

Factors that are central to the task of configuring the AOM are also called *performance drivers*. Performance drivers for AOM include concurrent users and average think time. Other important factors such as hardware resources will set limits on overall capacity or capacity per server.

Subsequent sections provide information and guidelines to help you achieve and maintain optimal performance and scalability.

These factors are critical in initially configuring your AOMs, particularly when specifying values for the AOM component parameters MaxTasks, MaxMTServers, and MinMTServers, which are discussed in "Tuning AOM Components for CPU and Memory Utilization" on page 34.

Concurrent Users

The number of concurrent users is the total number of user sessions supported at any one time. It also includes sessions supporting user logins (anonymous user sessions) or anonymous browser users. For planning and tuning purposes, you must consider concurrent users (and total users) at multiple levels:

- The entire deployment (enterprise)
- Each Siebel Server
- Each AOM component on each server
- Each multithreaded process for each AOM component

The maximum number of concurrent users per Siebel Server—assuming, for example, the application server machine is dedicated to running AOM components—will depend on the average think time, on your hardware resources, and on the nature of your Siebel applications deployment.

In terms of configuration, the maximum number of concurrent users for the AOM is limited by the value of the MaxTasks parameter. The effective maximum is limited by the number of multithreaded processes and by your hardware resources.

Depending on the average think time and other factors, each multithreaded process (process within the AOM) typically supports a maximum of about 100 concurrent users. Configure enough multithreaded processes (using the MaxMTServers parameter) to support your maximum number of concurrent users (peak loads).

Average Think Time

The average think time is the time between operations assumed for your application users. For example, after a user has executed a query, the think time is how long the user reviews a record before taking some other action that sends a request to the AOM.

The assumed think time has a direct relationship to the number of concurrent tasks that a multithreaded process can support. The ratio of 100 (100 tasks per process), based on a 30-second think time, is assumed in the formula for setting the MaxMTServers parameter. This formula is presented in "Tuning AOM Components for CPU and Memory Utilization" on page 34.

The ratio of 100 is based on having approximately three users running operations at the exact same time (100/30 = approximately 3.3). It is generally observed that each multithreaded process can handle about three operations at the same time with minimal performance degradation.

With longer think times, one multithreaded process may support more than 100 concurrent tasks; with shorter think times, fewer.

For example, if the think time is 15 seconds between user operations, then about 50 tasks per process could be supported (15 * 3.3 = approximately 50, or 50/15 = approximately 3.3.

NOTE: The ratio of concurrent tasks per multithreaded process varies based on the level of customization or the use of process automation for the application the AOM supports.

You need to determine the average think time based on the usage patterns typical of your user base. After the application has been configured, perform a clickstream analysis for your key processes, and try to capture the time between the user actions that are represented by the clicks. Consider the average time between each transaction, and calculate the overall average think time based on these factors.

Nature of Siebel Application Deployment

Which Siebel applications and other modules you are using, how you have configured your Siebel applications, how you have deployed your applications, and other such factors also affect AOM performance and how many concurrent users you can support. Some of these factors include:

- Will you support employee applications (such as Siebel Call Center), customer applications (such as Siebel eService), partner applications (such as Siebel PRM), or some combination of these? Typically, employee applications use high interactivity and customer applications use standard interactivity.
- Will you deploy your Siebel software in a global environment using multiple languages?
- What degree and what kind of application configuration changes have you made, such as those you do using Siebel Tools?

- Will you use specialized functionality such as offered by Siebel eConfigurator (for product configuration) or Siebel CTI (telephony integration for call center agents)? How will you deploy such functionality? What percentage of your user base will use such functionality?

Hardware Resources

Hardware resources for each Siebel Server machine, particularly CPU and memory, are a factor in how many concurrent users can be supported for each AOM component. For example, a four-way machine has twice the resources of a two-way machine and can potentially support twice as many concurrent users. Key hardware resources for AOM performance include:

- **CPU.** The CPU rating and the number of CPUs per server machine.
- **Memory.** The amount of RAM, and whether it can accommodate users without excessive paging.

Disk I/O and network capacity are other important hardware factors, but they do not affect AOM tuning. They do significantly affect performance for the Siebel Database and the Siebel File System.

The total number of machines you can devote to supporting AOM components will determine the total number of concurrent users.

Topology Considerations for AOM Deployments

Your Siebel applications can be deployed using a variety of topologies, or system layouts. Although AOMs are only a part of the overall deployment, they play a direct and central role in supporting Siebel application users.

You must determine on how many machines you will run Siebel Server, and on how many of these you will run AOM components. In some cases, you may choose to run multiple components on the same Siebel Server.

NOTE: AOM components are typically the major resource consumers for your Siebel Server machines. Tuning considerations discussed in this chapter generally assume that you are not running additional components on an AOM machine that will significantly contend for available resources.

Best Practices for AOM Tuning

Using your hardware resources optimally, and configuring your system appropriately, can help you to achieve your performance goals. You should consider your resources and requirements carefully, and test and monitor system performance on a continual basis.

Review information presented in *Siebel Server Administration Guide* and other sources. All tuning calculations must be done with some understanding of the overall system and the considerations described in "Performance Factors for AOM Deployments" on page 30.

Tuning AOM Components for CPU and Memory Utilization

This section provides background information and guidelines for tuning your AOM components, particularly for setting values for the parameters MaxTasks, MaxMTServers, and MinMTServers.

Settings for these parameters determine how well the system performs under specific user load and operations. Parameter settings provide a means of controlling the server capacity through the Siebel Server infrastructure, and directly impact the overall capacity for each server.

How you set the MaxTasks, MaxMTServers, and MinMTServers parameters is a direct function of the factors described in "Performance Factors for AOM Deployments" on page 30, which determine the true capacity of the server.

NOTE: The art of tuning AOM components is to come up with the right parameter settings that allow the server machines to host the largest number of users (scalability) with minimal impact on user response time (performance).

About MaxTasks, MaxMTServers, and MinMTServers

The AOM parameters MaxTasks, MaxMTServers, and MinMTServers are described below. You configure these parameters using Siebel Server Manager, which is described in detail in *Siebel Server Administration Guide*.

For background information about multithreaded processes, threads, and related concepts, see "AOM Infrastructure" on page 28.

- **MaxTasks (Maximum Tasks).** Specifies the total number of tasks (threads) that can run concurrently on this AOM, for this Siebel Server. Beyond this number, no more tasks can be started to handle additional requests.
- **MaxMTServers (Maximum MT Servers).** Specifies the maximum number of multithreaded processes that can run concurrently on this AOM. Beyond this number, no more multithreaded processes can be started to handle additional requests.
- **MinMTServers (Minimum MT Servers).** Specifies the default minimum number of multithreaded processes that will start on this AOM when the parent process is started. The parent process may be started either explicitly (using Siebel Server Manager) or automatically (if the Siebel Server is started when the component state was last set to Running). Setting MinMTServers to 0 effectively disables the AOM component.

As more users log in, new tasks start to handle these sessions, and new multithreaded processes are started to support the additional tasks. The tasks and processes are added according to the AOM load-balancing behavior, up to the maximum number of tasks and maximum number of multithreaded processes. For details, see "Effect of AOM Parameter Settings" on page 36, below.

NOTE: MaxTasks, MaxMTServers, and MinMTServers are generic parameters that apply to many different Siebel Server components. However, much of the behavior described in this chapter is unique to AOM components. For more information, refer to *Siebel Server Administration Guide*.

These parameters relate to one another in the following ways:

- MaxMTServers and MinMTServers are typically set to the same value. This is to avoid any performance penalty for a user whose login causes a new multithreaded process to start. (MaxMTServers *must* be equal to or greater than MinMTServers.)

  Starting all multithreaded processes up front when the parent process is started is generally acceptable. The memory overhead for running a multithreaded process itself, apart from the overhead of its threads, is minimal.

- The ratio MaxTasks/MaxMTServers determines the maximum number of threads (tasks) that can run concurrently on a given multithreaded process. For more information, see the discussion of think time under "Performance Factors for AOM Deployments" on page 30.

Effect of AOM Parameter Settings

This section illustrates how an AOM behaves given particular example settings for the MaxTasks, MaxMTServers, and MinMTServers parameters. More realistic examples may be found in "Formulas for Calculating AOM Parameter Values" on page 38.

For example, if MaxTasks = 500, and MaxMTServers = 5, then the ratio MaxTasks/ MaxMTServers = 100. This means that, at most, 100 threads (tasks) can run in a multithreaded process on this AOM.

Typically, MinMTServers would be set the same as MaxMTServers. However, in this example, assume MinMTServers = 4. In this case, four multithreaded processes start by default, which can handle a total of 400 concurrent threads.

As users start the application on the server, the number of concurrent threads rises, and the following occurs:

- As the number of concurrent threads rises, but remains below 400, these threads are distributed among the four multithreaded processes that started by default for this AOM. This is a form of load balancing internal to the AOM component. (It is based on operating-system scheduling, and is unrelated to load balancing done by Resonate Central Dispatch or done at the Web server level.)
- If the number of concurrent threads reaches 400, and a new request is received, a fifth multithreaded process starts for this AOM. The AOM now distributes threads among five multithreaded processes for this AOM.
- If the AOM reaches 500 concurrent threads, no more client session requests can be handled, because the existing multithreaded processes can start no more threads, and the AOM can start no more multithreaded processes. The AOM can be said to be “maxed out.”

If AOM loads fall back, as users log out or session timeouts are enforced, then threads are freed up. In some cases, a multithreaded process whose threads have completed may also time out and stop running (this can happen only when MaxMTServers is greater than MinMTServers).

Guidelines for Configuring AOM Parameters

This section provides formulas and guidelines for setting the MaxTasks, MaxMTServers, and MinMTServers parameters for your AOM components.

NOTE: All elements in the two formulas shown in “Formulas for Calculating AOM Parameter Values” on page 38 vary according to your deployment. The number of concurrent users an AOM can support will depend on factors such as the number of processors, session timeout settings, and the average think time.

Typically, the AOM is the only component using significant resources on the Siebel Server machine. If you run multiple server components, or run non-Siebel modules, then an AOM on this machine may support fewer concurrent threads.

Follow these general steps to determine how to set these parameter values:

- Determine the total number of concurrent users, based on the average think time and other factors discussed earlier.
- Determine the number of concurrent users that must be supported on a given Siebel Server machine running AOM. In the formulas outlined below, this is the target number of users plus the number of anonymous browser users. Also determine the number of anonymous users.
- Determine how many Siebel Server machines are needed to support your concurrent users. This is typically done by Siebel Expert Services or by platform vendors.
- Plug your values into the formulas below, then adjust the values to meet any additional criteria. In particular:
  - If your calculated value for MaxMTServers is not an integer, then round up the value to the nearest integer.
  - After you adjust the value of MaxMTServers, if your calculated ratio for MaxTasks/MaxMTServers is not an integer, then round up the value of MaxTasks until this ratio is an integer.
- Test your initial parameter settings, such as to gauge the actual number of anonymous users required, then adjust settings further as necessary.

Formulas for Calculating AOM Parameter Values

Use the formulas below for calculating parameter values for your AOM components:

- MaxTasks = *target_number_of_users* + *anon_browser_users* + *anon_users*
- MaxMTServers = (*target_number_of_users* + *anon_browser_users*)/100
- MinMTServers = MaxMTServers

As necessary, after making your initial calculations, round up MaxMTServers to the nearest integer, calculate the remainder (X) of MaxTasks/MaxMTServers, then increment MaxTasks by adding (MaxMTServers - X). You do this to make sure that the ratio of MaxTasks/MaxMTServers is an integer.

NOTE: The figure of 100 in the MaxMTServers formula represents the ratio of concurrent tasks per multithreaded process. The value of 100 is a rule of thumb only. For details, see below.

Variables in the above formulas are described below:

- *target_number_of_users* = The maximum number of concurrent user sessions your AOM will support (for users who are logged into the application).

  The maximum number of concurrent users is limited by the value of the MaxTasks parameter for the AOM, by the number of multithreaded processes you are running (determined by MaxMTServers and MinMTServers), and, effectively, by your hardware resources.

- *anon_browser_users* = The number of sessions on the AOM dedicated to anonymous browser users (threads that support users who do not log in).

  - For high interactivity applications (typically, employee applications like Siebel Call Center), anonymous browser users (*anon_browser_users*) are not supported, so this is not a factor.

  - For standard interactivity applications (typically, customer applications like Siebel eService), anonymous browser users (*anon_browsers*) may be approximately 25% of the target number of users.

- *anon_users* = The number of sessions on the AOM dedicated to the anonymous user (threads that are used for login purposes).

  - For applications where users log in and out infrequently (typical of high interactivity applications), anonymous users (*anon_users*) may be approximately 5% of the target number of users. Assume a higher figure if the peak number of simultaneous login requests is high, such as may occur during shift changes in a call center operation.

- For applications where users log in and out frequently (typical of standard interactivity applications), anonymous users (*anon_users*) may be approximately 20%, or as high as 90%, of the target number of users. Assume a higher figure if the peak number of simultaneous login requests is very high, such as may occur in certain online customer applications.

NOTE: Requirements for the size of the anonymous user pool may vary significantly and must be based on the usage characteristics of each implementation. The pool should be closely monitored to make sure it has sufficient resources during peak load periods.

- 100 = The approximate maximum number of concurrent threads each multithreaded process on the AOM can support. The number 100 is a rule of thumb. Use the number that is appropriate for your deployment.

NOTE: A ratio of 100 for threads per multithreaded process works for most AOM usage scenarios. However, if your deployment involves a shorter think time than 30 seconds, or a heavier than average load per thread, each multithreaded process will support fewer concurrent threads. Conversely, a longer think time or a lighter average load will support more concurrent threads. For more information about how the ratio of threads per multithreaded process relates to think time, see "Performance Factors for AOM Deployments" on page 30.

Example Settings for AOM Parameters

Along with other factors such as think time, the calculation of MaxTasks, MaxMTServers, and MinMTServers depends on your assumptions for *target_number_of_users*, *anon_browser_users*, and *anon_users*, which are described above. Example settings follow for Siebel Call Center and Siebel eService.

Example Settings for Siebel Call Center

For Siebel Call Center, assume (for example) a think time of 30 seconds, and assume that *target_number_of_users* = 500. For this application, *anon_browser_users* is not a factor. Depending on your implementation, *anon_users* might be about 5% of *target_number_of_users* (or 25). Your preliminary parameter values would be:

MaxTasks = (500 + 25) = 525

MaxMTServers = (500 + 25)/100 = 525/100 = 5.25 = 6 (round up)

MinMTServers = MaxMTServers = 6

Adjust the value of MaxTasks. The variable X = the remainder of (525/6) = 3. Increment MaxTasks by (MaxMTServers - X): 525 + (6 - 3) = 525 + 3 = 528. Therefore, the final calculations for parameter values would be:

MaxTasks = 528

MaxMTServers = MinMTServers = 6

Example Settings for Siebel eService

For Siebel eService, assume (for example) a think time of 30 seconds, and assume that *target_number_of_users* = 500. Depending on your implementation, *anon_browser_users* might be about 25% of *target_number_of_users* (or 125), and *anon_users* might be about 20% of *target_number_of_users* (or 100). Your preliminary parameter values would be:

MaxTasks = (500 + 125 + 100) = 725

MaxMTServers = (500 + 125)/100 = 6.25 = 7 (round up)

MinMTServers = MaxMTServers = 7

Adjust the value of MaxTasks. The variable X = the remainder of (725/7) = 4. Increment MaxTasks by (MaxMTServers - X): 725 + (7 - 4) = 725 + 3 = 728. Therefore, the final calculations for parameter values would be:

MaxTasks = 728

MaxMTServers = MinMTServers = 7

Anonymous User Pool on Siebel Web Server Extension

Calculations for anonymous browser users and anonymous users are part of the formulas for setting MaxTasks, MaxMTServers, and MinMTServers. The significance of these figures relates specifically to settings on the Siebel Web Server Extension (SWSE) that define anonymous user pools for one or more applications.

The size of the anonymous user pool should be based on the number of customers performing anonymous browsing without logging in as a registered user, and on how many users log in concurrently and how long each login takes.

After performing your initial MaxTasks sizing, review the SWSE `stats` page to gauge the actual size of the anonymous user pool at one time, and adjust your MaxTasks setting as needed.

The AnonUserPool parameter, located in the eapps.cfg file in the SWSE installation, determines the maximum size of the anonymous user pool for all affected applications served by the Web server:

- If AnonUserPool is defined in the [defaults] section of the eapps.cfg file (its default location), it affects all Siebel applications that connect through that Web server.
- If AnonUserPool is defined in a section of the eapps.cfg file that is specific to a particular application, it affects only that application.

Previous examples assumed *anon_users* = 25 for Siebel Call Center, and *anon_browser_users* = 125 and *anon_users* = 100 for Siebel eService.

- If a single Web server routes requests to both of these applications, and to no others, then you could define AnonUserPool in the [Default] section, and set it to 250 (25 for Siebel Call Center and 225 for Siebel eService).

  Or, you could define AnonUserPool in separate sections for each application, and provide separate values for each application (25 for Siebel Call Center and 225 for Siebel eService).

- If two Web servers route requests to one Siebel Server, then you might cut the AnonUserPool values in half, as configured in the eapps.cfg file for each SWSE installation, to maintain the correct total figures.

NOTE: The anonymous user pool also includes guest users, which are users who are logged in on a guest basis. Guest users apply to standard interactivity applications only. Anonymous browser users and guest users are subject to different timeout settings, using the parameters AnonSessionTimeout and GuestSessionTimeout, located in the eapps.cfg file in the SWSE installation. Your sizing calculations for anonymous browser users should consider guest users and all applicable timeout values affecting anonymous browser and guest user sessions.

For more information about the `stats` page and about the eapps.cfg file parameters AnonUserPool, AnonSessionTimeout, and GuestSessionTimeout, refer to *Siebel Server Installation Guide* for the operating system you are using and *Security Guide for Siebel eBusiness Applications*.

About Database Connections for AOM

This section provides an overview of database connections for your AOM components, including nonpooled connections and pooled connections. Subsequent sections describe how to configure database connection pooling.

NOTE: It is assumed that your RDBMS has a sufficient total number of database connections. Performance on the RDBMS, and usage of database connections by other than AOM components, is outside the scope of this section.

About Nonpooled Database Connections

By default, AOM database connection pooling is disabled, and database connections have a direct correspondence to the AOM sessions.

During session login, a database connection is established, using the user's database credentials. (When an external authentication system is used, such as LDAP, the user's database credentials may not be the same as the user's Siebel credentials.) This database connection becomes bound to the session, and is the default connection used for read, write, update, and delete database operations.

If, during the session, specialized code is invoked that uses the external transaction management capabilities of the AOM, then a second database connection is opened for this specialized use. This specialized connection is also bound to the session, and is used for all externally controlled transactions performed by the session. Siebel eAI components are a typical example of specialized code that does external transaction management.

The default database connection and (if created) the specialized database connection are closed when the session terminates.

No special AOM configuration is required for managing nonpooled database connections.

About Pooled Database Connections

Optionally, you can configure two types of pooled database connections for your AOM components:

- **Shared database connections.** These connections can support multiple user sessions at the same time, by multiplexing (sharing) database operations for multiple sessions over the same database connection. For details, see "Configuring Shared Database Connection Pooling" on page 44.
- **Specialized database connections.** These connections are dedicated to a single session at a time, and serve a specialized purpose. For details, see "Configuring Specialized Database Connection Pooling" on page 49.

NOTE: Shared database connection pooling configuration is sensitive to factors that include average think time and the usage of long-running queries. For more information, see "Configuring Shared Database Connection Pooling" on page 44.

Configuring Shared Database Connection Pooling

Shared database connections are used by most AOM operations. A connection will be shared by more than one user session once the number of sessions within the multithreaded process exceeds the maximum number of shared connections allowed per process, as explained below.

Configuring Parameters for Shared Connection Pooling

This section describes how to enable or disable connection pooling and multiplexing using the parameters MaxSharedDbConns and MinSharedDbConns. These parameters are included in named subsystems of type InfraDatasources.

- To enable connection pooling and multiplexing, set MaxSharedDbConns and MinSharedDbConns to positive values.
  - MaxSharedDbConns controls the maximum number of shared database connections for each multithreaded process.
  - MinSharedDbConns controls the minimum number of shared database connections the AOM tries to keep available for each multithreaded process.

    The setting of MinSharedDbConns must be equal to or less than the setting of MaxSharedDbConns. Depending on your AOM usage patterns, you may set these to the same value or set MinSharedDbConns to a lower value—if you determine this to be helpful in conserving database connection resources.
- To disable connection pooling and multiplexing, set MaxSharedDbConns and MinSharedDbConns to -1 (this is the default value).
- MaxSharedDbConns and MinSharedDbConns are defined per AOM component, on an enterprise basis. The database connections these parameters control are not shared across multithreaded processes. The actual number of database connections for each multithreaded process is determined by the ratio MaxTasks/MaxSharedDbConns.

To configure parameters for shared database connections

1. Determine the appropriate number of user tasks that should share a database connection.
2. Start with a 10:1 ratio for MaxTasks/MaxSharedDbConns: in other words, 10 user tasks will share the same database connection.
3. Adjust the ratio based on think time. The 10:1 ratio assumes a 30-second think time. For a 15-second think time, reduce the ratio proportionally, to 10/(30/15) = 5:1.

4 Adjust the ratio lower if there are known long-running queries in your deployment.

NOTE: A long-running query on a shared database connection may block other users sharing that database connection. Therefore, it is critical to optimize database access in your environment when using database connection pooling. If long-running queries cannot be avoided, monitor the overall database response time and reduce the ratio MaxTasks/MaxSharedDbConns accordingly, until a satisfactory response time is achieved.

Example Configuration for Shared Connection Pooling

Assume, for example, the following parameter settings:

```
MaxTasks = 500

MaxMTServers = 5

MinMTServers = 5

MaxSharedDbConns = 50

MinSharedDbConns = 50
```

With these settings, the AOM component can support a maximum of 500 threads. Those 500 threads would be spread over five multithreaded processes, each having 100 threads. Each multithreaded process would have a maximum of 10 shared database connections, each of which would serve up to 10 threads.

NOTE: Adjust the ratio based on think time. For example, if think time is 15 seconds, then the ratio would be 10/(30/15) = 5:1, and MaxSharedDbConns = 500/5 = 100.

How Shared Connections Are Assigned

When the AOM starts up, the shared connection pool is empty. When a user logs into the AOM, the shared connection pool is checked to see if a connection is available.

Shared database connections may be assigned to a new user session in any of the following ways:

- If a database connection is available in the pool that is not being used by another session, assign the connection to the new session. The connection is not removed from the pool.
- If the number of connections in the pool is less than MaxSharedDbConns, create a new connection, place it into the pool, and assign it to the new session.
- Select the current connection in the pool that is shared by the fewest sessions (has the lowest usage count), and assign it to the new session.

Once a shared connection is assigned to the new session, all database operations (read, write, update, and delete) for the session go through the connection.

When the session terminates, the usage count for the database connection is decremented. If the usage count has reached 0 (no sessions use this connection) and there are at least MinSharedDbConns connections already in the pool, the connection is removed from the pool and closed. Otherwise, it is left in the pool so the minimum number of shared connections is maintained.

When an AOM multithreaded process shuts down, any remaining connections in the pool are closed.

Database Connections and Database Authentication

When your deployment uses database authentication, a database connection is created for each login, for authentication purposes. Afterwards, this connection is released to the shared connection pool, if it has less than MaxSharedDbConns. Otherwise, if the pool is full, the connection is closed (terminated).

Therefore, even when the pool is full and connections are available, new connections are still created temporarily for each new session login. These connections must be accounted for in determining the allocation of database connections.

Database Connections and Long-Running Queries

When multiple user sessions are assigned to a shared database connection, all database operations from these users go through this shared connection. A database connection can process only one database operation at any particular moment.

If a long-running query is run which takes, for example, three seconds, then, for this duration, database requests from other users sharing the same database connection would be queued until the query operation completes.

For this reason, when you use database connection pooling, it is critical to minimize the number of long-running queries.

Scenario for Assigning Shared Connections

Assuming, for example, the parameter settings described in "Example Configuration for Shared Connection Pooling" on page 46, shared database connections will be handled as in the following scenario:

- If 10 users log in, in sequence, each user is assigned a new database connection on the same multithreaded process. (Each multithreaded process will have at most 10 shared database connections.)
- User 21–100, continuing to log in (in sequence), would reuse these connections.
- Users 51–100, logging in (in sequence again), would reuse Connections 1–50. (Each database connection will have at most a usage count of 10. Each multithreaded process would have at most a thread count of 100.)
- Once assigned a database connection, a user session is tied to that database connection for the duration of the session. This mapping is maintained until the user logs out or the session times out.
- So, assuming 100 users have logged in, in sequential order, then Connection 1 is then used by Users 1, 11, 21, 31, 41, 51, 61, 71, 81, and 91.
- When a user logs out or session timed out, the usage count for Connection 1 decrements by 1. (Connections with lower usage counts will be assigned to new user sessions, as needed.)
- Once the usage count for a database connection reaches 0, it is closed if the number of database connections is greater than MinSharedDbConns. If it is equal to or less than MinSharedDbConns, then it is not closed.

For details, see "How Shared Connections Are Assigned" on page 46.

Configuring Specialized Database Connection Pooling

Specialized database connections, which are not shared, are used primarily by specialized Siebel components such as Siebel eAI that need transactions to span multiple AOM operations. These connections are used for operations that use BEGIN TRANSACTION and END TRANSACTION.

Configuring Parameters for Specialized Connection Pooling

This section describes how to enable or disable specialized connection pooling using the parameter MinTrxDbConns. This parameter is included in named subsystems of type InfraDatasources.

- MinTrxDbConns controls the minimum number of specialized database connections for each multithreaded process. The connections are not created until they are needed. The minimum value is thus the minimum size of the pool of specialized connections once the pool has been filled.
  - To enable specialized connection pooling, set MinTrxDbConns to a positive value.
  - To disable specialized connection pooling, set MinTrxDbConns to -1 (this is the default value).
- There is no explicit limit to the maximum number of specialized connections. However, effectively, there cannot be more specialized connections than sessions. On average, there will be many fewer connections than sessions.
- MinTrxDbConns are defined is AOM component, on an enterprise basis. The database connections this parameter controls are not shared across multithreaded processes. The actual number of database connections for each multithreaded process is what you specify as the value for MinTrxDbConns.

NOTE: MinTrxDbConns works differently than MaxSharedDbConns and MinSharedDbConns, which specify the number of shared connections available for the entire AOM. For details, see “Configuring Parameters for Shared Connection Pooling” on page 45.

Example Configuration for Specialized Connection Pooling

Assume, for example, the following parameter setting, in addition to those described in "Example Configuration for Shared Connection Pooling" on page 46:

```
MinTrxDbConns = 5
```

With this setting, each multithreaded process would have a minimum of five specialized database connections. If all five multithreaded processes are running on this AOM, there would be a minimum of 25 specialized connections for this AOM.

How Specialized Connections Are Assigned

When the AOM starts up, the specialized connection pool is empty. When a request is made to start a transaction, the AOM requests a database connection from the specialized connection pool. If one is available, it is removed from the pool and given to the session for that session's exclusive use.

When the transaction completes (such as by being committed or canceled), the session returns the specialized connection to the pool. If the pool already contains more than the number of connections specified by MinTrxDbConns, the specialized connection is closed; otherwise, it is retained in the pool.

Scenario for Assigning Shared Connections

Assume, for example, that MinTrxDbConns is set to 2. Specialized connections will be handled as follows:

- User 1 starts Transaction 1. The specialized connection pool is empty, so a new connection is created. Once Transaction 1 completes, this connection is returned to the pool.
- User 2 starts Transaction 2. If Transaction 1 is still running, then a new specialized connection is created. If Transaction 1 completed, then Transaction 2 uses the first database connection.
- When two specialized connections have been created, they will remain in the pool until the AOM terminates.

Configuring SISNAPI Connection Pooling for AOM

This section provides information about how to manage SISNAPI connections for your AOM components.

SISNAPI (Siebel Internet Session application programming interface), a messaging format that runs on top of the TCP/IP protocol, is used for network communication between AOM and Siebel Web Server Extension (SWSE), installed on the Web server. SISNAPI connections can be configured to use encryption and authentication based on Secure Sockets Layer (SSL).

Each multithreaded process for an AOM component uses a pool of SISNAPI connections managed by the SWSE. The process multiplexes (shares) many client sessions over each connection.

Each client session request opens a new connection and adds it to the pool, until all the connections have been created. Subsequent requests are then multiplexed over the existing pooled connections. SISNAPI connections persist until the multithreaded process or the AOM component are shut down.

Multiplexing traffic over a set of SISNAPI connections helps to reduce the number of open network connections.

The SISNAPI connection pool size per multithreaded process for an AOM is determined by the combined settings of MaxTasks, MaxMTServers, and SessPerSisnConn.

SessPerSisnConn determines how many sessions can be multiplexed over a single SISNAPI connection. By default, SessPerSisnConn is set to 20 for AOM components. This figure is suitable for most deployments and generally does not need to be changed. You may set this differently, depending on how you calculated think time. For details, see "Performance Factors for AOM Deployments" on page 30.

For more information about configuring MaxTasks and MaxMTServers, see "Tuning AOM Components for CPU and Memory Utilization" on page 34.

The number of actual SISNAPI connections per multithreaded process for the AOM is determined by the following formula:

(MaxTasks/MaxMTServers)/SessPerSisnConn = *SISNAPI_conn_per_process* where *SISNAPI_conn_per_process* represents the number of SISNAPI connections per multithreaded process.

Assume, for example, the following parameter values:

```
MaxTasks = 600

MaxMTServers = 5

SessPerSisnConn = 20
```

In this case, the formula would be:

```
(600/5)/20 = 120/20 = 6
```

Or, if MaxTasks = 540 and SessPerSisnConn is set to 18, the formula would be:

```
(540/5)/18 = 108/18 = 6
```

In each case, six SISNAPI connections will be created and pooled for each multithreaded process for the AOM. In the first example, 20 sessions would be multiplexed over each connection. In the second example, 18 would be muliplexed over each connection.

Some Object Manager components are not AOM components. Configuration issues for such components may differ from that applicable to AOM components. For information about the EAI Object Manager, see Chapter 7, “Tuning Siebel eAI for Performance.”

Using Thread Pooling for AOM

Optionally, you can configure your AOM components to use thread pooling. Enabling AOM thread pooling as described in this section both pools and multiplexes (shares) multiple tasks across threads.

Using AOM thread pooling can improve performance and scalability on multiple-CPU machines that are under heavy load—for example, machines using eight or more CPUs that are running at more than 75% CPU capacity.

NOTE: AOM thread pooling is not recommended for smaller server machines or for machines that run under a relatively lower capacity.

About Thread Pooling for AOM

The pool size per multithreaded process for an AOM is determined by the combined settings of the parameters UseThreadPool, ThreadAffinity, MinPoolThreads, and MaxPoolThreads.

AOM thread pooling reduces some of system resource usage devoted to creating and closing session threads, as users log in and log out or are timed out. As when you are not using thread pooling, session threads are created as needed as session requests demand. However, instead of being closed when a session terminates, they are released to a pool, where they become available for use by a subsequent session.

NOTE: Using thread pooling introduces its own overhead, however, such as in task context-switching. For this reason, it is strongly recommended not to try to pool threads without also multiplexing them (that is, do not set UseThreadPool = TRUE, but ThreadAffinity = TRUE).

Because ThreadAffinity = FALSE, threads are multiplexed, as can be done with certain types of database connections or SISNAPI connections. At any given time, each thread may be dedicated to one or more user session (task).

Configuring AOM Thread Pooling

To use thread pooling, you set the following parameters on the AOM:

- UseThreadPool = TRUE (default is FALSE)
- ThreadAffinity = FALSE (default is FALSE)
- MinPoolThreads = *min_number_threads_in_pool* (default is 0)

  where *min_number_threads_in_pool* represents the minimum number of threads in the AOM thread pool.
- MaxPoolThreads = MinPoolThreads (default is 0)

NOTE: You must specify a value for MaxPoolThreads that is equal to or greater than the value of MinPoolThreads. Other than this requirement, the specific value you provide does not matter.

To determine an appropriate value for MinPoolThreads and MaxPoolThreads, start slowly, monitor system performance, then introduce more multiplexing, as may be appropriate for your deployment. For example, start with a formula like this (based on two tasks per thread):

```
MinPoolThreads = MaxPoolThreads = (MaxTasks/MaxMTServers)/2
```

Subsequently, you may increase this to five tasks per thread, using this formula:

```
MinPoolThreads = MaxPoolThreads = (MaxTasks/MaxMTServers)/5
```

For example, if MaxTasks = 525, and MaxMTServers = 5, this would be:

```
MinPoolThreads = MaxPoolThreads = (525/5)/ 5 = 105/5 = 21
```

Or, if MaxTasks = 725, and MaxMTServers = 5, this would be:

```
MinPoolThreads = MaxPoolThreads = (725/5)/ 5 = 145/5 = 29
```

NOTE: Adjust values for think time, as necessary. If you cut your think time value in half, then double the number of threads in the pool.

Tuning Server Request Broker (SRB)

The Server Request Broker (SRB) component routes requests between Siebel Server components, such as from an AOM to a batch component. SRB also handles requests between batch components. SRB is used whether the components run on the same machine or on different machines.

Server requests originating with an AOM component always go the SRB component to determine what to do with the request:

- If the destination component is running on the same Siebel Server, SRB passes the request to this component. If multiple instances of the destination component are running, SRB passes the request to each component instance in a round-robin fashion.
- If the destination component is not running on the same Siebel Server, SRB passes the request to SRB running on another machine. If the destination component runs on multiple Siebel Servers, SRB passes the request to each server in round-robin fashion.

SRB components are configured using the parameters MaxTasks, MaxMTServers, and MinMTServers. Default parameter settings are as follows:

```
MaxTasks = 100

MaxMTServers = MinMTServers = 1
```

NOTE: For most deployments, the default values for these parameters work well.

- MaxTasks determines the maximum number of SRB threads (tasks) that can run on the Siebel Server.
- MaxMTServers and MinMTServers determines the maximum and minimum number of multithreaded processes for SRB that can run on the Siebel Server. Each multithreaded process can run a maximum of MaxTasks/MaxMTServers threads.

The ratio MaxTasks/MaxMTServers should be at least equal to the sum of all instances of interactive and batch components and all Siebel Servers in the enterprise. (The default values support a ratio of 100.)

CAUTION: Setting MaxTasks, MaxMTServers, and MinMTServers parameter values for SRB components in such a way that does not meet the above requirement may result in request failures.

For more information about SRB, refer to *Siebel Server Administration Guide*.

Tuning AOM Caches

The AOM uses several caches, which affect memory usage for the AOM. Tuning AOM caches affects AOM performance and memory usage. The following are some of the major caches used by AOM that can be configured:

- **SQL cursor cache**. The SQL cursor cache is configured using the DSMaxCachedCursors parameter. This can be enabled on multithreaded components (such as AOM) with database connection pooling. The value represents the number of SQL cursors per database connection.

  For an AOM for which the Siebel Server machine is more likely to reach its CPU capacity before it reaches its memory capacity (for example, Siebel Employee Relationship Management), the default value of 16 for the DSMaxCachedCursors parameter may be appropriate. Such an application is sometimes referred to as *CPU-bound*.

  For an AOM for which the Siebel Server machine is more likely to reach its memory capacity before it reaches its CPU capacity (for example, Siebel Call Center), you can set DSMaxCachedCursors to a lower value, even to 0. Such an application is sometimes referred to as *memory-bound*.

  In general, the value should reflect the CPU and memory resource availability on the Siebel Server machine running a particular AOM component.

  The trade-off in setting this parameter is that allocating memory to caching SQL cursors means they would need to be created less often, but at a cost in memory.

- **SQL data caches.** The SQL data caches are configured using the DSMaxCachedDataSets parameter. Two types of data caches are guided by this parameter: global data cache, which is useful in most cases, and per-connection data cache (enabled with or without database connection pooling).

  For an AOM for which the Siebel Server machine is more likely to reach its CPU capacity before it reaches its memory capacity (for example, Siebel Employee Relationship Management), the default value of 16 for the DSMaxCachedDataSets parameter may be appropriate.

  For an AOM for which the Siebel Server machine is more likely to reach its memory capacity before it reaches its CPU capacity (for example, Siebel Call Center), you can set DSMaxCachedDataSets to a lower value, even to 0.

  In general, the value should reflect the CPU and memory resource availability on the Siebel Server machine running a particular AOM component.

  The trade-off in setting this parameter is that allocating memory to caching SQL data sets means they would need to be created less often, but at a cost in memory.

Memory Consumers in AOM

In addition to the caches described earlier, this section discusses major memory consumers in AOM components. For more information on some of these topics, see Chapter 8, "Tuning Customer Configurations for Performance."

- **Database client libraries.** Database client libraries have their own caches, caching metadata, connections, cursors and data. Some of these caches can be reduced in size by using Siebel database connection pooling.

- **Scripts.** A script defined on a business component or applet is loaded into AOM memory when the business component or applet is instantiated—whether or not the script is actually used. A script associated with a business service is loaded into AOM memory when the business service is instantiated—whether or not the service or the script is actually used. If a business service is cached, then any scripts associated with the business service are also cached.

- **Heavy configurations.** Performance is affected when an application is heavily configured.

Other memory consumers in AOM are the following:

- **Navigation pattern.** Numerous scenarios that can be used to navigate in the application can make using global caches ineffective.
- **Session timeouts.** Higher session timeout values mean more active sessions on the server at a time, therefore more memory being used. Lower session timeout values may mean more frequent logins.
- **Users per AOM.** More users per AOM means more sharing of global resources between the users. While the amount of memory used *per user* on this AOM is less, more memory is used overall.
- **Number of applets on views.** More applets configured on views means more business components will be needed at a time, hence higher overall memory usage.
- **PDQ size.** The list of items in the PDQ list are maintained on the server for the current business object. The higher the number of items in this list, the more memory it consumes. The size of PDQ strings also determines the memory usage because of PDQ.

Additional Parameters Affecting AOM Performance

This section provides guidelines for setting additional parameters that affect AOM performance.

- **DSPreFetchSize and DSMaxCursorSize.** These parameters should be set *only* for Siebel implementations on IBM DB2 UDB for OS/390 and z/OS. For more information on setting these parameters, refer to *Implementing Siebel eBusiness Applications on DB2 UDB for OS/390 and z/OS*.

  For all other databases, these parameters should be set to -1.
- **EnableCDA.** If an AOM component does not need to support Siebel eAdvisor or browser-based Siebel eConfigurator, set this parameter to FALSE in the [SWE] section of the configuration file, such as uagent.cfg for Siebel Call Center.

Tuning Siebel Web Client for Performance 3

This chapter describes configuration options that affect the performance and throughput of the Siebel Web Client, and provides guidelines for tuning the client to achieve and maintain optimal performance and scalability.

For more information, refer to the following documents on the *Siebel Bookshelf*:

- *Siebel Web Client Administration Guide*
- *Siebel Server Administration Guide*
- *Security Guide for Siebel eBusiness Applications*
- *System Requirements and Supported Platforms*

The following sections in this book also relate to Siebel Web Client performance:

- For performance considerations for Application Object Manager (AOM), see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."
- For performance considerations related to configuring Siebel applications, see Chapter 8, "Tuning Customer Configurations for Performance."

About Siebel Clients

A Siebel client is a computer that operates Siebel eBusiness Applications, accessing data and services by way of one or more servers. The Siebel clients allow users to access information managed by Siebel applications. All Siebel deployments include one or more of the Siebel client types. You can deploy a mixture of clients.

The Siebel eBusiness Applications client type covered in this book is the Siebel Web Client. This client runs in a standard third-party browser on the end user's client computer, and does not require any additional persistent software installed on the client.

Using HTTP, the browser connects to a Web server over a WAN, LAN, or VPN, or over the Internet. Through the Web server, the Siebel client connects to an Application Object Manager (AOM) component on a Siebel Server, which executes Siebel application business logic and accesses data. Data is accessed from the Siebel Database and may also be accessed from other data sources using virtual business components and a variety of integration methods.

Only the user interface layer of the Siebel eBusiness Applications architecture resides on the client computer.

For more information about the Siebel Web Client and other client types, and about supported browsers and browser settings, refer to *Siebel Web Client Administration Guide* and other applicable documents on the *Siebel Bookshelf*.

Performance Factors for Siebel Web Clients

Some performance considerations for Siebel applications involve processing or tuning activities on servers only, and do not affect Siebel client performance. However, many other such factors either directly or indirectly affect Siebel client performance. This chapter highlights some of the factors most directly related to the performance of the Siebel Web Client.

The performance of the Siebel client depends on many factors, some of which are summarized below. For additional information on these topics, refer to applicable documents on the *Siebel Bookshelf* or Siebel SupportWeb.

About Supporting Multiple Siebel Modules

Employee applications and customer applications have different requirements and characteristics and may use different browsers and other related technologies.

- Employee applications, such as Siebel Call Center, use high interactivity and run in supported Microsoft Internet Explorer browsers only.
- Customer applications, such as Siebel eService or Siebel eSales, use standard interactivity and may run in a wider range of browsers and browser versions.

All Siebel applications have many architectural elements in common. Multiple applications can use the same Siebel repository file (SRF). Each application uses its own AOM component. You may need to define, configure, and test multiple instances of each application to verify that your requirements are met in each usage scenario.

The performance of your Siebel applications will vary according to how you have configured the applications using Siebel Tools or custom browser scripts. See "Following Configuration Guidelines" on page 65.

Client performance will also vary according to which Siebel modules you deploy. The performance of the Siebel client is highly dependent on feature functionality. Therefore, performance characteristics of Siebel modules will differ.

Some modules add special processing requirements. For example, Siebel CTI uses the Communications Session Manager (CommSessionMgr) component, and supports the communications toolbar and displaying screen pops in the client. Server and local resources support this functionality.

Supporting users who are dispersed in offices around the country or around the world introduces special deployment factors that may affect performance.

About Local Machine Resources

The resources available on each user's local machine should meet or exceed the recommendations outlined in *System Requirements and Supported Platforms*. Some performance enhancement measures depend directly on the available resources.

Best Practices for Siebel Web Client Tuning

You should consider your hardware resources and requirements carefully prior to rolling out configuration changes, to make sure that business requirements have been met and the client performs as anticipated in the design phase.

Review guidelines presented elsewhere in this book, particularly in Chapter 8, "Tuning Customer Configurations for Performance," and in other relevant documents on the *Siebel Bookshelf*.

Ongoing testing and monitoring of your system performance is strongly recommended as database characteristics change over time.

To maintain an optimally performing system over time, you must plan for growth or other changes in your deployed application.

Activities you perform to achieve performance and scalability goals may include the following:

- Adjusting your system topology
- Configuring the Siebel application in Siebel Tools
- Configuring Siebel Server components, particularly the AOM
- Adjusting hardware resources available on local machines
- Adjusting operating system settings on server or client machines
- Adjusting Web server settings or network settings
- Adjusting Web browser settings
- Setting user preferences for Siebel applications

Providing Sufficient Web Server and Network Capacity

Make sure that your Web server is appropriately configured to meet your performance requirements. See also “Specifying Static File Caching” on page 67.

Make sure that your network capacity (bandwidth) meets your performance requirements. Several factors impact decisions regarding network bandwidth:

- **Application configuration.** Large, complex views will require bigger templates, more controls, and more data to be sent from the Web server to the client. If bandwidth is an issue, it is important to consider user scenarios to determine the optimal size and layout per view.

  For example, for views used frequently, reduce the number of fields displayed. For the high interactive client, the user can decide which columns are required in list applets. Rather than assuming a specific set, let users adjust it as necessary. Provide the minimal number of columns required in the base configuration.

  For more information, see Chapter 8, “Tuning Customer Configurations for Performance.”

- **View layout caching.** In high interactivity mode, administrators can determine the number of views to be cached locally. If the hardware supports a greater number of views to be cached, adjust the value accordingly.

  When a view is cached, subsequent visits will require a data update, but the Web templates need not be reloaded. This provides a substantial improvement in overall usability.

  For more information, see "Improving Performance Using View Layout Caching" on page 69.

- **Login.** The first login is generally the most expensive operation for the high interactivity client. The client infrastructure caches the main components of the application on first login. Subsequent logins require far fewer resources. Cached objects remain on the client computer until the cache is cleared or a new version of the application configuration is available.

Testing Performance for Web Clients

Siebel Expert Services offers general guidance based on information known about the characteristics of the configured Siebel application. However, customer testing is advised, because assumptions are based on general data. Actual experience can vary due to use-case scenarios. Select a few of the most common scenarios: those that represent the highest percentage of activity. Collect the overall bandwidth used.

Make sure you are testing with warm views (already visited and cached) if this is how the application will be used most of the time—if users log in and use the application for 4-8 hours at a time before logging off and starting a new session.

When you estimate bandwidth required for several users sharing a low-bandwidth connection, consider use-cases carefully and plan accordingly. Rather than planning for worst-case network-performance scenarios (such as all users simultaneous pressing the Enter key or visiting a new view), it is likely that very few users are actually using the network at the same time.

For more information about performance monitoring, see Chapter 9, "Monitoring Siebel Application Performance."

Providing Sufficient Client Hardware Resources

For best client performance for high interactivity applications, provide sufficient or generous hardware resources to your end users (typically, employees). Requirements may vary according to your deployment.

The more memory that is available on your client machines, the greater the number of views that can be cached. For more information, see:

- "Managing the Browser Cache" on page 65
- "Specifying Static File Caching" on page 67
- "Improving Performance Using View Layout Caching" on page 69

The speed of the processors (CPU) on your client machines will affect how quickly the Siebel application user interface is rendered.

For best performance for the high interactivity client, which is used by employee applications like Siebel Call Center, it is generally recommended to include the latest supported version of Microsoft Internet Explorer in your testing. More recent versions often include fixes and performance enhancements.

For best performance for the standard interactivity client, which is used by customer applications like Siebel eService, you must determine the minimum capabilities of customer environments, such as browser to support, processor speed, or expected Internet connection speed. Customer applications must support a wide range of customer environments. Accordingly, you should generally minimize the complexity of such applications.

For Siebel client hardware and other platform requirements and recommendations, refer to *System Requirements and Supported Platforms*.

For information about browser settings for Siebel applications, refer to *Siebel Web Client Administration Guide*.

Tuning System Components

Overall end user performance is affected by the processing on the client as well as by everything from the Web server to the Siebel Database Server and back. Explore all applicable areas for opportunities to improve overall performance.

Most performance tuning involving Siebel Server components should focus on the AOM. For more information, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

You can use Siebel ARM to monitor transactions through the Siebel infrastructure. Note areas which require substantial time and resources, and investigate them further for tuning opportunities.

For example, a custom configuration may have resulted in an unintendedly complex SQL statement for which the database instance has not been optimized. Small configuration adjustments in Siebel Tools, or database tuning, may improve both client performance and application scalability on Siebel Servers.

For more information about Siebel ARM, see Chapter 9, "Monitoring Siebel Application Performance."

Following Configuration Guidelines

For best performance by the Siebel client, you should carefully assess all customer configuration initiatives. All configuration changes should be justifiable in terms of the cost of configuration itself, and in terms of possible impact on performance.

Some application administration tasks may also affect application performance, and should also be carefully assessed.

Follow guidelines presented in Chapter 8, "Tuning Customer Configurations for Performance," or in other books on the *Siebel Bookshelf*.

Managing the Browser Cache

Some types of Siebel application elements are stored in the browser cache, to improve performance when users log in or access Siebel views.

NOTE: When measuring performance, you should take into account view layout caching or other types of caching. For example, performance is better when a Siebel view layout is retrieved from a cache than it is when the view layout is not cached and must be retrieved from the system. For more information, see "Improving Performance Using View Layout Caching" on page 69.

Cache usage varies according to what browser is being used, what applications are running, and application settings. For example, high interactivity applications use the browser cache more than standard interactivity applications.

For high interactivity applications, it is generally recommended that users do not clear their browser cache, including when the browser is closed. The following settings for Microsoft Internet Explorer are recommended:

- Choose Tools > Internet Options. Click the Advanced tab. In the Security options, uncheck the setting Empty Temporary Internet Files Folder when browser is closed.

  NOTE: If you do not use the above setting, then persistent view layout caching and preloading, described in "Improving Performance Using View Layout Caching" on page 69, will not work.

- Choose Tools > Internet Options. Click the Advanced tab. In the Security options, uncheck the setting Do not save encrypted pages to disk.

  NOTE: If you do not use the above setting, then persistent view layout caching and preloading, described in "Improving Performance Using View Layout Caching" on page 69, will not work for encrypted views (views encrypted using SSL).

- Choose Tools > Internet Options. In the General tab, click Settings. For the option Check for newer versions of stored pages, use the setting Automatically.

- Browser caching is also subject to the size of the temporary Internet files folder. This setting is located in Tools > Internet Options. In the General tab, click Settings, then specify the amount of disk space to use for this folder.

  NOTE: Setting the size of the temporary Internet files folder to 0 disables persistent view layout caching and preloading, which are described in "Improving Performance Using View Layout Caching" on page 69.

For more information about browser settings for Siebel applications, refer to *Siebel Web Client Administration Guide*.

Caching in the browser is also subject to Web server settings controlling static file caching. For details, see "Specifying Static File Caching" on page 67.

Specifying Static File Caching

Browser caching behavior is also subject to Web server settings for static file caching. Appropriate settings allow files that are rarely updated, such as image files, JavaScript files, or style sheet files, to be cached on the browser. Caching static files reduces network utilization and enhances Siebel Web Client response time.

Caching for Siebel Web template files is described in the persistent view caching section in "Improving Performance Using View Layout Caching" on page 69.

Because some static files may in fact be updated periodically, there is some risk that outdated versions of static files may be served from the cache. Therefore, some appropriate content expiration time should be specified. In general, setting an expiration time of 7 days may be appropriate.

If static files are rarely updated, you can specify a larger number, for less frequent expiration. If static files are updated more often, you can specify a smaller number, for more frequent expiration.

Instructions follow for specifying static file caching on Microsoft Internet Information Services (IIS), IBM HTTP Server (IHS), and Sun One Web Server. You must restart your Web server for the settings to take effect. For details, refer to your third-party Web server vendor documentation.

For more information about supported Web servers and versions, refer to *System Requirements and Supported Platforms*.

Static File Caching for Microsoft IIS

For Microsoft IIS, follow the procedure below to specify static file caching and content expiration.

To specify static file caching on Microsoft IIS

1. On the Web server machine, choose Start > Settings > Control Panel > Administrative Tools.

2. Run Internet Service Manager.

3. In Internet Service Manager, right-click Default Web Site.
4. In Default Web Site Properties, click the HTTP Headers tab.
5. Check the Enable Content Expiration check box.
6. Select Expire After, and specify the value of 7 (to expire static files after 7 days), or another value appropriate for your deployment.

Static File Caching for IBM HTTP Server

For IBM HTTP Server (IHS), follow the procedure below to specify static file caching and content expiration.

To specify static file caching on IBM HTTP Server

1. On the Web server machine, open the file httpd.conf for editing. This file is located in the Web server installation directory.
2. Verify that the following line is included and not commented out:

   ```
   LoadModule expires_module modules/mod_expires.so
   ```

3. Add the following lines, if not already present, to the file (below the line mentioned in Step 2). Or, instead of 7 days, specify another value appropriate for your deployment.

   ```
   ##################################################################
   ExpiresActive On
   <IfModule mod_expires.c>
   ExpiresByType image/gif                    "access plus 7 days"
   ExpiresByType image/jpeg                   "access plus 7 days"
   ExpiresByType application/x-javascript     "access plus 7 days"
   ExpiresByType text/css                     "access plus 7 days"
   </IfModule>
   ##################################################################
   ```

4. Save the file.

Static File Caching for Sun ONE Web Server

For Sun ONE Web Server, follow the appropriate procedure to specify static file caching and content expiration. For example, for Sun ONE Web Server 6.0, follow the steps below.

To specify static file caching on Sun ONE Web Server

1. From a browser, connect to the Web server administration page (for example, http://*web_server_name*/8080).
2. Select the server, and click Manage.
3. Click the link for Class Manager, in the upper right area.
4. Among the horizontal tabs at the top, click Content Mgmt.
5. Click the link for Cache Control Directives, in the left tab area.
6. Under Cache Control Response Directives, select Maximum Age (sec), and input 604800 (seconds) for a valid cache of 7 days.
7. Click Apply to apply the change.

Improving Performance Using View Layout Caching

View layout caching in the browser (also referred to as *layout caching* or *view caching*) improves the performance of accessing views in a high interactivity application. It speeds up the rendering of views in a Siebel application session by caching the following on the browser:

- Static HTML (from the templates) used for interpreting the view.
- Dynamic HTML generated on the client for rendering controls.

Appropriate caching settings can optimize client performance and network utilization for Siebel client sessions. Caching behavior is subject to considerations described under "Managing the Browser Cache" on page 65.

Two kinds of view layout caching are used for the Siebel Web Client. These types of caching work together and should be configured as a system.

- **Caching in browser memory.** For details, see "View Layout Caching in Memory" on page 70.

- **Persistent caching (in the browser cache directory on the local disk).** For details, see "Persistent View Layout Caching" on page 72.

NOTE: Whether views can be cached depends on the underlying requirements described in "Determining If Views Are Available for Layout Caching" on page 75.

View Layout Caching in Memory

View layout caching in memory creates multiple HTML frames on a browser to store the layout for a view. The number of these frames represents the view cache size. When a view is displayed, the HTML frame containing the layout for that view will be sized to occupy all (100%) of the available browser space, while the other frames will be hidden (that is, sized to occupy 0% of the space).

For information on setting the view cache size, see "Setting the View Cache Size" on page 71.

View layout caching uses the following logic:

- If a user navigates to a view whose layout is already available in the browser memory cache, the HTML frame containing that view will be made visible and the currently visible frame will be hidden.
- If a user navigates to a view whose layout is not in the browser memory cache, one of the available HTML frames will be used to load the layout of the view into memory. The view layout will be loaded from the persistent cache, if possible. The view layout in memory will be cached subject to the View Cache Size setting.
- If the view layout is not currently stored in the persistent cache, then it is loaded from the server. It will also be stored in the persistent cache. The view layout in memory will be cached subject to the View Cache Size setting.

For more information, see "Persistent View Layout Caching" on page 72.

NOTE: The high interactivity framework separates the retrieval of the Siebel application user interface from the server and the retrieval of database records. Database records to be displayed in views are always retrieved from the server.

The memory cache contains the layouts of views that the user has visited and that are available for view caching. When the view cache is full and another view is visited, the first view visited is removed from the cache. The memory cache contents are thus managed on an LRU or least recently used basis.

The HTML frames are loaded into memory when a user navigates to the view. To cache a startup view (one that is cacheable), the user must visit the view twice—that is, visit it a second time after visiting another view.

NOTE: Views specifically created as home page views, such as Home Page View (WCC) for Siebel Call Center, are standard interactivity views and are not cacheable.

The view caching framework is designed so that if the frames containing cached views are deleted (for example, by performing a browser refresh, which removes any previously cached views), the framework begins reloading the layout cache, starting with the next cacheable view the user visits.

At startup, view layouts for recently visited views may be preloaded into the memory cache from the persistent browser cache on disk. This behavior is specified using the parameter ViewPreloadSize. For more information, see “Persistent View Layout Caching” on page 72 and “Preloading Cached Views into Memory” on page 73.

Setting the View Cache Size

For browser memory caching, the size of the view layout cache is controlled by the View Cache Size user preference setting for each user, as described below.

NOTE: Setting View Cache Size to 1 turns off view caching. This has the same effect as setting the EnableViewCache parameter to FALSE, as described in “Disabling View Layout Caching” on page 74.

To set the size of the view layout cache

1 From the application-level menu, choose View > User Preferences.

2 From the Show drop-down list, choose Behavior.

3. In the View Cache Size field, select a value from the drop-down list, or type in a value.

The default value for View Cache Size is 10. This value specifies that 10 HTML frames are cached in memory to represent Siebel view layouts. One of these frames is displayed at any one time.

- Using a figure that is too low may not provide enough caching if your users access many views and client machines have sufficient memory.
- Using a figure that is too high may impair performance by using more memory than is available on the machine.

Persistent View Layout Caching

Persistent layout caching stores the layout of certain views in a local client's browser cache on disk. The stored layout is then reused for subsequent visits to this view, in the same session or in a subsequent session. (For subsequent visits in the same session, the view layout is accessed from the browser memory cache, if available.)

Persistent view layout caching helps improve performance by reducing the number of pages that have to be generated from the server from session to session.

The parameter WebTemplateVersion determines whether the Siebel Web Engine will use a view layout stored in the browser's cache or build a new view layout. This parameter is located in the [SWE] section of the application configuration file, such as uagent.cfg for Siebel Call Center. This file is located on the Siebel Server machine (running AOM).

When you modify Web templates for Siebel views, add the WebTemplateVersion parameter to the configuration file (if not already present), and set its value to 1. For example:

```
[SWE]

WebTemplateVersion = 1
```

Subsequently, each time you change any of the Web templates, increment the value of the parameter by 1. Doing so forces loading view layouts from the Web templates on the server.

When a view is requested, the Siebel Web Engine includes in the URL a checksum value that encapsulates the value of the WebTemplateVersion parameter.

- If the parameter value and the value encapsulated in the URL match, then it is assumed that the view layout for this view has not been updated. If it is available, the view layout stored in the persistent cache can be used.
- If no match is found, then a new view layout is loaded from the server. The Web template on the server is presumably more current than the view layout stored in the browser's persistent cache.

Preloading Cached Views into Memory

For recently visited views, view layouts that are cached in the persistent cache on the browser may be preloaded into browser memory when the user logs in. The number of views that can be preloaded depends on the content of the persistent cache and is limited by the setting of the View Cache Size setting for each user.

For better performance at login time, it may be helpful to further limit the number of view layouts that are preloaded into memory during startup. To do this, use the parameter ViewPreloadSize.

NOTE: ViewPreloadSize only affects a user session when it is set to a positive integer value lower than the View Cache Size value. If the parameter is not set, the default behavior is to preload the number of view layouts corresponding to the View Cache Size value, minus one. (One of the frames specified using View Cache Size is reserved for the application startup view, where applicable.)

ViewPreloadSize should be added to the [SWE] section of the application configuration file, such as uagent.cfg for Siebel Call Center. This file is located on the Siebel Server machine (running AOM). For example:

```
[SWE]

ViewPreloadSize = 5
```

If ViewPreloadSize is set to 0, then no view layouts are preloaded into memory. In scenarios where users frequently log into the Siebel application, such as to access a single view, then log out again, login performance may be more important than precaching multiple views. In this case, you may choose to set this parameter to 0.

Disabling View Layout Caching

You can disable browser memory caching of view layouts for your application users by changing the parameter EnableViewCache to FALSE in the [SWE] section of the application configuration file, such as uagent.cfg for Siebel Call Center. For example:

```
[SWE]

EnableViewCache = FALSE
```

NOTE: In general, setting EnableViewCache to TRUE is recommended. If some users do not need view layout caching, they can set View Cache Size to 1, as described in "Setting the View Cache Size" on page 71.

Setting EnableViewCache to FALSE disables browser memory view layout caching only. It does not disable persistent view layout caching.

Determining How Current View Layout Was Loaded

If you are running an application and want to determine how the current view was retrieved, you can go to the view and then choose Help > About View. The Cache Mode identified for the current view indicates how the application retrieved the view layout. Possible values include:

- **Not Cached.** The view layout was not cached (and cannot be cached).
- **Memory.** The view layout was retrieved from the browser memory cache.
- **Server.** The view layout was retrieved from the Siebel Server and the Web server. If the view is cacheable, and you visit another view and then return to this one, the Cache Mode value changes to Memory.
- **Disk.** The view layout was retrieved from the browser disk cache (persistent caching). If the view is cacheable, and you visit another view and then return to this one, the Cache Mode value changes to Memory.

  The longer you go without clearing the cache, the more likely that a rarely visited view will be retrieved from the persistent cache on the browser, rather than from the server.

Determining If Views Are Available for Layout Caching

Not all Siebel views are available for layout caching. Views that contain applets that have dynamic layouts or controls that are data-dependent cannot be cached. Only applets that support high interactivity are available for view layout caching.

Layout caching is a feature of the C++ class that implements an applet. The ability to be cached is determined by a property of each applet's class object definition. Using Siebel Tools, check the value of the High Interactivity Enabled property of a class object definition to determine whether or not applets for this class support layout caching.

NOTE: For a view to be available for caching, the class objects for *all* of the applets in the view must have High Interactivity Enabled values of 2 or 4 (available for caching).

For detailed information about settings for the High Interactivity Enabled property for a class, refer to *Object Types Reference*.

View layout caching is also disabled for a view in the following cases:

- If personalization rules are defined for any of the applets
- If any of the applets are dynamic toggle applets
- If any of the applets are hierarchical list applets or explorer (tree) applets
- If HTML frames are used within the view template (for example, explorer views)

Managing Performance Related to Message Bar

Employee applications such as Siebel Call Center include a message bar feature. The message bar requires local resources on the client machine, as well as network resources to continually update the displayed text.

- If your deployment does not require it, turn off the message bar feature to save processing resources.
- If some of your users require the message bar, you can specify that users will be able to turn it off. If this option is enabled, users can access it from View > User Preferences > Message Broadcasting.

For more information about message broadcasting using the message bar, refer to *Applications Administration Guide*.

Tuning Siebel Communications Server for Performance 4

This chapter describes some issues that affect the performance and throughput of selected functionality for Siebel Communications Server and related modules, and provides guidelines for tuning these modules to achieve and maintain optimal performance and scalability.

Functionality covered in this chapter includes session communications (typically, Siebel CTI) and Siebel eMail Response. Other communications-related modules are not covered.

For more information about topics in this chapter, refer to the following documents on the *Siebel Bookshelf*:

- *Siebel Communications Server Administration Guide*
- *Siebel eMail Response Administration Guide*
- *Siebel Server Administration Guide*

Also refer to documents for related modules:

- *Siebel Universal Queuing Administration Guide*
- *Siebel Smart Answer Administration Guide*
- *Siebel eCollaboration Administration Guide*

About Siebel Communications Server

Siebel Communications Server provides an infrastructure to support several kinds of communications activities for Siebel application users.

For session communications performance tuning information, see "Session Communications Infrastructure" on page 79 and subsequent sections.

For Siebel eMail Response performance tuning information, see "Siebel eMail Response Infrastructure" on page 94 and subsequent sections.

- **Session communications.** Supports interactive (session) communications for contact center agents who use the multichannel communications toolbar to:
    - Make or receive voice calls using computer telephony integration supported by CTI middleware, such as Siebel CTI Connect or third-party products
    - Receive inbound email messages (for Siebel eMail Response)
    - Receive inbound Web collaboration work items (for Siebel eCollaboration)
- **Inbound communications.** Supports integrating with third-party email servers and processing inbound email (when using Siebel eMail Response) or other inbound work items (when using Siebel Universal Queuing). Also supports integrating with wireless messaging providers and processing inbound wireless messages (when using Siebel Wireless Messaging).
- **Outbound communications.** Supports integrating to a variety of third-party communications systems, such as email servers or wireless messaging providers, to send outbound communications.
    - Supports agents sending email replies using Siebel eMail Response.
    - Supports the Send Email, Send Fax, and Send Wireless Message commands for Siebel application users. (Send Page is also available, but uses the Page Manager server component.)
    - Supports users sending outbound communications content (email, fax, wireless message, or page) using communication requests. Requests can be created and submitted either programmatically or manually through a user interface described in *Siebel Communications Server Administration Guide*.

      Many Siebel modules invoke business service methods through workflows to send outbound communications. Siebel Marketing sends outbound communication requests as email/fax offers.

Session Communications Infrastructure

Session communications refers to using Communications Server components to enable contact center agents or other users to handle interactive communications work items. For example, Siebel CTI supports this capability, enabling agents to handle voice calls using the communications toolbar.

It is important to understand the infrastructure that supports session communications in order to prevent or address performance issues in this area.

Session communications performance is addressed in this section and in:

- "Performance Factors for Session Communications" on page 81
- "Topology Considerations for Session Communications" on page 83
- "Best Practices for Session Communications Tuning" on page 85

Key Siebel Server Components

Session communications are supported in the Siebel Server environment primarily by the following components:

- **Communications Session Manager (CommSessionMgr).** This server component manages interactive communications work items such as voice calls.
- **Application Object Manager (AOM).** This server component manages application sessions for end users who use the Siebel Web Client, including users who handle communications work items (agents). Interactive communication requests from agents typically go through AOM.

  For more information about AOM, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

- **Server Request Broker (SRB).** This server component handles communications between the AOM and certain other Siebel Server components, including CommSessionMgr.

  For example, when a Siebel CTI agent makes a call through the communications toolbar, the request goes from AOM to CommSessionMgr by way of SRB.

  SRB is used whether CommSessionMgr runs on the same machine as the AOM, or on a different machine. For more information about such scenarios, see "Topology Considerations for Session Communications" on page 83.

  For more information about SRB, see "Tuning Server Request Broker (SRB)" on page 54.

Other Siebel Server Components

You may also be using the following components in your Siebel Server environment and communications infrastructure:

- **Communications Configuration Manager (CommConfigMgr).** This server component may optionally be used to cache communications configuration data.
- **Communications Inbound Manager (CommInboundMgr).** This server component, and related elements such as workflow processes and response groups, receives and processes inbound email for Siebel eMail Response. This component may also route communications work items by invoking Siebel Universal Queuing.

  See also "Siebel eMail Response Infrastructure" on page 94.
- **Communications Outbound Manager (CommOutboundMgr).** This server component sends outbound email or other types of messages.

Siebel Product Modules

In addition to Siebel CTI or Siebel eMail Response, you may be using the following Siebel product modules for session communications:

- **Siebel CTI Connect.** This module consists of CTI middleware, communications driver, and sample communications configuration data. Siebel CTI Connect is based on third-party CTI middleware—Intel NetMerge, formerly Dialogic CT Connect. For Siebel CTI Connect, consult "Dialogic" documentation provided on the *Siebel eBusiness Third-Party Bookshelf*.

- **Siebel Universal Queuing.** This module routes communications work items to agents.

  For more information, see "Performance for Siebel Universal Queuing" on page 92.

- **Siebel Smart Answer.** This module analyzes the content of email and search requests and returns an automatic response or suggests one or more responses to the user for approval.

  Siebel Smart Answer is based on third-party products from Banter. Refer to *Siebel Smart Answer Administration Guide* and consult "Banter" documentation provided on the *Siebel eBusiness Third-Party Bookshelf*.

  For more information, see "Performance for Siebel Smart Answer" on page 99.

- **Siebel eCollaboration.** This module helps agents work with customers directly over Web communications channels.

Third-Party Product Modules

You may be using third-party product modules—for example, CTI middleware, driver, and configuration; routing products; predictive dialers; interactive voice response modules; email servers; fax servers; and so on. For information about supported email servers, refer to *System Requirements and Supported Platforms*.

NOTE: If you are not using Siebel CTI Connect, then, to use Siebel CTI, you must obtain a third-party CTI middleware package and work with your vendor to integrate this module.

Performance Factors for Session Communications

This section describes factors that drive or affect performance for session communications deployments.

Depending on your deployment, your agents may be handling phone calls (Siebel CTI), email messages (Siebel eMail Response), work items of other communications channels, or a combination of these.

- **Inbound calls processed per hour.** The number of inbound calls (or other types of work items) processed per hour (or some other time period) by your communications infrastructure.
- **Outbound calls processed per hour.** The number of outbound calls processed per hour (or some other time period) by your communications infrastructure. (For outbound predictive dialer calls, only the calls that are answered and processed by Communications Server are relevant here.)
- **Number of user communications actions per minute (load).** The average number of communications-related user actions per minute, and the average think time between such user actions. Communications-related actions typically refers to actions performed using the communications toolbar.

  Longer think times mean less load on the Siebel Database Server and Siebel Server. Think time is an important factor in overall system load. Estimation of think time should approximate actual user usage.

  For more information about think time and AOM tuning, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."
- **Number of concurrent communications users (agents).** The number of concurrent users of session communications features—typically, contact center agents. This figure will be some percentage of the total number of concurrent users on the AOM.

  You also need to understand how agents work with these features, the average number of inbound and outbound work items per agent, and how these factors relate to your organization's service goals. Some agents receive a large number of work items from ACD queues or Siebel Universal Queuing, or initiate a large number of work items. Supervisors or other users may be defined as agents but may receive only escalated work items, for example.

  For more information about concurrent users and AOM tuning, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

- **Volume of customer data.** The total volume of customer data.

  Data volume affects how quickly data can be retrieved for various purposes, such as to perform lookups for screen pops, route work items, or populate the customer dashboard. In many cases, data volume directly affects response times seen by agents. The volume of data should be realistic and the database needs to be tuned to reflect real-world conditions.

These and many other factors—such as the average call time, average time between calls for an agent, and so on—will affect system performance as experienced by contact center agents. An agent will be concerned with general response time, screen pop response time, and other perceived measures of performance.

Third-Party Product Considerations

Review information presented in applicable third-party documentation for any requirements that affect your deployment. For example:

- Some CTI middleware software may place limitations on the number of agents that may be served at a single contact center site.
- Integration with ACD queues, predictive dialers, or other modules may affect your configurations, affect network traffic, or have other impacts.
- The capacity of your telephony link (between the ACD switch and the CTI middleware) may affect performance.

Topology Considerations for Session Communications

Generally, Siebel Communications Server components for session communications, such as CommSessionMgr, should be run on the same Siebel Server machines as those running AOMs. In some cases, however, you must run CommSessionMgr on a different machine than the AOMs. These options are described in detail below.

CTI middleware generally runs on servers located at each contact center facility.

Running CommSessionMgr on AOM Machines

Generally, Siebel Communications Server components for session communications should be run on the same Siebel Server machines as those running AOMs. Such a topology allows the AOM load-balancing mechanism to indirectly balance Communications Server load. CommSessionMgr loads are fairly light and do not, in themselves, present a reason to run this component on dedicated machines.

Set the Enable Communication parameter to TRUE for all AOMs to which your agents will connect. If you are using Resonate Central Dispatch for load balancing, then all AOMs to which requests are distributed should be configured the same way.

Running CommSessionMgr on Dedicated Machines

Sometimes you *must* run CommSessionMgr on a different machine than the AOM components.

CommSessionMgr must run on the same machine where the communications driver for your CTI middleware is running. If your driver requires a particular operating system platform, then you must install Siebel Server and run CommSessionMgr on a machine of this platform. (Communications drivers are required to be able to run on one of the supported Siebel Server platforms, as described in *System Requirements and Supported Platforms*.)

If your AOM components (Call Center Object Manager) run on machines using a different platform, then you set several parameters in the communications configuration, including CommSessionMgr and RequestServer, in order to designate the machine where CommSessionMgr is running. All communications session requests from an AOM supporting users for this communications configuration will be routed to the CommSessionMgr component on the dedicated machine.

For related information, see "Tuning the CommSessionMgr Component" on page 86. For more information about the above parameters, refer to *Siebel Communications Server Administration Guide*.

Best Practices for Session Communications Tuning

Using your hardware resources optimally, and configuring your system appropriately, can help you to achieve your performance goals. You should consider your resources and requirements carefully, and test and monitor system performance on a continual basis.

Review information presented in *Siebel Communications Server Administration Guide*, *Siebel Server Administration Guide*, Siebel CTI Connect or relevant third-party documentation, and other sources.

Activities you perform to achieve performance and scalability goals may include, but are not limited to, the following:

- Adjusting your system topology. For more information, see "Topology Considerations for Session Communications" on page 83.
- Configuring the AOM component. For more information, see "Tuning the AOM Component" on page 85.
- Configuring CommSessionMgr and related components. For more information, see "Tuning the CommSessionMgr Component" on page 86.
- Modifying communications configurations, communications driver settings, and so on. Many of the activities described in the sections that follow are of this nature.

To maintain an optimally performing system over time, you must plan for changes in the volume of incoming communications, number of users, and so on. Verify that your CTI middleware can support an anticipated increase in the volume of incoming communications and in the number of users. Then additional hardware may be required to run more AOM components and CommSessionMgr components to support the increase in volume of communications and in number of users.

Tuning the AOM Component

CommSessionMgr and CommConfigMgr components use a small percentage of the resources of the Siebel Server on which it runs. AOM performance has the greatest effect on overall system performance, even when CommSessionMgr or CommConfigMgr components are present.

AOM memory requirements for agent sessions depend on many factors. AOM memory usage for an agent using session communications is greater than for other users (those who are not defined as agents in a communications configuration).

AOM tuning also depends on your communications configuration caching methods. See also "Conserving AOM Server Resources Through Caching" on page 86.

For more information about AOM tuning, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

Tuning the CommSessionMgr Component

For the CommSessionMgr component, the MaxTasks parameter determines the maximum number of communications events that can be processed at one time.

Generally, the default values are appropriate for the MaxTasks, MinMTServers, and MaxMTServers parameters, particularly if CommSessionMgr runs on each AOM machine.

If you use a dedicated Siebel Server machine to run the CommSessionMgr component, then it may be appropriate to set these parameters to higher values to optimize usage of server resources such as CPU and memory. See also "Topology Considerations for Session Communications" on page 83.

Conserving AOM Server Resources Through Caching

You can use two caching mechanisms to make communications configuration data load faster for each agent session and to reduce demand on server resources on the AOM.

These caching mechanisms may be used together or separately. For more information, refer to *Siebel Communications Server Administration Guide*.

- **CommConfigCache parameter (AOM).** Setting the CommConfigCache parameter on the AOM to TRUE caches communications configuration data when the first agent logs in. For agents associated with the same communications configuration, each agent session uses the same cached data. See also "Tuning the AOM Component" on page 85.
    - Performance is improved for subsequent agent logins, because the configuration data is loaded from the cache rather than from the database.

  - AOM scalability is also improved because configuration data is shared in AOM memory across agent sessions, thus conserving server resources even as the number of agent sessions increases.

- **CommConfigMgr server component and CommConfigManager parameter (AOM).** The CommConfigMgr server component caches communications configuration data when the first agent logs in. Setting the CommConfigManager parameter on the AOM to TRUE enables this server component.

  - Performance is improved for subsequent agent logins, because the configuration data is loaded from the cache rather than from the database.

  - Using this component to cache configuration data does not, by itself, improve AOM scalability, because configuration data is separately loaded for each agent session rather than shared across agent sessions.

  - If you use *both* the CommConfigMgr component and the CommConfigCache parameter, then the AOM loads configuration data into its cache from the CommConfigMgr cache.

Improving Performance for Communications Configurations

When you deploy session communications, you create communications configurations, define employees as agents, and associate each agent with one or more configurations. How you do these things affects performance and scalability.

In a deployment supporting a large number of agents across multiple physical sites, you must determine criteria for grouping your agents within configurations.

For example, some dialing filters you define, using the parameter DialingFilter.Rule*N*, may be appropriate for agents at a specific place, such as within the same country or area code. Other dialing filters may be suitable for a different set of agents.

In addition, some switch, teleset, or CTI middleware settings are reflected in your communications configuration, and may differ between physical locations.

It may be helpful to define a communications configuration to apply to users at a single location only. In addition to simplifying the process of defining communications configurations, telesets, or other elements, this approach can help you reduce demand on server resources such as AOM memory or CPU.

If call transfers or similar functions are to be supported between contact centers, additional configuration issues apply.

For more information about defining communications configurations and agents, refer to *Siebel Communications Server Administration Guide*.

Configuring Logging for Session Communications

Logging data may be analyzed as part of performance monitoring or tuning, as described in Chapter 9, "Monitoring Siebel Application Performance."

Higher levels of logging provide more data to help you resolve system errors or performance issues; this is appropriate for system testing. For production systems, however, logging levels should be reduced to improve performance.

Log-related parameters applicable to session communications are summarized below. The AOM component logs activity related to the user's client session, including usage of the communications toolbar, screen pops, and so on. The CommSessionMgr logs activity related to this component, such as commands and events for the communications driver.

The logging for AOM and CommSessionMgr are written to separate files for each user. Typically (though not necessarily), these logging mechanisms both write into the same set of files. This makes it easier to monitor or troubleshoot issues related to session communications for a particular user session.

For details on these logging parameters, refer to *Siebel Communications Server Administration Guide*.

AOM Logging Parameters

AOM parameters that log session communications activity include:

- **CommLogFile.** Specifies the name of the log file (default value is SComm.log). A separate log file is created for each agent session, in the form SComm_*username*.log.
- **CommLogDebug.** Specifies whether log files should contain extra detail. Setting to FALSE provides better performance.
- **CommMaxLogKB.** Specifies the maximum size of log files.

- **CommReleaseLogHandle.** Specifies that the log file handle should be released periodically. The default setting of TRUE provides better performance.

CommSessionMgr Logging Parameters

CommSessionMgr parameters that log session communications activity include:

- **LogFile.** Specifies the name of the log file (default value is SComm.log). A separate log file is created for each agent session, in the form SComm_*username*.log.
- **LogDebug.** Specifies whether log files should contain extra detail. Setting to FALSE provides better performance.
- **MaxLogKB.** Specifies the maximum size of log files.
- **ReleaseLogHandle.** Specifies that the log file handle should be released periodically. The default setting of TRUE provides better performance.

Dialogic CTI Driver Logging Parameters

Dialogic CTI (Siebel CTI Connect) communications driver parameters that log session communications activity include:

- **Driver:DriverLogFile.** Specifies the name of the log file (ctc.log by default). A single log file is created for the driver session (for all users). Siebel CTI Connect events are also logged.
- **Service:ServiceLogFile.** Specifies the name of the log file (ctc_{@Username}.log by default). A separate log file is created for each agent session, in the form ctc_*username*.log. Siebel CTI Connect events for each agent session are also logged.
- **LogDebug.** Specifies whether log files should contain extra detail. Setting to FALSE provides better performance.
- **MaxLogKB.** Specifies the maximum size of log files.
- **ReleaseLogHandle.** Specifies that the log file handle should be released periodically. The default setting of TRUE provides better performance.

Improving Availability for Session Connections

When agents log into the Siebel application after experiencing browser failure or a dropped connection, session communications may sometimes remain unavailable.

Session communications availability can be considered a performance issue. In addition to affecting agent productivity, loss of availability of session communications wastes server resources that could support other functions.

You can improve session communications availability using the following mechanisms:

- **Push Keep Alive driver.** Using the Push Keep Alive communications driver pushes empty messages (heartbeat messages) to agents at regular intervals. In this manner, it helps keep the communications push channel alive. This feature can help in environments where enforced timeouts sometimes cause communications session connections to be dropped.

  For example, many customers deploy some kind of network appliance to load-balance Web servers. By default, such network appliances may time out connections to browsers, causing communication interruptions for agents. The Push Keep Alive driver generates periodic traffic so connections do not time out due to inactivity.

  To use the Push Keep Alive driver, you create a driver profile, and specify a heartbeat interval (such as 180 seconds) using the PushKeepAliveTimer driver parameter. Then you add this profile to your communications configurations.

- **ChannelCleanupTimer parameter (communications configuration).** The ChannelCleanupTimer parameter for communications configurations reduces reconnection delays related to session timeouts. This parameter allows the system to identify when a connection is no longer functioning—for example, due to dropped connections or browser failure.

  NOTE: If you are using the Push Keep Alive driver, you *must* also use the ChannelCleanupTimer parameter.

- **CommMaxMsgQ and CommReqTimeout parameters (AOM).** In addition to setting general application timeouts, setting the AOM parameters CommMaxMsgQ and CommReqTimeout can also help you manage agent connections effectively.

For more information about using these features, refer to *Siebel Communications Server Administration Guide*.

Improving Screen Pop Performance

Screen pop response time as experienced by contact center agents is an important indicator of acceptable performance. A screen pop is the display of a view and, optionally, specific records, in response to a communications event. Such events are typically received from CTI middleware—for example, an incoming call is ringing, or the agent has answered the call.

Screen pop behavior is determined by call-handling logic that applies to a particular call based on data attached to the call. Behavior for individual agents is also affected by user settings in the Communications section of the User Preferences screen.

Screen pop performance is affected by the relative complexity of your communications configuration elements, such as event handlers and event responses, and by scripts or business services that may be invoked. Query specifications, database performance, and network capacity and latency also affect screen pop performance. For related information, see "Improving Performance for Communications Configurations" on page 87.

For more information about Siebel Web Client response time, see Chapter 3, "Tuning Siebel Web Client for Performance."

Improving Screen Pop Performance for Siebel CTI Connect

If you are using Siebel CTI Connect, you can use another method to improve screen pop performance. For general considerations, see "Improving Screen Pop Performance" on page 91.

A screen pop triggered by an agent answering a call generally involves a small lag time from when the agent answers the call to when the CTI middleware connects the agent with the caller. For Siebel CTI Connect, you can reduce this lag time.

The Dialogic CTI communications driver for Siebel CTI Connect includes the EventAnswerCall device event. This event is triggered whenever the AnswerCall device command is invoked by the Dialogic CTI driver—typically, when an agent answers a call using the communications toolbar. The EventAnswerCall event occurs before Siebel CTI Connect sends the corresponding TpAnswered event, and thus provides extra time in which to generate the screen pop.

To use this feature, create an event handler definition based on the EventAnswerCall device event. This event handler invokes an event response that generates a screen pop and invokes the appropriate event logs.

For more information, including examples, refer to *Siebel Communications Server Administration Guide*.

Reviewing Performance Impact of Activity Creation

By default, for each communications work item, an activity record is created in the S_EVT_ACT table and related tables.

As you plan your deployment, you must consider how or whether such records are created, review the indexing and layout of applicable database tables, and review the performance impact of generating activity records.

Performance for Siebel Universal Queuing

Siebel Universal Queuing routes communications work items to agents.

For more information about this module, refer to *Siebel Universal Queuing Administration Guide*.

It supports a standard interface using XML/HTTP messages, and its integration into the rest of Siebel eBusiness Applications also goes through this interface. The most important factor in Siebel Universal Queuing performance is the incoming rate of the work items, such as email messages or voice calls.

An email message, for example, that is assigned by Siebel Universal Queuing goes through the following components in the Siebel architecture:

- Email server
- CommInboundMgr server component (with workflow processes)

- CommSessionMgr server component
- Siebel Universal Queuing
- HTTP transport adapter (including EAI Object Manager)
- Call Center Object Manager (AOM)

As the volume of work items increases, the following components and parameters need to be tuned to handle the load:

- **EAI Object Manager.** As the rate of incoming work items increases, you may need to increase the MaxTasks parameter. This ensures there are enough tasks in the EAI Object Manager to handle inbound XML messages.

  Check the EAI Object Manager log files. If you see error messages relating to running out of tasks, increase the MaxTasks parameter accordingly. Also set MaxMTServers and MinMTServers parameters. For more information, see Chapter 7, "Tuning Siebel eAI for Performance."

- **Call Center Object Manager.** Set the MaxTasks parameter for the AOM, according to the concurrent user load. For details, see Chapter 2, "Tuning the Siebel Application Object Manager for Performance."

- **Siebel Universal Queuing.** Increase the MaxConnections parameter as the number of inbound messages increases.

Siebel Universal Queuing performs better when the Siebel Universal Queuing process has affinity to a particular processor. To do this, select the Siebel Universal Queuing process (QUQConnector.exe process) and assign it to a particular CPU on the server. Adding more CPUs does not necessarily increase Siebel Universal Queuing throughput.

From a deployment perspective, it was found that running Siebel Universal Queuing on a smaller but dedicated server will help increase its throughput.

You may also want to consider running CommInboundMgr on a separate or dedicated server, because inbound message processing can be resource intensive. The HTTP adapter also uses the Web server, which typically resides on a different server from the Siebel Server.

For HTTP adapter performance tuning, see Chapter 7, "Tuning Siebel eAI for Performance."

Siebel eMail Response Infrastructure

Siebel eMail Response uses Communications Server components to enable contact center agents to read and respond to inbound email messages.

It is important to understand the infrastructure that supports Siebel eMail Response communications in order to prevent or address performance issues in this area.

Siebel eMail Response performance is addressed in this section and in:

- "Performance Factors for Siebel eMail Response" on page 95
- "Topology Considerations for Siebel eMail Response" on page 96
- "Best Practices for Siebel eMail Response Tuning" on page 97

Key Server Components

Siebel eMail Response is supported in the Siebel Server environment primarily by the following components:

- **Communications Inbound Manager (CommInboundMgr).** This server component, and related elements such as workflow processes and response groups, receives and processes inbound email for Siebel eMail Response. This component may also route communications work items by invoking Siebel Universal Queuing.
- **Communications Outbound Manager (CommOutboundMgr).** This server component sends outbound email.
- **Siebel File System Manager.** This server component writes to and reads from the Siebel File System. It stores inbound messages prior to processing and stores attachments to inbound and outbound email messages.

Other Siebel Components or Modules

In addition to Siebel eMail Response, you may be using the following Siebel components or modules:

- **Siebel Smart Answer.** This module analyzes the content of email and search requests and returns an automatic response or suggests one or more responses to the user for approval.

  Siebel Smart Answer is based on third-party products from Banter. Refer to *Siebel Smart Answer Administration Guide* and consult “Banter” documentation provided on *Siebel eBusiness Third-Party Bookshelf*.

  For more information, see “Performance for Siebel Smart Answer” on page 99.

- **Siebel Assignment Manager.** This module may be used for routing email messages to agents.

- **Siebel Universal Queuing and session communications components.** If you are using Siebel Universal Queuing to route email work items, then additional session communications components apply. The communications toolbar is enabled in the Siebel application to support accepting new work items.

  For more information, refer to “Session Communications Infrastructure” on page 79 and “Performance for Siebel Universal Queuing” on page 92.

Third-Party Email Server

Siebel eMail Response works in conjunction with your third-party email server. Review information presented in documentation for your email server for any requirements that affect your deployment. For information about supported email servers, refer to *System Requirements and Supported Platforms*.

Performance Factors for Siebel eMail Response

This section describes factors that drive or affect performance for Siebel eMail Response deployments.

- **Inbound email messages processed per hour.** The number of inbound email messages processed per hour (or some other time period) by your communications infrastructure.

  Requirements for processing outbound messages are relatively minor and are tied to inbound message volume. However, other usage of the CommOutboundMgr component or of the email system must also be considered. For example, the Send Email command may be configured to send email through CommOutboundMgr.

- **Volume of customer data.** The total volume of customer data, including templates or categories, literature items, and so on. Template format (HTML or plain text) is a related factor.

  If you are deploying Siebel Smart Answer, you must also consider the size of the knowledge base.

Other factors include the size and complexity of inbound email messages and outbound replies.

Also relevant are user settings in the Outbound Communications section of the User Preferences screen, such as whether a reply contains the original message (Include Original Message in Reply setting), or whether HTML or plain text is an agent's default message format (Default Message Format setting).

NOTE: Siebel eMail Response coverage in this book focuses on inbound and outbound email processing. In a multichannel environment, or when Siebel Universal Queuing is deployed, session communications performance issues also apply. Using Siebel Smart Answer, especially for auto-response capabilities, reduces the number of agents needed to handle incoming email and reduces corresponding demand on session-related computing resources such as AOM or CommSessionMgr.

Topology Considerations for Siebel eMail Response

Processing inbound email messages makes more demands on server resources, particularly CPU usage levels, than processing outbound messages.

Processing of inbound messages associated with a single response group must be handled on a single machine.

If inbound message volume warrants it and if multiple server machines are available to run CommInboundMgr and related components, then you should consider running CommInboundMgr on a separate machine (or machines) from other Communications Server components.

CommOutboundMgr and Siebel Smart Answer (Smart Answer Manager) may be run together on a different machine (or machines), as appropriate.

Combining processing of messages for multiple email accounts in a single response group can make processing of inbound messages more efficient. However, if message volume is expected to grow, then limiting the number of email accounts processed by each response group will give you more flexibility to distribute processing across multiple servers, and thereby avoid processing bottlenecks.

Best Practices for Siebel eMail Response Tuning

Using your hardware resources optimally, and configuring your system appropriately, can help you to achieve your performance goals. You should consider your resources and requirements carefully, and test and monitor system performance on a continual basis.

Review information presented in *Siebel eMail Response Administration Guide*, *Siebel Communications Server Administration Guide*, *Siebel Smart Answer Administration Guide*, relevant third-party documentation, and other sources.

Configuring CommInboundMgr Subtasks

Each CommInboundMgr task runs three subtasks by default, to process the workflow processes for messages associated with applicable response groups.

If extra CPU capacity exists on a given server machine, you can run more subtasks for each applicable CommInboundMgr task. To do this, set the parameter The Number of Subtasks (alias NumSubtasks) to a higher value for the CommInboundMgr tasks.

Managing Email Processing Directories

By default, CommInboundMgr temporarily writes the content of inbound email messages into subdirectories of the Siebel Server installation directory, until the messages can be processed by the applicable response group and workflow process.You can use parameters for the Internet SMTP/POP3 Server communications driver to specify alternative directory locations for incoming email, processed email, sent email, and email messages representing certain other processing statuses. You can also set certain driver parameters to specify whether to save or delete processed email messages, for example.

- You must consider the resource requirements for temporary email processing directories when you set up your system.
- Do not delete messages from incoming or queued email directories. Email messages written to processed or sent directories may subsequently be deleted or saved, according to your needs.
- Because of the frequency by which CommInboundMgr processing writes to temporary email processing directories, the disk should be defragmented regularly.

For more information about email processing directories, refer to *Siebel Communications Server Administration Guide* and *Siebel eMail Response Administration Guide*.

Reviewing Performance Impact of Activity Creation

For each email work item, an activity record is created in the S_EVT_ACT table and related tables.

Attachments to such activity records, for inbound and outbound messages, are stored in the Siebel File System.

As you plan your deployment, you must consider how such records are created and managed, review the indexing and layout of applicable database tables, and review the performance impact of generating activity records.

In addition, you must consider the resource requirements for the Siebel File System for storing activity attachments.

The File System Manager server component should generally run on the same Siebel Server machines where you are running CommInboundMgr and CommOutboundMgr.

NOTE: Because of the frequency by which Siebel eMail Response processing writes to the Siebel File System, the disk should be defragmented regularly.

For more information about activity attachments stored for inbound email, refer to *Siebel Communications Server Administration Guide* and *Siebel eMail Response Administration Guide*.

Configuring Logging for Siebel eMail Response

Logging data may be analyzed as part of performance monitoring or tuning, as described in Chapter 9, “Monitoring Siebel Application Performance.”

Higher levels of logging provide more data to help you resolve system errors or performance issues; this is appropriate for system testing. For production systems, however, logging levels should be reduced to improve performance.

An applicable parameter for the Internet SMTP/POP3 Server communications driver is LogDebug. For details, refer to *Siebel Communications Server Administration Guide*.

Applicable event log levels for Siebel eMail Response include those for task execution, workflow step execution, workflow process execution, and workflow performance.

Performance for Siebel Smart Answer

Siebel Smart Answer analyzes the content of email and search requests and returns an automatic response or suggests one or more responses to the user for approval. Smart Answer has an internal AI (artificial intelligence) engine that reads inbound message content and determines the nature (category) of the message.

Key performance factors to consider are the following:

- **Complexity of the inbound message.** If inbound messages are complex or large in size, then Smart Answer will have to process more text. This will impact Smart Answer performance. Therefore, if the format of inbound messages is subject to your control, consider that smaller or simpler messages will allow Smart Answer to perform better.

- **The number of categories in the knowledge base (KB) file.** As the number of categories increases, Smart Answer has to look through more data to determine a category. It is recommended to keep a reasonable number of categories in the KB file.

- **Whether Smart Answer runs in standalone or master/slave mode.** Smart Answer supports a multiserver mode where several instances of Smart Answer can be running at the same time across multiple servers. However, one node is designated as a master node that “learns” from the email it reads and provides feedback to the KB. Smart Answer in slave mode, however, simply processes the email messages without providing feedback to the KB.

- **Number of Smart Answer instances.** By default, MaxMTServers is set to 1, which should be enough for most deployments.

- **Placement of Smart Answer in relation to CommInboundMgr.** Both Smart Answer and CommInboundMgr process the text of inbound email messages, and both take up significant server resources. Therefore, as inbound email volume, the number of categories, or the complexity of inbound messages increases, you may want to consider running CommInboundMgr and Smart Answer on separate physical servers.

Tuning Siebel Workflow for Performance 5

This chapter describes configuration options that affect the performance and throughput of Siebel Workflow, and provides guidelines for tuning Siebel Workflow policies and processes to achieve and maintain optimal performance and scalability.

For more information on Siebel Workflow, refer to the following documents on the *Siebel Bookshelf*:

- *Siebel Business Process Designer Administration Guide*
- *Siebel Server Administration Guide*

To tune Siebel Workflow for performance, review the following areas of Siebel Workflow:

- **Workflow Policies.** For details, see "Monitoring Workflow Policies" on page 102 and "Tuning Workflow Policies for Performance" on page 107.
- **Workflow Processes.** For details, see "Monitoring Workflow Processes" on page 112, "Tuning Workflow Processes" on page 117, and "Tuning Workflow Process Manager for Performance" on page 120.

About Siebel Workflow

Siebel Workflow is an interactive software tool that automates business processes. Workflow processes are designed and administered using the Business Process Designer, a graphical user interface.

Designing, planning, creating, and testing individual business workflows using the Business Process Designer are described in detail in *Siebel Business Process Designer Administration Guide*.

Workflow Policies and Workflow Processes are two components of Siebel Workflow that are designed and created when automating a business process. These components are defined as follows:

- **Workflow Processes.** The representation of a business process. A workflow process comprises one or more steps that indicate when a business process starts and ends and includes information about individual activities within the business process.

- **Workflow Policies.** A systematic expression of a business rule. A workflow policy contains one or more policy conditions and one or more policy actions. If all the policy conditions for a workflow policy are true, then the policy action occurs when all the policy conditions are met. A workflow policy is contained by one workflow policy group and is related to one workflow policy object. A workflow policy contains additional properties that govern its behavior.

This chapter provides guidelines for tuning workflow processes and policies for performance and scalability. For these guidelines, see the following sections:

- "Monitoring Workflow Policies" on page 102
- "Tuning Workflow Policies for Performance" on page 107
- "Monitoring Workflow Processes" on page 112
- "Tuning Workflow Processes" on page 117
- "Tuning Workflow Process Manager for Performance" on page 120

Monitoring Workflow Policies

You need to monitor Workflow Policies regularly to check that all events are handled correctly and that the Siebel Server uses its resources optimally. Purging your log files periodically prevents them from becoming too large.

Workflow Policies use the General Events event for logging. To see informational messages, set the log level to 3. To see debugging information, set the log level to 4.

You can monitor a Workflow Agent process using the following logs and files:

- **Workflow Policy Log view.** Provides a list of all executed policies. The Policy Frequency Analysis view and Policy Trend Analysis views are available to analyze how frequently policies are executed over time.
- **Workflow Agent trace logs.** These include:
  - Workflow Monitor task log. Workflow Monitor provides detailed information about its processing in its trace file.
  - Workflow Action Agent task log. Workflow Action Agent provides detailed information about its processing in its trace file.
  - Email and Page Server trace logs.
    - Run Email and Page Server components with Trace Flag set to 1 for detailed reporting on email activity.
    - Query S_APSRVR_REQ for status information on email and page requests that were logged by Action Agent.
- Admin logging facility
- Admin task information log
- S_ESCL_REQ table
- S_ESCL_STATE table
- S_ESCL_ACTN_REQ table

Using the Workflow Policy Log View

The Workflow Policy Log view displays a log of all the policies executed as evidenced by a Workflow Monitor Agent process. The policy maker can monitor Workflow Agent process activity to determine if the current policies are adequate, if new policies need to be created, or if policies need to be refined.

You access the Workflow Policy Log view from the Siebel client. The log information is generated by the Siebel Server components of workflow policy.

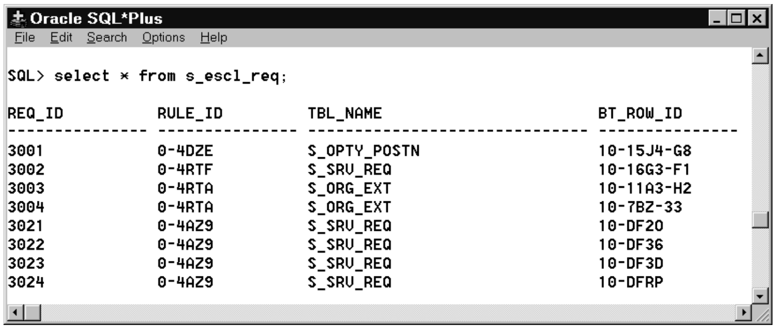
NOTE: The Policy Frequency Analysis and Policy Trend Analysis views let you view Policy Log data in a graphical format.

The Workflow Policy Log view contains the following fields:

- **Policy.** The name of the policy that was executed.
- **Workflow Object.** The name of the assigned workflow policy object.
- **Object Identifier.** The ID of the workflow policy object for which the policy was executed.
- **Object Values.** Identifying information for the row that executed the policy.
- **Event.** The date and time of the policy execution event.

Monitoring the S_ESCL_REQ Table

Figure 3 shows the S_ESCL_REQ table.



```
SQL> select * from s_escl_req;

REQ_ID          RULE_ID         TBL_NAME                       BT_ROW_ID
--------------- --------------- ------------------------------ ---------------
3001            0-4DZE          S_OPTY_POSTN                   10-15J4-G8
3002            0-4RTF          S_SRV_REQ                      10-16G3-F1
3003            0-4RTA          S_ORG_EXT                      10-11A3-H2
3004            0-4RTA          S_ORG_EXT                      10-7BZ-33
3021            0-4AZ9          S_SRV_REQ                      10-DF20
3022            0-4AZ9          S_SRV_REQ                      10-DF36
3023            0-4AZ9          S_SRV_REQ                      10-DF3D
3024            0-4AZ9          S_SRV_REQ                      10-DFRP
```

Figure 3. S_ESCL_REQ Table

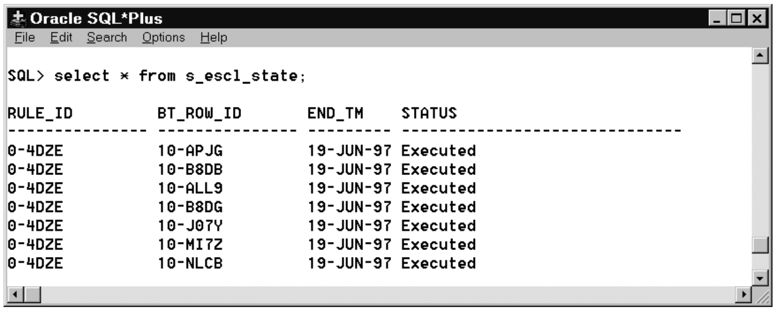
When a trigger fires against a Workflow policy condition, a record is inserted in the Escalation Request table, S_ESCL_REQ. This table contains all the rows in the database that could trigger a Workflow Policy to take action. After the workflow Monitor Agent processes a request, it removes the row from this table.

Use your database tools to monitor the size and efficiency of the table. If the table becomes very large, this could indicate that the number of policies being monitored is too large and a new Workflow Policies process needs to be created to share the load. If rows are being monitored and not being removed after the time interval is met, this could indicate that a policy was deactivated without removing the database triggers. The triggers are continuing to send data that is not being acted on by a Workflow Policies instance.

NOTE: If you expire or delete any active Workflow Policies, confirm that no outstanding records are in the S_ESCL_REQ, S_ESCL_STATE, or S_ESCL_ACTN_REQ tables.

Monitoring the S_ESCL_STATE Table

Figure 4 shows the S_ESCL_STATE time-based table.



```
SQL> select * from s_escl_state;

RULE_ID         BT_ROW_ID       END_TM    STATUS
--------------- --------------- --------- ------------------------------
0-4DZE          10-APJG         19-JUN-97 Executed
0-4DZE          10-B8DB         19-JUN-97 Executed
0-4DZE          10-ALL9         19-JUN-97 Executed
0-4DZE          10-B8DG         19-JUN-97 Executed
0-4DZE          10-J07Y         19-JUN-97 Executed
0-4DZE          10-MI7Z         19-JUN-97 Executed
0-4DZE          10-NLCB         19-JUN-97 Executed
```

Figure 4. S_ESCL_STATE Table

The S_ESCL_STATE time-based table contains all the rows that have been executed (all conditions are true) and are waiting for the time duration element to expire.

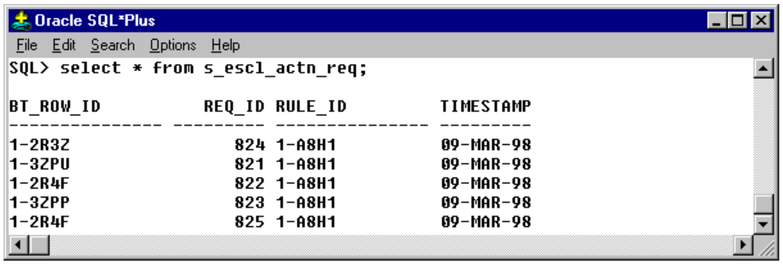
Use your database tools to monitor the size and efficiency of the S_ESCL_STATE table. If the table becomes very large, this could indicate that the number of policies being monitored is too large for the current number of Workflow Policies processes and a new Workflow Policies process needs to be created to share the load.

If rows are being monitored, but are not being removed after the time interval is met, this could indicate that a policy was deactivated without removing the database triggers. The triggers are continuing to send data that is not being acted on by a Workflow Policies process.

NOTE: If you expire or delete any active Workflow Policies, confirm that no outstanding records are in the S_ESCL_REQ, S_ESCL_STATE, or S_ESCL_ACTN_REQ tables.

Monitoring the S_ESCL_ACTN_REQ Table

Figure 5 shows the S_ESCL_ACTN_REQ table.



```
SQL> select * from s_escl_actn_req;

BT_ROW_ID           REQ_ID RULE_ID         TIMESTAMP
--------------- ---------- --------------- ---------
1-2R3Z                 824 1-A8H1          09-MAR-98
1-3ZPU                 821 1-A8H1          09-MAR-98
1-2R4F                 822 1-A8H1          09-MAR-98
1-3ZPP                 823 1-A8H1          09-MAR-98
1-2R4F                 825 1-A8H1          09-MAR-98
```

Figure 5. S_ESCL_ACTN_REQ Table

The S_ESCL_ACTN_REQ table contains all the rows that are awaiting action execution. These rows have violated the policy; and the time duration element, if any, has expired.

Use your database tools to monitor the size and efficiency of the S_ESCL_ACTN_REQ table. If the table becomes very large, this could indicate that the number of policies being monitored is too large for the current number of Workflow Policies processes and a new Workflow Policies process needs to be created to share the load.

If rows are being monitored, but are not being removed after the time interval is met, this could indicate that a policy was deactivated without removing the database triggers. The triggers are continuing to send data that is not being acted on by a Workflow Policies process.

NOTE: If you expire or delete any active Workflow Policies, confirm that no outstanding records are in the S_ESCL_REQ, S_ESCL_STATE, or S_ESCL_ACTN_REQ tables.

Tuning Workflow Policies for Performance

Workflow Policies can be tuned to optimize your resources and also meet the policy's timing requirements by grouping similar policies and assigning these policy groups to Siebel Servers that can handle the workload.

Performance tuning can be handled in the following interrelated ways.

Creating Workflow Policy Groups to Manage Siebel Server Load

Workflow policy groups allow you to group policies with similar polling intervals. This distributes the load to allow efficient processing. For example, if you have very critical policies that must be responded to within minutes of the policy trigger event and you have other policies that need a response within a day, you can assign them to different workflow policy groups.

The advantage of selective grouping is that a Workflow Agent's polling resources are focused on a smaller number of policies, which helps make monitoring and action execution more effective.

Multiple Workflow Monitor Agents and Workflow Action Agents

For each Workflow policy group, you need to define a Workflow Monitor Agent and Action Agent combination. Each Workflow Agent combination monitors the policies within its assigned workflow policy group.

If you are a high-volume call center or you have a large number of policies that need very short polling intervals, you may want to create multiple groups with Workflow Agent processes to run in parallel. A single Workflow Agent process that is monitoring and handling a large number of events may become slow to respond and not meet the time interval commitments set by the policy.

Running Workflow Agents on Multiple Siebel Servers

You can run Workflow Agent processes on different Siebel Servers to ease the workload on each Siebel Server. You can then adjust the polling interval for each group so that polling for noncritical policies does not prevent efficient processing of critical policies.

Running Workflow Agent Processes through Siebel Server Manager

To run Workflow Monitor Agent and Workflow Action Agent using a command-line interface, you need to supply the Component Alias. Workflow Monitor Agent is WorkMon, and Workflow Action Agent is WorkActn. For more information about Component Alias, refer to *Siebel Server Administration Guide*.

For example, to get parameters for WorkMon, list parameters for server *Siebel_Server_Name* component WorkMon.

NOTE: You need to enclose parameter values that contain a space in quotes. For example, if you run the workflow monitor at the command line with `GROUPNAME=Assignment Group`, you will get an error. Use `GROUPNAME="Assignment Group"`.

For complete srvrmgr syntax, refer to *Siebel Server Administration Guide*.

Setting Optimal Sleep Interval for Workflow Policy Groups

By creating groups with similar polling intervals, you can assign the workflow policy group to a Workflow Agent process with a polling rate that matches the workflow policy group. Different polling intervals can be assigned to each workflow policy group using the Sleep Time parameter. For more information about Workflow Policies server administration, refer to *Siebel Business Process Designer Administration Guide*.

After Workflow Agents process all requests, the agent processes sleep for the interval specified by this argument before processing begins again. Set the sleep intervals as large as is possible, but at an interval that still meets your business requirements.

NOTE: Setting sleep intervals at values that are too small can put undue stress on the entire infrastructure. Make sure the sleep interval is as large as possible within the context of the business process.

Adjust the sleep interval for each Workflow Agent process to meet the requirements of each workflow policy group.

For example, workflow policy group A contains accounts that require a response to a Severity 1 service request within 10 minutes. Workflow policy group B contains policies that require a customer follow-up call within 14 days.

Workflow policy group A is very time-critical, so you could set the sleep interval to 60 seconds so that the assigned Workflow Policies instance polls frequently. Workflow policy group B is not as time-critical, so you could set the sleep interval to 48 hours and the Workflow Policy instance can still meet its commitments.

Another example where optimal configuration of the Sleep Time parameter may be required is in the case of multiple users who may need to update the same record. If you have, for example, a workflow policy that monitors service requests and you have multiple users that retrieve and modify open service request records, you need to set the sleep time parameter so that users will have enough time to update the text fields.

If the sleep interval is not set high enough, you may encounter an error message stating "The selected record has been modified by another user since it was retrieved. Please continue." In this case, you will lose your changes as the new field values for this record are displayed.

Setting Optimal Action Interval for Each Workflow Action Agent

For each Workflow Action Agent, you can set an action interval, which determines when actions for a given policy are re-executed on a given base table row. The purpose of this argument is to limit the number of times actions are executed if a row keeps going in and out of a matching condition.

For example, if a service request severity is set to critical and triggers a policy, you do not want to re-execute the policy action if it is changed and has been reset to critical during this interval.

Creating Multiple Workflow Agent Processes

To create multiple Workflow Agent processes

1. Navigate to the Workflow Policies Group view to create the workflow policy groups and assign policies to the groups.

   In this first step, group all your policies according to their similar polling intervals. If you have a large number of policies in a group with short polling intervals, divide them into multiple groups.

2. Navigate to the Server Tasks view under Siebel Server.
3. Click New.
4. Select the Workflow Monitor Agent or Workflow Action Agent component.
5. Click Parameters.
6. Set the group for Workflow Monitor Agent or Workflow Action Agent to monitor.
7. Set an appropriate sleep interval parameter.

   For a list of parameters, refer to *Siebel Business Process Designer Administration Guide*.

8 Click Start to begin Workflow Monitor Agent or Workflow Action Agent.

Repeat these steps to start the Workflow Monitor Agent and Workflow Action Agent process for each Workflow group.

9 Test your groups and sleep intervals.

CAUTION: Assign a workflow policy group to only one Workflow Monitor Agent and Workflow Action Agent process. Multiple Workflow Monitor Agent and Workflow Action Agent processes running the same workflow policy group cause unpredictable completion times and possible multiple actions to be created for one trigger.

Performance Tuning Tips

The following are some tips to improve performance:

- Monitor the size of S_ESCL_REQ and S_ESCL_STATE tables.

  If these tables are too large, they may slow down your system's performance.

  In general:

  - Too many records indicate that the number of workflow policies monitored is too large. In this case, add more Workflow Agents to handle the load.
  - If rows are not removed after the time interval is met, the workflow policy may have been deactivated but the triggers were not removed. These tables will become very large if you do not restart Generate Triggers.

NOTE: Maintain the S_ESCL_REQ, S_ESCL_ACTN_REQ, and S_ESCL_STATE tables by adjusting storage, access, and cache related parameters. Refer to the database documentation for additional information on properly adjusting these table parameters. Also, make sure the database administrator (DBA) is aware of these key tables.

- Run multiple Workflow Monitor and Workflow Action Agents in parallel. Doing so:
  - Focuses an agent's polling resources on a smaller number of workflow policies.
  - Allows faster throughput by shortening the time between when the workflow policy event is triggered and when the agent notices the event.
- Distribute workflow policy processes across Siebel Servers. You can distribute processes so that:
  - High-maintenance policies can be grouped on a Siebel Server with sufficient resources to handle the workflow CPU requirements.
  - Low-maintenance policies can be run on a Siebel Server that shares resources with other Siebel processes.
- If you find that Workflow Policies runs significantly slower during a certain time period, investigate what other processes may be contending for CPU resources on the Siebel Server. You may discover that the Siebel Server has certain time periods with high activity that interfere with the ability of the Workflow Policies process to monitor or act. Arrange the Workflow Policies processes on the Siebel Servers so that the polling periods are compatible with the resources available.

Monitoring Workflow Processes

Use the persistence feature of Siebel Workflow to monitor workflow processes. This feature has the ability to:

- Trace workflows during the development phase.
- Support long-running workflows—that is, workflows that introduce wait states (which range from minutes to days) and require the workflow state to persist in the database in order to resume the workflow at a subsequent time.

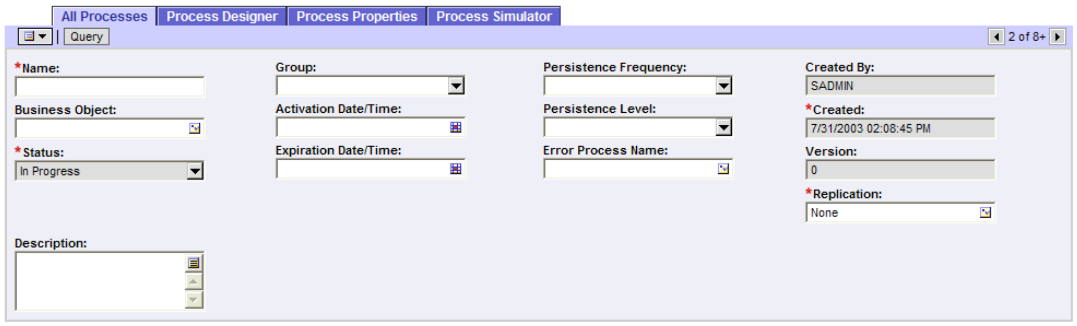
Defining persistence is useful for troubleshooting and monitoring key process instances. However, setting persistence to either NULL or lower settings is recommended for performance tuning.

Setting Persistence for Workflow Processes

Setting the Persistence fields for a workflow process assists with monitoring and tracing the process. Setting the persistence fields is part of working with workflow process definitions.

For full details on creating, administering, and working with workflow processes, refer to *Siebel Business Process Designer Administration Guide*.

Figure 6 shows the All Processes view where you set persistence for a workflow process.



*Name:	Group:	Persistence Frequency:	Created By: SADMIN
Business Object:	Activation Date/Time:	Persistence Level:	*Created: 7/31/2003 02:08:45 PM
*Status: In Progress	Expiration Date/Time:	Error Process Name:	Version: 0
			*Replication: None
Description:			

Figure 6. Setting Persistence for a Workflow Process

Use the following procedure to set persistence for a workflow process.

To set the persistence fields of a workflow process

1. Navigate to the Workflow Processes screen.
2. Select the workflow process of interest.

3 In the All Processes view, modify the fields Persistence Frequency and Persistence Level. For descriptions of these fields, see Table 3.

Table 3. Persistence Field Descriptions

Field	Description
Persistence Frequency	Persistence Frequency controls how often the state of the workflow is written to the database. The setting On Pause saves the data whenever the workflow is in the start or end step plus any other step that is waiting. The setting Every Step saves the data at every step execution in the workflow.
Persistence Level	The level setting controls the quantity of workflow state data saved to the database. The setting Current State only saves the data at the current step whereas the setting All Steps saves the data for all steps.

Persistence Setting Guidelines for Workflow Processes

In general, workflow processes are classified into two categories:

- **In-memory or short duration workflows.** These workflows are typically jobs that start and finish as a single execution of a series of steps in memory.

  In-memory flows are generally characterized by a large numbers of flows that are inexpensive to execute.

  An example of an in-memory workflow is the creation of an activity record for a customer service representative (CSR) when a Service Request is created and sends an email to the CSR. The lifespan of this workflow is in seconds.

- **Long-running workflows.** These workflows are typically flows that start, perform an activity, suspend, and resume at a later point.

  The lifecycle of such a flow can span multiple suspends and resumes. At execution time, such long-running flows are usually fewer in number but higher in complexity and number of steps.

  An example of a long-running workflow is the creation of an activity record for a CSR when a Service Request is created, sends an email to the CSR, and waits for a day for the activity to be completed; if the activity is not completed in a day, the workflow creates an activity record for the customer service supervisor. The lifespan of this workflow is in days.

Persistence Guidelines for In-Memory Workflow Processes

For in-memory workflows, it is recommended not to set persistence for these workflow processes. The performance cost of in-memory workflows is significantly increased when persistence is turned on.

Errors that occur when executing in-memory workflows are usually logged to Siebel Server log files. Review these log files to detect performance errors.

NOTE: Usage of Wait step (in minutes, hours, and days) implicitly turns on persistence, but no user setting is needed for this setting.

Persistence Guidelines for Long-Running Workflows

For long-running workflows, the recommended settings are as follows:

Field	Setting
Persistence Frequency	On Pause
Persistence Level	Current State

It is recommended that these settings be used only for workflow processes whose execution spans a significant time duration and needs to be suspended and resumed at a later time. Production workflows must have these settings to enable the long-running workflow feature.

There is a significant performance impact when using this feature. The performance impact is minimized when these settings are applied to complex workflows where the overall execution time of the workflow is much larger than the overhead of storing and retrieving workflow state.

Persistence Guidelines for Debugging Workflow Processes

Use persistence for either long-running or in-memory workflows to debug and troubleshoot workflows. Setting persistence is typically recommended during the development phase in order to make sure workflows are working correctly. For debugging and tracing, any combination of level and frequency can be used and provides detailed data with appropriate performance impacts.

Use the following settings to provide current step level debugging data with medium performance impact. This setting is the minimum setting.

Field	Setting
Persistence Frequency	On Pause
Persistence Level	Current State

Use the following settings to provide step level debugging at all steps with very high performance impacts. This setting this is the maximum setting.

Field	Setting
Persistence Frequency	Every Step
Persistence Level	All Steps

It is strongly recommended to:

- Use persistence settings only for troubleshooting and testing.
- Use persistence settings on a process-by-process basis rather than on all processes.
- Turn off persistence once the workflow is ready for deployment.

Error Handling and Monitoring

For application error handling, it is recommended that workflow processes be developed to incorporate error handling within the workflow definition. Siebel Workflow provides error handling through two features: exception branches and error processes. Generally, use exception branches or error processes to handle application errors.

For more information on exception branches, refer to *Siebel Business Process Designer Administration Guide*.

Tuning Workflow Processes

In order to improve performance when running workflow processes, you can follow the guidelines explained in the following sections:

- "Minimizing Usage of Parameter Search Specification" on page 117
- "Monitoring Conditions Based on Parent and Child Business Components" on page 118
- "Configuring Siebel eBusiness Applications for Workflow Performance" on page 118
- "Monitoring Memory Overhead" on page 119

NOTE: This performance tuning information is provided as general guidelines for tuning and optimizing performance of workflow processes. Every implementation of Siebel applications is unique, so every use of workflow processes is also unique.

Minimizing Usage of Parameter Search Specification

Although the server component parameter Search Specification (alias SearchSpec) is a feature of Siebel Workflow, it is recommended that you minimize your use of this parameter with workflow processes that are frequently invoked.

Minimizing your use of SearchSpec, especially for frequently invoked processes, improves Workflow engine performance during runtime because the engine does not have to construct the SearchSpec string.

It is important, however, that you do not completely avoid using SearchSpec, because not using this parameter can indicate actions taking place on the current row in some cases, and on all rows in other cases. For specific guidelines, note the following:

- For Siebel operations, minimize usage of SearchSpec.
- For batch process requests, use a SearchSpec that matches as few rows as necessary to get the job done.

Indexing Fields in SearchSpec

If you determine that SearchSpec indeed needs to be used, it is recommended that you make sure all the fields being used are properly indexed. Proper indexing of the fields helps Siebel Workflow and the underlying database to efficiently build queries.

Monitoring Conditions Based on Parent and Child Business Components

When a condition is being evaluated at a decision step or any other step using a combination of parent and child business components, it is recommended that you closely benchmark the expression or the condition. In some cases, this will require spooling the SQL. For more information, see "Analyzing Generated SQL for Performance Issues" on page 159.

NOTE: The query plan of the SQL might show an extended and poorly performing query. In such cases, it is better to break the conditions up into multiple decision steps and evaluate the conditions separately.

Configuring Siebel eBusiness Applications for Workflow Performance

In some cases, you may need to perform a comparison between different objects.

Assume, for example, a service request is assigned to a candidate depending on the industry of the account associated with it. In this case, it is necessary to perform a query against Account to fetch the appropriate industries, or to check an industry against all the industries with which the account is associated.

If the workflow process in this example is going to be evaluated frequently, consider exposing Account Industry on Service Request by the appropriate configuration in order to enhance workflow performance.

Monitoring Memory Overhead

Overhead varies depending on whether you are running workflows locally or in Workflow Process Manager.

Running Workflows Locally

A workflow instance—that is, one run of a workflow definition—can run within a UI object manager (UI/OM). In this case, the workflow runs locally, within the current thread that the logged-in user is using. This means that if N users are connected and they all need to run a workflow definition, the definition would run in that user thread.

In this mode, Workflow adds a fixed overhead (100–200K) to the user memory (usually referred to as the model) plus memory taken up by other objects (such as business components) contained in the tasks within that workflow.

Running Workflows in Workflow Process Manager

The workflow itself runs within a separate Application Object Manager (AOM), which uses a fixed set of resources (parameters MaxMTServers, MaxTasks) to schedule the workflow.

The Workflow Process Manager (component alias: WFProcMgr) is a multithreaded process that runs multiple workflows and is more scalable because it uses a pool of threads and models.

Generally, the mode of the workflow used depends on what the application is trying to achieve. It is generally recommended that you try to schedule a workflow task in the WFProcMgr, especially if the results of a run are not immediately needed.

Asynchronous Mode

Use of the asynchronous mode comes with the following pros and cons:

Pros

- All user threads are not loaded.
- More scalable as long as:
    - There are maximum N simultaneously connected users.
    - There are maximum X simultaneous running workflows.
    - If X is smaller than N, then a WFProcMgr with X tasks can handle a much larger pool (N) of users.

Cons

- On error, you must look at the log files because there is no automatic notification.
- The SRB could have a timeout or retry feature.
- Slightly more latency. Additional cost (minimal) of one request per response.

Tuning Workflow Process Manager for Performance

This section provides general approaches to tune and optimize performance of Workflow Process Manager.

It is imperative to remember that every implementation of Siebel applications is unique, and so every use of workflow processes is also unique. It is in your best interest to test, continually monitor, and tune your workflow processes to achieve optimal throughput.

You can follow the guidelines explained in the following sections:

- "Caching Business Services" on page 121
- "Setting Workflow Process Manager Parameters for Performance" on page 122

- "Setting Siebel Server Environment Variables for Performance" on page 123

NOTE: The information provided in this section should be considered general background information. No attempt is made to detail the many variables that affect tuning at specific sites. This section is not a substitute for specific tuning recommendations made by Siebel Technical Support.

Caching Business Services

The business services invoked through Workflow Process Manager should have the Cache property set to TRUE. This makes it possible for the Workflow engine to not reload and re-parse the business service. This feature enhances the performance of workflows that invoke business services.

NOTE: Predefined Siebel business services that have the Cache property set to OFF should *not* be reset to TRUE.

Setting Workflow Process Manager Parameters for Performance

Workflow Process Manager requires configuration to common parameters available in Siebel eBusiness Applications. Table 4 lists some of these parameters and includes suggested settings. For detailed definitions of these parameters, refer to *Siebel Server Administration Guide*.

Table 4. Workflow Process Manager Parameters and Settings

Parameter	Alias	Suggested Setting or Comments
Maximum MT Servers	MaxMTServers	MaxMTServers = target #users / *users*/AOM
Minimum MT Servers	MinMTServers	MinMTServers = MaxMTServers Setting MinMTServers less than MaxMTServers can cause a delay of service for new users as additional multithreaded processes get initialized.
Maximum Tasks	MaxTasks	20% target #users For example, for 500 users, set MaxMTServers = 5 and MaxTasks = 100.
DB Multiplex - Min Number of Dedicated DB Connections	MinSharedDbConns	10% target #users
DB Multiplex - Max Number of Shared DB Connections	MaxSharedDbConns	10% target #users
DB Multiplex - Min Number of Shared DB Connections	MinTrxDbConns	10% target #users
OM-Model Cache Maximum	ModelCacheMax	Determines the size of the cache for model objects in AOM-based server components, such as Workflow Process Manager. For more information about this parameter, refer to *Siebel Server Administration Guide*.

Table 4. Workflow Process Manager Parameters and Settings

Parameter	Alias	Suggested Setting or Comments
Honor MaxTasks	HonorMaxTasks	If HonorMaxTasks is set to TRUE, then once MaxTasks is reached, all further requests are rejected instead of being queued
Recycle Factor	RecycleFactor	If excessive memory usage exists, set this parameter to periodically restart the Workflow Process Manager component.

NOTE: With the setting Bypasshandler = TRUE, there will be no regular component logging unless the component experiences difficulties and generates an error message.

NOTE: Closely monitor the WFProcMgr process usage during a steady state run, and then adjust the parameters according to your observations.

Setting Siebel Server Environment Variables for Performance

It is very important that you keep the Siebel Server running under 80% CPU utilization. If there are any changes on MaxTasks, change the Siebel Server environment variables SIEBEL_OSD_LATCH and SIEBEL_OSD_NLATCH based on the following operations:

- SIEBEL_OSD_LATCH = 2 * (accumulated MaxTasks of all components)
- SIEBEL_OSD_NLATCH = 10 * (accumulated MaxTasks of all components)

For example, on Siebel Server, you have enabled two multithreaded server components: CallCenter_enu, and WFProcMgr. MaxTasks = 500 for the component CallCenter_enu and MaxTasks = 100 for the WFProcMgr component.

So, SIEBEL_OSD_LATCH should be set accordingly to 1200 (as a result of 2*[500 + 100]) and SIEBEL_OSD_NLATCH should be set accordingly to 6000.

Tuning Siebel eConfigurator for Performance 6

This chapter describes some issues that affect the performance and throughput of server-based deployments of Siebel eConfigurator, and provides guidelines for tuning this module to achieve and maintain optimal performance and scalability.

Siebel eConfigurator provides product configuration and solution-computing capabilities, and can be deployed as a server-based or browser-based module.

NOTE: This chapter covers Siebel eConfigurator server-based deployments only. For additional information, refer to *Product Administration Guide*.

Siebel eConfigurator is one of the Siebel Interactive Selling modules. These modules work together to support various phases in conducting commerce, including online selling.

For more information about Siebel eConfigurator, refer to the following documents on the *Siebel Bookshelf*:

- *Product Administration Guide*
- *Siebel Server Administration Guide*

Also refer to documents for related Siebel Interactive Selling modules:

- *Pricing Administration Guide*
- *Siebel Order Management Guide*
- *Siebel eSales Administration Guide*
- *Siebel Interactive Designer Administration Guide*

Siebel eConfigurator Infrastructure

Siebel eConfigurator uses several infrastructure elements to manage configuration sessions. Siebel eConfigurator is supported in the Siebel Server environment by the following components:

- **Application Object Manager (AOM).** Siebel eConfigurator functions may be performed within the AOM, such as Call Center Object Manager (SCCObjMgr) for Siebel Call Center.
- **Siebel Product Configurator Object Manager (eProdCfgObjMgr).** An optional component, suitable for some Siebel eConfigurator deployments, that processes configuration requests for user sessions submitted from an AOM component. Typically, this component is run on a separate Siebel Server machine than the one running the AOM. For more information, see "Topology Considerations for Siebel eConfigurator" on page 128.
- **Siebel File System.** Stores cached object definitions for customizable product models in the CFGCache directory. For more information, see "Using Siebel eConfigurator Caching" on page 133.

NOTE: For more information about elements of the internal architecture of Siebel eConfigurator, including Instance Broker (Complex Object Instance Service business service) and Object Broker (Cfg Object Broker business service), refer to *Product Administration Guide*.

Performance Factors for Siebel eConfigurator

In planning Siebel eConfigurator server-based deployments, or in troubleshooting performance for existing deployments, you must consider several key factors that determine or influence performance.

Subsequent sections provide information and guidelines to help you achieve and maintain optimal performance and scalability.

Performance contexts to consider include response times for:

- **Loading customizable products.** This is the time elapsed from the moment a user clicks Customize in a quote or order until the user interface for the customizable product has been loaded and displayed to the user.

  Snapshot Mode caching of customizable products (objects) and services can significantly reduce loading times. For more information, see "Using Siebel eConfigurator Caching" on page 133.

- **Responding to user selections.** This is the time elapsed from the moment a selection is made by the user until Siebel eConfigurator returns a response such as an update to the customizable product or a conflict message.

The factors below, particularly customizable product size and complexity, are relevant in both of these contexts.

Some of the key performance factors for server-based deployments of Siebel eConfigurator include:

- **Number of concurrent configuration users.** The number of concurrent users who access customizable product models. This figure will be some percentage of the total number of concurrent users on the AOM.

  More specifically, you would be concerned with the total number of configuration sessions per hour, and the average length of those sessions.

- **Size and complexity of product models.** The total size and complexity of each customizable product model, particularly where multiple hierarchical levels, many constraints, and a complex user interface are defined.

  A major potential performance factor is custom scripting attached to update events on applicable business components, such as Quote, Quote Item, Quote Item Attribute, Order, Order Item, and Order Item Attribute.

- **Number of product models.** The number of customizable product models accessed by users. It is assumed that each user accesses no more than one customizable product model at one time. A given group of concurrent users may access multiple models, however, each of which must be separately cached.

Topology Considerations for Siebel eConfigurator

This section describes considerations for defining the topology for Siebel eConfigurator server-based deployments. There are two major topology approaches to deploying Siebel eConfigurator:

- Running Siebel eConfigurator in the AOM component.
- Running Siebel eConfigurator on one or more dedicated Siebel Servers. (Such servers are sometimes referred to as remote servers, because they are remote to the machine on which AOM is running. In general, this section uses the term dedicated servers.)

These approaches are described in the subsections that follow.

The optimal deployment approach for Siebel eConfigurator, and the optimal number of server machines you require for this module, depends on factors such as those described in "Performance Factors for Siebel eConfigurator" on page 126.

Running Siebel eConfigurator in the AOM Component

You can run Siebel eConfigurator in the AOM component, such as for Siebel Call Center.

If a small number of concurrent users require configuration sessions, or there are a small number of customizable product models, then this deployment option may yield reasonable performance and make the most effective use of your hardware resources.

With this option, you set all parameters for managing Snapshot Mode caching on each applicable AOM. For details, see "Using Siebel eConfigurator Caching" on page 133.

Running Siebel eConfigurator on Dedicated Servers

You can run Siebel eConfigurator on one or more dedicated Siebel Server machines using a server component other than the AOM. This component is Siebel Product Configurator Object Manager (eProdCfgObjMgr).

Possible variations on this general topology option include:

- Running one eProdCfgObjMgr component with one AOM component
- Running multiple eProdCfgObjMgr components with one AOM component
- Running one eProdCfgObjMgr component with multiple AOM components

If a large number of concurrent users require configuration sessions, or there are a large number of customizable product models, then this deployment option (using one or more dedicated servers) may yield the best performance and make the most effective use of your hardware resources.

With this option, you set some parameters for managing Snapshot Mode caching on each applicable AOM, and some on each applicable dedicated eConfigurator server. For details, see "Using Siebel eConfigurator Caching" on page 133.

Configuring AOM for Dedicated eConfigurator Deployments

When you designate one or more dedicated server machines to run the eProdCfgObjMgr component, then you must configure any AOM components from which users will initiate configuration sessions to route configuration requests to these machines.

The AOM forwards each configuration session request to the dedicated Siebel eConfigurator server with the fewest concurrent users.

Table 5 lists server parameters for managing dedicated Siebel eConfigurator deployments. Using Server Manager, set these parameters on each AOM (do not set them on the dedicated eConfigurator server machine).

Table 5. Server Parameters for Dedicated Siebel eConfigurator Server Deployment

Parameter Name	Display Name	Data Type	Default Value	Description
eProdCfgRemote	Product Configurator -Use remote service	Boolean	FALSE	Set this parameter to TRUE if you are running the eProdCfgObjMgr component on one or more dedicated servers. Set this parameter to FALSE for eConfigurator deployments using AOM only.
eProdCfgServer	Product Configurator -Remote server name	Text		Specifies the name of the dedicated server machine on which you are running eProdCfgObjMgr. If you are designating multiple dedicated servers for Siebel eConfigurator, separate the machine names using semicolons (;). Dedicated machines, which may be either Microsoft Windows or UNIX servers, should be specified using the names as they are known to the AOM machine.
eProdCfgTimeOut	Product Configurator -Time out of connection	Integer	20	Sets the length of time, in milliseconds, that the AOM tries to connect to a dedicated Siebel Server running eProdCfgObjMgr. After the timeout has been reached, an error is returned to the user.

Best Practices for Siebel eConfigurator Tuning

Using your hardware resources optimally, and configuring your system appropriately, can help you to achieve your performance goals. You should consider your resources and requirements carefully, and test and monitor system performance on a continual basis.

Review information presented in *Product Administration Guide*, *Siebel Server Administration Guide*, and other sources.

Activities you perform to achieve performance and scalability goals may include:

- Adjusting your system topology. For more information, see "Topology Considerations for Siebel eConfigurator" on page 128.
- Configuring Siebel Server server components for Siebel eConfigurator.
- Designing and deploying your customizable product models. For more information, see "Defining Customizable Product Models and Classes" on page 132.

This section applies to deployments using Siebel Web Client.

Tuning Siebel eConfigurator

How you configure your Siebel Server components for Siebel eConfigurator server deployments, for appropriate tuning, depends in part upon which deployment method you use, as described in "Topology Considerations for Siebel eConfigurator" on page 128.

- If you deploy Siebel eConfigurator on the AOM, then your eConfigurator tuning calculations must be made in combination with your AOM tuning calculations.
- If you deploy Siebel eConfigurator using the Product Configurator Object Manager (eProdCfgObjMgr) server component on a dedicated Siebel Server machine, then your eConfigurator tuning calculations will be only indirectly related to your AOM tuning calculations and will be determined primarily by configuration-related concurrent users and request loads.

In particular, note that, for a dedicated Siebel eConfigurator server, the MaxTasks parameter should generally be set much lower than for an AOM. By default, the ratio of MaxTasks to MaxMTServers is 20:1 for eProdCfgObjMgr.

In addition, depending on request load, MaxTasks should generally be set lower for an AOM running Siebel eConfigurator than for an AOM that is *not* running Siebel eConfigurator.

You can follow this general procedure to determine how to set these parameters:

- Determine what percentage of users for your Siebel application are also users of Siebel eConfigurator. For example, for every 100 users, 60 work with Quotes.

- Calculate what percentage of time these users spend using Siebel eConfigurator. For example, out of the 60 users mentioned above, only 30 are concurrently using Siebel eConfigurator.
- Maintain the default ratio of 20:1 for MaxTasks/MaxMTServers.

Sizing the Siebel File System

The Siebel File System is used by many different features or modules in Siebel eBusiness Applications. Siebel eConfigurator caches customizable product information in the CFGCache directory in the Siebel File System.

Accordingly, you must consider the resource requirements for the Siebel File System when you set up your system.

Defining Customizable Product Models and Classes

This section describes some guidelines about creating customizable products and classes in a manner that will optimize performance:

- To maintain good performance, do not make your customizable products or classes any larger or more complex than absolutely necessary.
- Complexity is a function of the number of hierarchical levels and constraints built into the customizable product models and of the structure of the class.
- For defining class relationships, use specific classes as much as possible. For example, avoid defining class relationships without specifying classes, or use a subclass rather than a parent class if it is so defined.
- Minimize the complexity of user interface elements you associate with your customizable product models.
- Generally, using interactive or automatic pricing updates for customizable products is recommended. If performance is adversely affected, consider switching to manual pricing updates.
- When creating rules, using the Set Preference template allows you to create soft constraints that guide the Siebel eConfigurator engine in producing solutions, but which the engine can ignore if needed to avoid conflicts or performance problems.

- By default, when you add a customizable product to a quote, for example, default products and selections will be included, and Siebel eConfigurator may be invoked to create this default instance. If the customizable product default selections are large and complex, and if users are required to further customize the product, then turning off the Default Instance Creation feature will enhance performance with no loss of functionality.

For more information on these issues, refer to *Product Administration Guide*.

Using Siebel eConfigurator Caching

Siebel eConfigurator supports several types of caching of customizable product information, to optimize response time for configuration-session users. Caching options include:

- Caching in memory (default behavior, described below)
- Caching in the CFGCache directory on the Siebel File System (default behavior, described below)

  The CFGCache cache directory maintains a history of the customizable products that have been loaded into the memory cache.

- Caching in memory using Snapshot Mode (optional but highly recommended caching model that works with the other caching mechanisms)

  Snapshot Mode adds more memory caches for customizable products and for business services associated with configuration sessions. For details, see "Configuring Snapshot Mode Caching for eConfigurator" on page 134.

NOTE: The memory resources for your Siebel eConfigurator server machine must be sufficient to support your caching requirements.

Siebel product administration and class administration provides the ability to refresh all cached data or to selectively refresh cached customizable product data.

Default Caching Behavior for eConfigurator

The default caching behavior for Siebel eConfigurator is as follows:

- When a user starts a configuration session, Siebel eConfigurator looks to see if the customizable product is cached in memory.
- If the customizable product is not cached in memory, eConfigurator looks in the CFGCache directory for the product.
- If the customizable product is not in the CFGCache cache, it is loaded from the Siebel Database. The product is added to the memory cache and to CFGCache.
- Thereafter, when a configuration session starts, the customizable product is loaded from the memory cache or CFGCache.
- Before loading the customizable product from CFGCache, the system checks the Siebel Database to make sure each item in the product is the current version.
- If the cached product has changed in the database, the current version of the item is loaded from the database. This ensures that the most recent version of a customizable product and its contents are loaded.
- When the product administrator releases a new version of a customizable product, the changes are written to the Siebel Database. The memory cache and the CFGCache directory are not updated with the changes until the next configuration session is requested for the customizable product.

Configuring Snapshot Mode Caching for eConfigurator

When Snapshot Mode memory caching has been configured for server-based Siebel eConfigurator deployments, when a user starts a configuration session, customizable products and related services may be loaded from the Snapshot Mode cache. Using Snapshot Mode can greatly improve performance for initializing configuration sessions.

If you do not use Snapshot Mode caching, then configuration sessions are subject to the behavior described in "Default Caching Behavior for eConfigurator" on page 134.

Snapshot Mode caches the following data:

- All objects associated with customizable product definitions
- A Factory instance for each customizable product
- A Worker instance for each user session

For more information about Siebel eConfigurator architecture elements such as factories and workers, refer to *Product Administration Guide*.

If an item is not in the Snapshot Mode cache, the item is retrieved from CFGCache, if it is verified to be the current version, and then added to the Snapshot Mode cache for subsequent use.

Using Snapshot Mode is highly recommended, particularly if you have large numbers of users.

Note the following behavior for configuration sessions for which Snapshot Mode is in effect:

- When a product administrator goes into validate mode, the workspace version of the customizable product is used rather than the version in the Snapshot Mode cache.
- When a product administrator releases a new version of a customizable product, the Snapshot Mode cache is marked. When a new user session tries to access the customizable product, the new version is loaded into the cache.
- When the size limit is reached for a Snapshot Mode cache, the oldest or least frequently accessed items are deleted. The Snapshot Mode cache contains the most recently or most frequently requested customizable product items.

Guidelines for Using Snapshot Mode

Observe the following guidelines for using Snapshot Mode:

- For information about the ways customizable products in the Snapshot Mode cache can be refreshed, see "Refreshing the Snapshot Mode Cache" on page 139.

- If the customizable product development environment and the production environment are on the same machine, and Snapshot Mode is turned on, the product administrator may need to refresh the Snapshot Mode cache frequently to see changes during development. Doing so also refreshes the Snapshot Mode cache for production users.
- When a customizable product contains rules that have start or end dates, the arrival of these dates does not cause the revised declarative portion of the product to be loaded into the Snapshot Mode cache. You must refresh the cache manually on the effective date to load the revised declarative portion of the product.

NOTE: If a customizable product does not have configuration rules, then the worker (and the worker cache) does not apply to this product.

Parameters for Configuring Snapshot Mode Caching

To use Snapshot Mode caching, you specify values for several server parameters. At a minimum, you turn it on by setting eProdCfgSnapshotFlg to TRUE. Other parameters must be sized following guidelines such as those described in "Determining Rough Sizing for Caching Parameters" on page 138.

Table 6 lists the server parameters for configuring Snapshot Mode caching. Using Siebel Server Manager, set these parameters on each AOM component, or on the eProdCfgObjMgr component, according to your deployment.

Table 6. Server Parameters for Configuring Snapshot Mode

Parameter Name	Display Name	Data Type	Default Value	Description
eProdCfgSnapshotFlg	Product Configurator -Collect and use snapshots of the Cfg objects	Boolean	FALSE	Enables or disables Snapshot Mode. Set to TRUE to turn on Snapshot Mode. ■ For an AOM deployment of eConfigurator, set this parameter on the AOM component. ■ For a dedicated eConfigurator server deployment, set this parameter on the AOM *and* on the eProdCfgObjMgr component.
eProdCfgNumOfCachedObjects	Product Configurator -Number of objects cached in memory	Integer	1000	Sets the maximum number of objects that can be cached in memory by the Object Broker. ■ For an AOM deployment of eConfigurator, set this parameter on the AOM component. ■ For a dedicated eConfigurator server deployment, set this parameter on the AOM *and* on the eProdCfgObjMgr component.

Table 6. Server Parameters for Configuring Snapshot Mode

Parameter Name	Display Name	Data Type	Default Value	Description
eProdCfgNumbofCachedWorkers	Product Configurator -Number of workers cached in memory	Integer	50	Sets the maximum number of workers that can be cached in memory. ■ For an AOM deployment of eConfigurator, set this parameter on the AOM component. ■ For a dedicated eConfigurator server deployment, set this on the eProdCfgObjMgr component instead.
eProdCfgNumbOfCachedCatalogs	Product Configurator -Number of cached catalogs	Integer	10	Sets the maximum number of catalogs that can be cached in memory. Catalogs contain the default product structure. ■ For an AOM deployment of eConfigurator, set this parameter on the AOM component. ■ For a dedicated eConfigurator server deployment, set this on the eProdCfgObjMgr component instead.

Determining Rough Sizing for Caching Parameters

To help you determine how to set the Snapshot Mode caching parameters, a general suggestion is to measure the incremental memory required for a customizable product.

Requirements for factory and worker caching are more relevant than those for object caching. Object caching has a small requirement, and applies to multiple users. Factory caching applies to multiple users (using the same customizable product). Worker caching also applies to multiple users.

You can try this on a Siebel Dedicated Web Client (a Mobile Web Client using a dedicated database connection) by checking the memory used by the siebel.exe process before and after you click Customize for a customizable product included in a quote or order, and again after you have further configured the customizable product (to reach maximum likely memory usage).

For example, X may be the before-loading memory size, Y may be the after-loading size, and Z may be the memory size after additional product configuration.

Of the incremental memory observed, consider the following breakdown:

- The size of a factory for a customizable product is about 25% of the incremental memory required to instantiate the product (that is, 25% of Y – X).
- The size of a worker for a customizable product varies during runtime, generally increasing as user selections are made. This size may be approximated by subtracting the factory size from the total incremental memory required for instantiating and configuring the product (that is, subtracting the factory size from Z – X).

Refreshing the Snapshot Mode Cache

Siebel administrators or product administrators can refresh the Snapshot Mode cache in any of several ways:

- "Refreshing the Snapshot Mode Cache" on page 139
- "Refreshing the Cache with Product Changes" on page 140
- "Refreshing the Cache with Class Changes" on page 141

Refreshing the Snapshot Mode Cache

A product administrator can select Refresh Cache to erase the Snapshot Mode cache on all the servers connected to the Siebel Database.

This action does not erase the contents of the CFGCache cache on the Siebel File System. Periodically you should do this manually.

The next configuration session reloads the Snapshot Mode cache and the CFGCache cache on the Siebel File System with the content applicable to that session. Subsequent sessions load from the Snapshot Mode cache.

NOTE: Because refreshing the cache has a significant effect on the performance of product configuration sessions started afterwards, carefully decide when it is appropriate to do this.

To refresh the Snapshot Mode cache

1. Navigate to the Product Administration screen.
2. Select a record for a customizable product.
3. In Customizable Products > Product Versions, open the menu and click Refresh Cache.

NOTE: Restarting the Siebel Database Server also erases the Snapshot Mode cache on the server. The next configuration session is loaded as if the user had selected the Refresh Cache menu option.

Refreshing the Cache with Product Changes

While editing a product record, a product administrator can select Refresh Product Cache to erase from the Snapshot Mode cache all the customizable products containing the product.

In other words, when a product administrator changes a product record, the product record can serve as a filter to selectively update the Snapshot Mode cache.

The next time a user requests the customizable product, the user receives a freshly instantiated version reflecting the product change and the cache is refreshed with this version. For example, you could change the product description or part number and then refresh the cache.

You cannot propagate changes to class assignment by doing this type of refresh.

To refresh the cache with product changes

1. Navigate to the Product Administration screen.

2 Select the record for a customizable product that has been changed or that is to be refreshed.

3 From the Products menu, choose Refresh Product Cache.

Refreshing the Cache with Class Changes

While editing a product class record, a product administrator can select Refresh Class In Configuration Cache to erase from the Snapshot Mode cache all the customizable products containing products from the class.

In other words, the product administrator can use a product class as a filter to selectively delete customizable products from the cache.

If you have Snapshot Mode turned on and a customizable product that is affected by the class change is in the Snapshot Mode cache, the changes are not propagated to the cached version of the product. The next user that requests the customizable product will receive the cached version, which does not reflect the class changes. To make sure users receive the class changes immediately, use Refresh Class In Configuration Cache.

The next time a user requests the customizable product, the user receives a freshly instantiated version reflecting the product change and the cache is refreshed with this version. This new instance will reflect the changes you made to the class.

To refresh the cache with class changes

1 Navigate to Application Administration > Class Administration.

2 Select a product class and modify it or its attribute definitions as needed.

3 From the Classes menu, choose Refresh Class In Configuration Cache.

Tuning Siebel eAI for Performance 7

This section discusses tuning for Siebel eBusiness Application Integration (Siebel eAI) that might be required for optimal performance.

For more information about Siebel eAI, refer to the following documents on the *Siebel Bookshelf*:

- *Overview: Siebel eBusiness Application Integration Volume I*
- *Integration Platform Technologies: Siebel eBusiness Application Integration Volume II*
- *Transports and Interfaces: Siebel eBusiness Application Integration Volume III*
- *Business Processes and Rules: Siebel eBusiness Application Integration Volume IV*
- *XML Reference: Siebel eBusiness Application Integration Volume V*

About Siebel eBusiness Application Integration

Siebel eAI provides components for integrating Siebel eBusiness Applications with external applications and technologies within your company and is designed to work with third-party solutions from IBM, TIBCO, Vitria, SeeBeyond, webMethods, and other vendors.

Siebel eAI provides bidirectional real-time and batch solutions for integrating Siebel applications with other applications. Siebel eAI is designed as a set of interfaces that interact with each other and with other Siebel components.

Best Practices for Siebel eAI Tuning

This section describes best practices for maintaining acceptable performance using Siebel eAI.

General guidelines are followed by recommendations specific to Siebel eAI features such as IBM WebSphere MQ (formerly MQSeries) Transport adapter, HTTP Inbound Transport adapter, EAI Siebel Adapter, virtual business components, and Workflow Process Manager.

Follow these general guidelines to improve overall performance for data integration and throughput of Siebel eBusiness Applications:

- Try to minimize round trips between systems. For example, if an integration needs to request three pieces of data, do not send a request for one piece of data, wait for the response, and then send the next request. If you need multiple pieces of data, gather the data in a single request.
- Try to keep processing in a single session wherever possible, to avoid having to make calls between server components.
- Within a session, try to minimize the nesting of calls between components such as workflow, scripting, and the EAI Siebel Adapter. For example, use a workflow process to sequence the calling of business services and keep scripting code in self-contained steps. Workflow subprocesses can be used to package together commonly called sequences of services.
- Try to represent the incoming external data in the same code page and encoding that the Siebel application uses internally (UCS-2). This eliminates the need to use the Transcode business service in your workflow process, thus improving performance.

The following sections discuss specific technologies and what you can do to improve performance in each area.

Improving IBM WebSphere MQ Transport Performance

The performance of an IBM WebSphere MQ queue is highly dependent on the disk performance of the queue manager machine and the layout of the queue's files on the disk. You should test your queue with stand-alone utilities so that you have an upper boundary for the performance that can be expected in a live application.

To achieve higher throughput, consider the following options:

- **Run multiple MQ Receiver tasks.** Run multiple MQ Receiver tasks in parallel on the same machine or across several machines. The optimal number of MQ Receiver tasks depends on the transaction type.

  NOTE: This guide refers to *MQ Receiver*, where the actual Siebel Server component you are using may be MQSeries Server Receiver (alias MqSeriesSrvRcvr) or MQSeries AMI Receiver (alias MqSeriesAMIRcvr).

  The default number of MQ Receiver tasks is 1. You can set this to 10 or more, depending on the nature of your transactions and on available server capacity.

  Adding MQ Receivers is generally most helpful for handling CPU-bound transactions, where the dequeuing rate is low and MQ contention is not experienced.

  Sometimes contention is still experienced after adding MQ Receiver tasks, such as when multiple MQ Receivers connect to the same MQ queue manager or queue. See the next item for more information.

- **Run multiple MQ queue managers.** If you experience diminishing returns from adding MQ Receiver tasks, you may benefit from running additional MQ queue managers. Doing so can help to reduce contention of MQ resources stored in physical folders on disk.

- **Turn off persistent queueing if it is unneeded.** Performance issues for nonCPU-bound transactions or for persistent queueing are often related to MQ contention, which is not helped by adding receivers. If you do not require persistent queueing, turn it off.

  Persistent queueing is significantly slower than normal queueing for WebSphere MQ. If you do not use this feature, however, messages will be lost if the queue manager goes down.

- **Set Maximum Number of Channels parameter.** Set the Maximum Number of Channels parameter in the WebSphere MQ queue manager to be greater than or equal to the maximum number of simultaneous clients you have running.

In addition, there are specific actions you can take to improve WebSphere MQ Transport performance for outbound and inbound transports, as detailed below.

Inbound Messages

For inbound WebSphere MQ messages, run multiple MQ Receivers in parallel to increase throughput. See additional comments earlier in this topic for details.

Outbound Messages (Send, SendReceive)

Caching of WebSphere MQ Transport business services can improve outbound performance by eliminating the need to connect to the queue for each message. Caching is disabled by default because it is not usable in every situation. Follow these tips to enable caching:

- Cache in client sessions only. Do not use caching if your transport will be called within the Workflow Process Manager (WfProcMgr) component. The threading model of this component is not compatible with the WebSphere MQ APIs.
- To enable caching for a business service, set the Cache property to TRUE in Siebel Tools, then recompile the SRF file.
- If you need to call the WebSphere MQ Transport in Workflow Process Manager and in a client session, make a separate copy of the service (one cached and one uncached) for each situation.
- Caching occurs on a per-queue basis and only one connection is kept open at a time. If a single session is going to talk to multiple queues, consider making a copy of the transport for each outbound queue.

NOTE: See your IBM WebSphere MQ documentation for performance and sizing guidelines.

Performance Events

You can get detailed performance tracing of the WebSphere MQ Transport by setting the EAITransportPerf event to level 5.

You can set this event level for multiple Siebel Server components that play a role in Siebel eAI functionality, including Workflow Process Manager (WfProcMgr), EAI Object Manager (EAIObjMgr), MQ Receiver, or other components. For example, you can srvmgr to set the event level for MQ Receiver:

```
change evtloglvl EAITransportPerf=5 for comp MqSeriesSrvRcvr
```

Improving HTTP Inbound Transport Performance

The HTTP Inbound Transport supports two modes, session mode and sessionless mode:

- In session mode, the session stays live until a logoff call is made
- In sessionless mode, login and logoff occur automatically for each request

You should use session mode whenever possible, because the time required to log into the application is usually significantly longer than the time required to process an average request.

You can also use the SessPerSisnConn component parameter to control the number of sessions sharing the same physical SISNAPI connection between the Web server and the EAI Object Manager.

Setting this parameter to 1 will provide a dedicated physical connection for each Siebel session. The default value is 20, to allow up to 20 sessions to share the same SISNAPI connection.

For usage patterns involving a large number of sessions, the default value should be sufficient. For usage patterns where the number of simultaneous sessions is small, you can lower this value to make a better use of your system resources.

You can change this parameter using srvrmgr at the Enterprise or Server level. For example, to set the parameter at the Enterprise level for the EAI Object Manager, you enter the following command:

```
change param SessPerSisnConn=1 for compdef eaiobjmgr_enu
```

For more information about configuring SessPerSisnConn, see “Configuring SISNAPI Connection Pooling for AOM” on page 51.

EAI Siebel Adapter Performance

Use the techniques described here to improve the EAI Siebel Adapter performance and throughput.

Reviewing Scripting

Avoid scripting events on business components used by the EAI Siebel Adapter. Perform any scripting task either before or after the EAI Siebel Adapter call, rather than within it.

For general scripting guidelines, see also "Siebel Scripting Guidelines for Optimal Performance" on page 166.

Disabling Logging

You should disable logging for performance-critical processes that are functioning correctly to gain about 10% faster performance. You can disable logging for the EAI Object Manager (or other applicable server components, such as MQ Receiver) by setting the BypassHandler server parameter to TRUE.

Minimizing Integration Object Size

The size of an integration object and its underlying business components can have an impact on the performance of the EAI Siebel Adapter. To minimize this impact, you can:

- Inactivate unneeded fields and components in your integration objects—that is, where Force Active is set to TRUE, set it to FALSE. Activate only the fields needed for message processing.
- Inactivate unneeded fields under each business component.

For more information, see "Limiting the Number of Active Fields" on page 178.

Setting Force Active to FALSE prevents the EAI Siebel Adapter from processing these fields. If you do not inactivate these fields, the EAI Siebel Adapter processes them even though they are not actually included in the integration object.

Analyzing SQL Produced by EAI Siebel Adapter

Requests to the EAI Siebel Adapter eventually generate SQL to be executed against the Siebel Database. By setting the event SQL to level 4 in the component running in the EAI Siebel Adapter, you can get a trace of the SQL statements being executed, along with timings for each statement.

You can get timings for each EAI Siebel Adapter operation by setting the event EAISiebAdptPerf to 4. Do this to correlate the EAI Siebel Adapter calls with their associated SQL.

After you have this information, look through the logs to find any SQL statements taking significantly longer than average. To improve the performance of such statements, look at the business component (perhaps eliminating unnecessary joins and fields) or at the physical database schema (perhaps adding indexes).

Running EAI Siebel Adapter in Parallel

A common technique to improve throughput is to run multiple instances of the EAI Siebel Adapter in parallel.

For the MQ Receiver, you do this by running multiple receiver tasks. For more information, see "Improving IBM WebSphere MQ Transport Performance" on page 144.

For the EAI Object Manager, you do this by setting the MaxTasks, MaxMTServers, and MinMTServers parameters, in order to run more threads (tasks) on more multithreaded processes for the EAI Object Manager component. Also start multiple simultaneous HTTP sessions. There is little interaction between each instance of the EAI Siebel Adapter.

If the Siebel Database Server is large enough, almost linear scalability of the EAI Siebel Adapter is possible until either the limits of the CPU or the memory limits of the Siebel Server are reached.

CAUTION: If two sessions attempt to simultaneously update or insert the same record, one will succeed and one will produce an error. Therefore, when running the EAI Siebel Adapters in parallel, you need to prevent the simultaneous update of the same record in multiple sessions. You can prevent this by either partitioning your data or retrying the EAI Siebel Adapter operation where the error occurs.

Caching Business Objects

The EAI Siebel Adapter caches business objects by default. The default cache size is five objects. Using caching, subsequent runs on the adapter are significantly faster because the business objects do not need to be re-created for each run.

Use the BusObjCacheSize parameter on the EAI Siebel Adapter to change the size of the cache, if required. However, the five-object cache size is enough for most purposes. Making this number too large creates an unnecessarily large memory footprint.

Virtual Business Component Performance

Because users must wait for the virtual business component (VBC) response to display the GUI component for the integration on their screens, this type of integration is especially sensitive to latency.

To improve virtual business component performance when your integration has multiple requests, put the requests for a given system in a single batch.

Improving Workflow Process Manager Performance

This section discusses some performance issues for the Workflow Process Manager component.

For more information about Siebel Workflow performance, see Chapter 5, "Tuning Siebel Workflow for Performance." Also refer to *Siebel Business Process Designer Administration Guide*.

Workflow Process Manager is a task-based server component. A new thread is created for each request. However, sessions for Object Manager components (such as EAI Object Manager or Application Object Manager) that may invoke workflow processes are cached and reused for subsequent requests. When sizing a system, you need to look at the maximum number of workflow tasks you expect to have active at a given time. This determines the maximum number of Object Manager sessions Siebel applications create.

The exact CPU and memory consumption of each task depends on the actions performed in your workflow processes. To estimate CPU and memory consumption in your production environment, run a single task, measure its resource consumption, and make an estimation based on your maximum concurrent sessions. Take session caching into account when making these measurements.

If you need a large number of sessions, you may want to run Workflow Process Manager on multiple Siebel Server machines. You can then use Resonate Central Dispatch to load-balance requests across the Siebel Servers. If you plan to run a significant number of tasks per server (such as 100 or more), you may also want to run multiple multithreaded processes.

If you are going to run several different types of workflows, you should run each type in a separate process. This makes it easier to monitor the overall CPU and memory usage of each process type.

The number of multithreaded processes and the number of tasks per process are controlled through the parameters MaxMTServers (Maximum MT Servers), MinMTServers (Minimum MT Servers), and MaxTasks (Maximum Tasks).

NOTE: These parameters are per Siebel Server. For example, MaxMTServers refers to how many multithreaded processes to run on each Siebel Server machine. For details, refer to *Siebel Server Administration Guide*.

Performance Events

You can get performance tracing of workflows by setting the event WfPerf for the component in which your workflow is running. Setting the event to level 4 gives timing for the execution of the overall process. Setting the event to level 5 provides timing for each step as well.

You can set this event level for any Siebel Server component that invokes a workflow process as part of Siebel eAI functionality. For example, to set this event level for the MQ Receiver using srvmgr, enter the following:

```
change evtloglvl WfPerf=5 for comp MqSeriesSrvRcvr
```

These events can be useful not just for measuring workflow performance but also for measuring the performance of business services executed within these workflows.

Other Best Practices for Siebel eAI

Review the following issues for applicability to your deployment, for optimizing Siebel eAI performance:

- **Check disks on the machine.** Do a preliminary test on the queue manager you are using to see how many sends and corresponding receivers it can support per second (use multiple drivers). Queue vendors such as IBM WebSphere MQ provide test programs you can use to drive these and determine how much the queue itself can scale. The speed of the disks on the machine is important.

- **Optimize messages.** In the messages, reference only the columns you require.

- **Create smaller business components.** Messages might use only a small portion of the actual business components.

  Create copies of the business components you are using. In the copies, keep active all fields used by the optimized integration object or otherwise used for correctly processing of messages (like the visibility fields or status fields). Deactivate all other fields. Also deactivate the join definitions and multi-value links (MVLs) that are not needed for processing of the messages.

  The original business components are often large and complex and contain elements you will not need for your integration purposes. Use the smaller business components and business objects and links created when creating the optimized integration object.

  Business components may have fields with Force Active set to TRUE. Check this property for fields in the business components, using Siebel Tools. If the fields are not needed, set Force Active to FALSE.

- **Set user property All Mode Sort to FALSE.** Set the user property All Mode Sort to FALSE for optimized business components (if not already set). Do this only for the smaller business components created for use with Siebel eAI, because this user property changes the order in which rows are retrieved—which might not be appropriate or normal clients. For more information about All Mode Sort, refer to *Siebel Developer's Reference*.

- **Optimize database queries.** Review queries generated by the receiver process and verify that they are optimized.

- **Turn off irrelevant logging.** Turn off server-side logging that you do not require.

Tuning Customer Configurations for Performance 8

This chapter discusses how you can avoid common performance-related problems in Siebel applications that stem from customer configuration done using Siebel Tools or Siebel scripting languages.

The Siebel application architecture has been designed and tuned for optimal performance, making use of features such as database indexes, data caching, RDBMS cursors, efficient SQL generation, native database APIs, and so on.

In custom configurations, however, there are various potential performance pitfalls, and their impact can be amplified in environments with large databases and wide data distribution across servers. Follow guidelines presented here and in other documentation to avoid such problems.

Application development information is also available in the following books on the *Siebel Bookshelf* and in *Siebel Tools Online Help*:

- *Siebel Tools Reference*
- *Configuration Guidelines*
- *Siebel Developer's Reference*
- *Object Types Reference*
- *Siebel Object Interfaces Reference*
- *Siebel eScript Language Reference*
- *Siebel VB Language Reference*

This chapter contains the following subsections:

- "General Best Practices for Customer Configurations" on page 154
- "Best Practices for Data Objects Layer" on page 170

- "Best Practices for Business Objects Layer" on page 177
- "Best Practices for User Interface Objects Layer" on page 184

General Best Practices for Customer Configurations

This section provides some general best practices for customer configuration using Siebel Tools or Siebel scripting languages.

Using your hardware resources optimally, and configuring your system appropriately, can help you to achieve your performance goals. You should consider your resources and requirements carefully, and test and monitor system performance on a continual basis.

Review information presented in *Siebel Tools Reference* and other documentation on the *Siebel Bookshelf*, and other sources.

Miscellaneous Configuration Guidelines

The following are some miscellaneous configuration guidelines for maintaining optimal performance:

- **Limit the number of views accessible to users.** Assign views to responsibilities only as needed. (This is an application administration task.)
- **Limit the number of screen tabs accessible to users.** Displaying a large number of screen tabs reduces application performance. You can use responsibilities to manage the default tab layouts for users and minimize this performance factor. (This is an application administration task.)

  For more information about using responsibilities to specify default tab layouts, see the access control section of *Security Guide for Siebel eBusiness Applications*.

- **Avoid the use of case insensitivity.** Use of case-insensitive queries can significantly increase the possibility of performance issues due to the additional complexity required at the database level to support case-insensitive database operations.

  Prior to enabling case insensitivity, a thorough review of business requirements and performance criteria is highly recommended. In addition, if the feature is enabled, a performance test should be conducted with a full copy of the production database. The severity of the performance impact increases with the complexity of the configuration and the size of the production database.

  It is also recommended that Siebel Expert Services be engaged to optimize the configuration and review requirements. Case insensitivity is a database platform constraint and should also be reviewed with the database platform vendor.

  For more information about configuring case insensitivity for an application or for specified fields, see the *Applications Administration Guide*.

- **Limit the use of case insensitivity for queries.** Case-sensitive searches perform better than case-insensitive queries. Siebel applications are case-sensitive by default. You can enable case insensitivity either for the entire application or for specified fields. In general, the larger the database, and the larger the number of records returned by a case-insensitive query, the more that overall database performance is affected. Overall performance is also affected by the number of users who perform case-insensitive queries. End users can also force case-sensitive or case-insensitive queries.

  For more information about configuring case sensitivity for an application or for specified fields, see the *Applications Administration Guide*.

- **Avoid overly complex user interface configuration.** In general, do not include a large number of applets per view (generally include no more than four applets), or a large number of fields per applet.

- **Limit the number of business components in a view.** An excessive number of different business components used in applets in a view can slow down the display of data upon entry into that view. This is because each of the applets must be populated with data.

- **Limit the number of fields in business components or applets.** There is no set limit on the number of fields in a business component, or number of list columns in a list applet. However, a business component with too many active fields will have degraded performance. Also, in some database systems it is possible to generate a query that is too large to be processed. See also "Limiting the Number of Active Fields" on page 178.

  In particular, reduce the number of fields displayed in the master applet on related views. The information is static and may not be necessary. Additional space will be available on the view for supporting data without users needing to scroll. (This will also provide a usability benefit.)

  End users can reduce or increase the number of fields displayed in a list applet, by using the Columns Displayed menu option. However, it is best to provide an optimal default number of visible fields for each applet. It is also best to provide the minimum required total number of fields, including those that are hidden by default.

- **Limit the number of records returned.** To limit the number of records returned for a business component, you can add a search specification to the business component or applet, or you can define a default predefined query on the view.

- **Limit the number of joins, extension tables, and primary ID fields in a business component.** Joins degrade performance by causing an extra row retrieval operation in the joined table for each row retrieval in the main table. Extension tables and primary ID fields also use joins, although implied rather than explicitly defined, adding a row retrieval operation for each.

  The more joins, extension tables, and primary ID fields defined in a business component, the higher the number of row retrievals required in tables other than the main table, with a corresponding performance degradation.

- **Limit the use of Link Specification property in fields.** TRUE settings in the Link Specification property in fields may also slow performance. If TRUE, the field's value is passed as a default value to a field in the detail business component through a link.

  This is necessary if the master business component has a link relationship (in the current business object) with one or more detail business components, and these detail business components utilize the "Parent:" expression in the Pre Default Value, Post Default Value, or Calculated Value properties in any fields. The master business component must pass the field value to any detail records displayed.

  As with the Force Active property, fields with the Link Specification property set to TRUE will be retrieved every time the business component is queried.

- **Use inner joins rather than outer joins.** Inner joins may be used for joined tables, with a resulting savings in overhead, provided you are guaranteed that all foreign key references are valid.

  For example, when the join is from a detail business component to its master, you are guaranteed of the existence of the master. You can configure the join as an inner join by setting the Outer Join Flag property of the Join object definition to FALSE. This improves the performance of queries that use the join.

- **Configure Cascade Delete appropriately for many-to-many links.** The Cascade Delete property in a Link object definition must be correctly configured for use in a many-to-many link, or the first insertion or deletion in the association applet will be abnormally slow. A link object definition used in a many-to-many relationship is one that contains a non-NULL value for the Inter Table property. The Cascade Delete property in such a link must be set to None.

- **Remove unneeded sort buttons.** Remove sort buttons from list columns in list applets where this capability is not required.

- **Reduce the need to scroll in a view.** Whenever possible, design views that do not require scrolling. (This will also provide a usability benefit.)

- **Provide tuned PDQs.** Provide tuned PDQs (predefined queries) that address most user requirements. Doing so reduces the likelihood of users creating undesirably complex queries. You may also provide guidance to end users on constructing appropriate queries.

- **Cache business services.** Cache business services that should be accessible at all times in a user session. To do this, set the Cache parameter to TRUE for each applicable Business Service object definition.

Setting Unneeded Object Definitions to Inactive Status

Activate the object definitions that your applications require, and deactivate those that are not required. Doing this will result in a smaller SRF, thereby improving performance and scalability. It will also reduce the complexity of generated SQL and the infrastructure to support it.

Application performance improves when the SRF is smaller, particularly when it includes fewer object definitions that must be instantiated. In general, it is advisable to set unneeded object definitions to the status Inactive (Inactive property is set to TRUE), so they will be excluded when the SRF is compiled. The Inactive property applies to every object type.

You must consider all applications that may be supported from the same SRF file. An object definition must remain active if any feature (such as a script) or application requires it.

As an alternative, you may be able to use denormalization. This involves copying object definitions in order to specify different Inactive status for child objects.

For example, suppose you have a business component that is invoked by two scripts. One script is invoked rarely but requires all the business component fields to be active. Another script is invoked frequently and requires only a few fields. In this case, you could copy the business component, and set fields to Inactive in the version of the business component invoked by the script that does not require these fields. The benefit will be that fewer unnecessary object instantiations will occur. The tradeoff is that a larger SRF is required. The tradeoff may be worth it based on the performance implications, particularly when many fields are involved.

Setting unneeded object definitions to an inactive state results in a smaller SRF (unless, of course, you create additional object definitions by denormalizing) and smaller objects such as business components, and thereby improves performance and scalability. It also reduces the complexity of generated SQL and the infrastructure needed to support it.

NOTE: The property Force Active, which applies to certain object types, including business components and fields, does not override the Inactive property. Force Active only affects object definitions for which Inactive is set to FALSE. For more information, see "Limiting the Number of Active Fields" on page 178.

Analyzing Generated SQL for Performance Issues

Performance troubleshooting is an iterative process. You need to consider performance implications during design and development. Note any changes to potentially troublesome areas, such as MVGs, business component sort and search specifications, joins, extension tables, or indexes.

Then you test the application to determine bottlenecks, using realistic data volumes and distribution in your test environment. Focus your testing effort on the slowest, most important, and most highly configured views.

If a performance problem is detected in testing or production, your next step is to analyze the SQL statements being generated by Siebel applications. This is one of the most useful diagnostic tools available to you for performance analysis.

Specifying SQL Spooling in Siebel Dedicated Web Client

After making configuration changes in Siebel Tools, spool the SQL that is generated by the Siebel application during runtime. You do this to troubleshoot configuration-related performance issues.

To spool the generated SQL into a trace file, start the Siebel application in the Siebel Dedicated Web Client (connecting to the Siebel Database) using the command-line option `/s` *`sql_trace_file`*.

For more information about installing and running the Siebel Dedicated Web Client, refer to *Siebel Web Client Administration Guide*.

The SQL trace file contains all of the unique SQL statements generated during the current session, and identifies the amount of time spent processing each one. The trace file may be opened in a text editor for examination after the session has ended. The SQL trace file, which is simply a text file holding the spooled SQL from the session, is overwritten during every new session.

You can specify the `/s` *`sql_trace_file`* option by modifying properties for the Start menu item or desktop shortcut from which the Siebel application is invoked. The following example shows a command line for spooling generated SQL from Siebel Call Center using the Siebel Dedicated Web Client:

```
c:\sea752\client\bin\siebel.exe /c
c:\sea752\client\bin\enu\uagent.cfg /s siebel_sql.txt
```

If you do not specify a path, the SQL trace file is created in the Siebel client root bin directory, such as `c:\sea7`*`xx`*`\client\bin`.

- For the purpose of spooling SQL, you can create shortcuts for Siebel Dedicated Web Client to run customer applications such as Siebel eService. For example, the shortcut would point to the application configuration file eservice.cfg.
- You can enable SQL spooling for an Application Object Manager (AOM) component by setting the Object Manager SQL Log (ObjMgrSqlLog) parameter to 4 at the component level. For more information, refer to *Siebel Server Administration Guide*.
- You can also programmatically start and stop SQL spooling though the Siebel Object Interfaces by using the TraceOn and TraceOff methods on the Application object. For more information about these methods, refer to *Siebel Object Interfaces Reference*.

Troubleshooting Performance Using SQL Trace Files

As described, you can generate SQL trace files related to your configuration changes, such as for a particular view you have configured. Analyze the contents of the SQL trace file to identify any possible performance issues.

As you look through the SQL trace file, you should be aware of factors such as:

- The number and complexity of SQL statements.

- Execution times for SQL statements. This is the SQL execution time plus the time it takes to return rows. It does not include time for client-side processing.
- Sorting criteria in the ORDER BY clauses, indicating sort specifications.
- Selection criteria in the WHERE clauses, indicating search specifications.
- The use of joins.

NOTE: If the same SQL statement is executed repeatedly, the Siebel application displays the entire statement for the first query. For each subsequent iteration of the same query, only the bind variables are displayed. You can recognize a query that is repeated by the specific set of bind variables it uses.

SQL statements are displayed for all queries, including housekeeping queries. These are queries that are necessary for system operation, such as looking up the user's login to obtain responsibilities, and determining today's alarms in the calendar. You will also see queries to the S_LST_OF_VAL table to populate picklists. Queries that populate views are also present in the SQL trace file, and should be easily distinguishable based on the tables they access.

Troubleshooting Performance Using SQL Query Plans

If you identify a problematic query in the SQL trace file, you can obtain more information about it using the database query tool provided with the RDBMS, such as SQL*Plus for Oracle.

Copy and paste the SQL statement from the trace file into the database query tool, execute the query against the Siebel Database, then generate a query plan. A query plan is a detailed reporting of various statistics about the query you executed. For an example of generating a query plan against an SQL Anywhere database, see "Example of Obtaining Query Plan" on page 164.

Use query plans to check:

- The use of indexes
- The use of temporary tables
- The use of sequential table scans

Finally, compare your results with a standard application (that is, not custom-configured) in order to identify any potentially slow queries.

You can resolve many performance issues either by modifying search specifications or sort specifications, or by creating new indexes on the base table.

CAUTION: Only specially trained Siebel Systems personnel can modify existing Siebel indexes. This restriction is enforced so that performance in other modules (such as Siebel EIM) is not adversely affected by any index modifications you make to improve query performance through the user interface. For more information, see "Managing Database Indexes in Sorting and Searching" on page 171.

Consider any potential performance implications before modifying search specification and sort specification properties for a business component. By spooling out the SQL into trace files, you can analyze which indexes are likely to be used when your application queries the business component through each applet.

Run your query plans against datasets that are comparable to the production dataset. You will not obtain useful results analyzing the performance of a query against a 30-record test dataset when the production database has 200,000 records.

You may find it useful to prioritize the views to examine, as follows:

- **First priority.** Views that are known to have the biggest performance bottlenecks.
- **Second priority.** Views that are accessed most frequently.
- **Third priority.** Views that are the most highly configured (as compared to the standard Siebel application).

Comparison with the standard Siebel application provides you with a benchmark for evaluation. It is often very useful to obtain a trace file from the standard Siebel application, following a preselected route through the views. Then you obtain a separate trace file from the custom-configured application, following the same route as closely as possible. The two trace files are compared, noting differences in the bullet items listed previously.

NOTE: When you review a query plan, keep track of the business object to which each query applies, You can tell where each new business object is being opened by searching for the S_APP_QUERY statement. The business object that was accessed is represented using the bind variable statements beneath the query.

Bind variables are the values that determine which records are brought back. The RDBMS substitutes the value of a bind variable into an SQL statement when the same SQL statement is being reused, generally in place of each occurrence of a question mark or series of question marks. For example, a business object bind variable is used in an S_APP_QUERY statement because the purpose of this statement is to open the business object.

Watch for the following indications of potential problems:

- Unnecessary fields are being accessed, especially ones not exposed in the user interface and not needed for calculated fields, or used for passing values to detail records.
- Unnecessary joins are occurring, particularly to tables that are not being accessed.
- Unnecessary multiple joins are being made to the same table. This can indicate duplicate join or Multi Value Link (MVL) object definitions, or joins using the same foreign key.
- Multiple short queries similar to the following:

```
...FROM

     SIEBEL.S_ADDR_PER T1
```

When a short query appears many times, this generally indicates that an MVG without a primary join is being accessed by a list applet. The system is running a secondary query for each master record to obtain its detail records. The secondary queries are the short queries appearing in the log file. This is usually your best diagnostic indicator of the need for a primary join.

When a short query appears only once, it indicates the same situation, but accessed in a form applet. In either case, the cure is a primary join, as explained in "Using Primary ID Fields to Improve Performance" on page 182.

Example of Obtaining Query Plan

The following procedure shows an example of obtaining a query plan when running against a local SQL Anywhere database.

To obtain a query plan for an SQL statement in your trace file

1. Execute the Interactive SQL (dbisqlc.exe) program, located in the Siebel client installation directory (Siebel Mobile/Dedicated Web Client).
2. In order to analyze an SQL statement from the SQL trace file, copy the SQL statement and paste it into the Interactive SQL program's Command pane.
3. Replace bind variable references with the corresponding bind variable values.
4. Click the Execute button.

   The query runs against the local SQL Anywhere database. The Statistics pane provides analysis information.

SQL Queries Against Database Data

The database that underlies Siebel applications can be queried to obtain information on a read-only basis.

CAUTION: Update queries should never be directly performed on the Siebel Database. All data manipulation and restructuring should be performed through Siebel Tools or through the Siebel application.

Using Declarative Alternatives to Siebel Scripting

Often, customers use scripts for data validation, responses to data changes, or other purposes that may best be addressed through declarative means: by defining properties or specifying business service method invocation using Siebel Tools.

Scripting is often unnecessary and should be minimized or avoided because it may introduce performance problems, add risk and complexity, require greater maintenance, and duplicate functionality already available in Siebel applications.

For example, the Validation field property, which allows for common VB expressions and comparison operators, can be used to perform field validation or string manipulation of data entered through the user interface or through Siebel Object Interfaces.

Expressions for the Validation property can include methods such as LoginId(), LoginName(), LookupValue() ParentFieldValue(), PositionId(), PositionName(), Today(), and so on.

The Force Case field property may also be useful in a data-validation context, such as to ensure that personal names entered have initial capital letters.

For more information on supported expressions and operators, refer to *Siebel Developer's Reference*.

Setting the Auto Primary property on MVL object definitions can also help you achieve results that you might otherwise use scripting for. For example, if your business requirement is to assign the first record in an MVG as the primary record (for example, primary address or primary owner), then set Auto Primary to the value Default.

For more information about using Primary ID fields, see "Using Primary ID Fields to Improve Performance" on page 182 and refer to *Siebel Tools Reference*.

Scripting can be used in combination with declarative methods, such as to present customized error messages that guide users to enter data appropriately for each field subject to validation rules.

Functionality such as custom responses to data changes, which may often be handled through scripting, may best be addressed through declarative means. Such mechanisms, many of which may be used in combination, include:

- User properties on applets or business components
- Siebel Workflow
- State model
- Siebel Personalization
- Run-time events
- Named methods
- Business services
- Visibility configuration

For more scripting guidelines, refer to *Configuration Guidelines*. For more information on many of the above topics, consult the *Siebel Bookshelf*.

Siebel Scripting Guidelines for Optimal Performance

This section provides guidelines for appropriate use of Siebel scripting using Siebel eScript or Siebel VB.

For more information about these and other guidelines, refer to:

- *Siebel eScript Language Reference*
- *Siebel VB Language Reference*
- *Siebel Object Interfaces Reference*
- *Configuration Guidelines*

The following are some guidelines for appropriate use of Siebel scripting:

- **Use declarative alternatives.** Generally, you should try all other possibilities before using scripting to accomplish a functional requirement. See also "Using Declarative Alternatives to Siebel Scripting" on page 165.

- **Use browser scripts for simple client-side functions such as field validation.** Browser scripts are best used to perform simple procedural logic on the client side, such as performing field validation, or displaying blocking messages or alerts to users. Some such uses, particularly field validation, can reduce server round trips. Using more complex browser scripts, however, may reduce performance.

  For example, using Set/Get Profile attribute calls, or invoking multiple business service methods, may require more server round trips and lead to performance problems. Adding extra functionality to scripts that display messages may have a similar effect.

  NOTE: Setting the Immediate Post Changes field property has a similar effect on server round trips.

- **Do not return large result sets from server business services to browser scripts.** Browser scripts that invoke server scripts should return simple values or a single record, and should not return large result sets.

- **Use simple scripts on applet and business component events.** Scripts written on events for applets or business components—for example, for Change Record events—should be very simple. Complex or I/O-intensive operations in such events will adversely affect performance.

- **Declare your variables.** Declaring your variables and specifying their data type, as appropriate, may use less memory and improve performance.

- **Destroy any created objects when you no longer need them (Siebel eScript).** Theoretically, the Siebel eScript interpreter takes care of object cleanup, complex code involving many layers of object instantiation may in some cases cause the interpreter not to release objects in a timely manner. Destroying or releasing objects helps to minimize the impact on resources such as server memory.

  Explicit destruction of Siebel objects should occur in the procedure in which they are created. To destroy an object in Siebel eScript, set it to NULL, or set the variable that contains it to another value. The best practice is to destroy objects in reverse order of creation—that is, destroy child objects before you destroy parent objects.

- **Verify your script is invoked using the right method.** A script that is not invoked using the right method may cause performance impact. For example, it is better to invoke a script from BusComp_WriteRecord() rather than from BusComp_SetFieldValue(). Limit your use of specialized invocation methods.
- **Verify your script is implemented in the right view.** A script that is not implemented in the right view may cause significant performance impact. Verify that this script is implemented in the right place in the configuration, based on data manipulations, navigation requirements, and business requirements in general.
- **Avoid redundant repository object settings.** Do not perform unnecessary object validation. Each method invocation you perform has a performance cost. Details on this issue regarding field activation, for example, are provided below.
- **Use the ActivateField() method sparingly (Siebel eScript).** Do not activate a field if you will not use it. Use the ActivateField() method sparingly. Using this method increases the number of columns retrieved by a query, and can lead to multiple subqueries involving joins. These operations can use a significant amount of memory, and can degrade application performance.

  Do not perform any unnecessary field activation (for fields that are already active). Each method invocation you perform has a performance cost.

  - Do not activate system fields, because they are already activated by default. Such fields include Created, Created By, Updated, and so on.
  - Do not activate any other fields that are already active. Check the Force Active field property in Siebel Tools to see if you need to activate it.
- **Use the ExecuteQuery() method sparingly (Siebel eScript).** Removing calls to execute a business component, using the method ExecuteQuery(), can yield significant performance benefit. It is better practice to use shared variables to share values of specific business component records across scripts than to separately invoke ExecuteQuery() in each script.
- **Use SetSearchSpec() method rather than NextRecord() method (Siebel eScript).** You can improve performance by using the SetSearchSpec() method to get a specific record, rather than using the NextRecord() method to go through a list of retrieved methods until a specific record is found.

- **Use ForwardOnly cursor mode (Siebel eScript).** Use the ForwardOnly cursor mode for ExecuteQuery() unless ForwardBackward is required. Using ForwardBackward uses a significant amount of memory, which can degrade application performance.
- **Use appropriate error handling.** Appropriate error handling can help maintain optimal performance. Although error handling may be important, it also has a performance cost. It is best to minimize error handling code in your scripts.
- **Avoid nested query loops.** Nested query loops may involve a large number of subqueries and may significantly impact performance. Use this technique very sparingly. Implement a nested query loop in the correct order in order to minimize the number of iterations. Be aware that a nested query loop may be invoked implicitly, depending on how your script is written.
- **Use the This object reference (Siebel eScript).** The special object reference *this* is eScript shorthand for "the current object." You should use it in place of references to active business objects and components.

  For example, in a business component event handler, you should use *this* in place of ActiveBusComp(), usage of which may have a significant performance impact. Refer to the following example:

  ```
  function BusComp_PreQuery()
  {
  this.ActivateField("Account");
  this.ActivateField("Account Location");
  this.ClearToQuery();
  this.SetSortSpec( "Account(DESCENDING)," +
  " Account Location(DESCENDING)");
  this.ExecuteQuery();
  return (ContinueOperation);
  }
  ```

- **Use the Switch construct (Siebel eScript).** The Switch construct directs the program to choose among any number of alternatives you require, based on the value of a single variable. Using this construct offers better performance than using a series of nested If statements, and is easier to maintain.
- **Use the Select Case construct (Siebel VB).** The Select Case construct directs the program to choose among any number of alternatives you require, based on the value of a single variable. Using this construct offers better performance than using a series of nested If statements, and provides other benefits.

- **Test your custom scripts.** Make sure your scripts are fully tested and optimized, and are no more complex than required to meet your business needs.

Best Practices for Data Objects Layer

This section describes best practices for configuring selected elements in the data objects layer for optimal performance.

Multilingual LOVs Query and Cache Performance

Multilingual List of Values (MLOV) fields are implemented below the business component level. Fields that point to MLOVs with enabled target columns return display values that match the current language setting for the session.

For display, the underlying language-independent code is converted to its corresponding display value using a Siebel application lookup. For searching and sorting, however, a database join to the list of values table (S_LST_OF_VAL) is performed. Make sure that any configuration directly involving the S_LST_OF_VAL table is compatible with your Siebel application MLOV functionality.

When a view with MLOVs is displayed for the first time, a separate query on the S_LST_OF_VAL table is made for each field that has an MLOV. The query obtains all the display values for that MLOV and writes the values to the LOV cache in memory. When the view is subsequently displayed during the same session, the values are obtained from the cache rather than by issuing another query.

NOTE: Displaying multiple records in a list applet that contains one or more MLOV fields will cause memory consumption to increase, and can produce poor performance. The problem manifests particularly when multiple fetches are performed against a given logical result set—that is, you scroll through records. It may also manifest when client-side export is performed to automate this behavior, or anytime the NextRecord method is invoked repeatedly on the business component. It is generally recommended to use MLOV fields sparingly in list applets, or to disable client-side export from list applets containing MLOVs.

For more information on configuring MLOVs, refer to *Siebel Tools Reference*.

Managing Database Indexes in Sorting and Searching

A *database index* is a data structure in the RDBMS that is associated with a table. It provides references to all records in the table for quick lookup and filtering, and is sorted in a particular order for sorting in that order quickly. The Siebel Database Server uses an index to efficiently retrieve and sort the result set of a query.

Indexes provided in the Siebel Data Model are tuned for optimal performance of standard Siebel applications. When you add new business components with custom sorting or filtering requirements, you need to make sure that a database index is present that supports the requirement and delivers the result set efficiently. You may need to add new indexes.

You add indexes using the Index and Index Column object types. The index is added in the database as a result of its being created in Siebel Tools and database extensions being applied.

NOTE: The addition of custom indexes does not always improve performance and may reduce performance in some cases. The incremental value of an index depends in large part on the heterogeneity and distribution of the data.

When data is heterogeneous, all or most of the values are unique (such as with row ID values, which are unique). The less heterogeneous the data—that is, the more repeated instances of values (homogeneity)—the less benefit the index offers relative to its costs.

For Boolean fields, indexes generally offer little value. Some performance benefit may be found when querying for the least commonly represented values. Little or no benefit is found when querying on more commonly represented values or values that are evenly distributed. Similar guidelines apply for other homogeneous data, such as fields that are constrained to a list of values.

Indexing generally improves performance of SELECT operations. However, it may significantly reduce performance for batch UPDATE and INSERT operations, such as are performed by Siebel EIM.

You should discuss any custom index requirements with Siebel Expert Services.

Sort Specification

The Sort Specification property for a business component or picklist orders the records retrieved in a query, and serves as the basis for the ORDER BY clause in the resulting SQL issued. An index needs to be present that supports the order specified in the sort specification. Otherwise, the RDBMS engine physically sorts the entire result set in a temporary table.

The index needs to include the base columns for all of the fields, and to use them in the same order. There can be more columns specified in the index than are used in the sort specification, but the reverse is not true.

For example, the sort specification Last Name, First Name in the Contact business component is supported by at least one index on the S_CONTACT base table. One of these indexes is called S_CONTACT_U1, and it contains the LAST_NAME, FST_NAME, MID_NAME, PR_DEPT_OU_ID, OWNER_PER_ID, and CONFLICT_ID columns, in that order. If you wanted a sort specification that ordered contacts in first-name order, you would need to create a custom index.

Search Specification

The Search Specification property for a business component, applet, link, or picklist selectively retrieves rows from the underlying table that meet the criterion specified in the property. The search specification is the basis for the WHERE clause in the resulting SQL issued. An index needs to be present that supports the criterion. Otherwise, the RDBMS may scan through all rows in the table rather than only those to be returned by the query.

The index needs to contain all the columns referenced by fields in the search specification.

In Sales Rep views such as My Accounts, if the user queries or sorts columns that are denormalized to the intersection table (for example, NAME and LOC in S_ORG_EXT), performance is likely to be good. The Siebel application uses the intersection to determine visibility to records in the base table, and indexes can be used on the intersection table to improve performance.

For related information, see "Reusing Standard Columns" on page 173.

NOTE: If a query or sort includes columns that are not denormalized to the intersection table, performance is likely to degrade, because indexes are not used.

Reusing Standard Columns

The architecture and data model of your application has been tuned for best performance. This optimization is achieved by using proper indexes, data caching, and efficient SQL generation, and also by denormalizing columns on certain tables. These denormalized columns are indexed so that the application can improve the performance of complex SQL statements by using these columns for search or sort operations instead of the columns of the original tables.

NOTE: Do not remap existing fields, especially those based on User Key columns, to other columns in the same table.

CAUTION: Do not use custom denormalized columns without the assistance of Siebel Expert Services. Denormalized columns can improve performance by allowing indexes to be placed directly on an intersection table, rather than on its master or detail table. However, if this is configured improperly, the data in the denormalized column can become out of sync with its source. This can result in a number of problems ranging from inconsistent sorting to corrupt data.

Example: Reusing NAME and LOC in S_ORG_EXT Table

The columns NAME and LOC of the S_ORG_EXT table are denormalized into ACCNT_NAME and ACCNT_LOC in the S_ACCNT_POSTN table.

When sorting accounts by name and location in views where the Visibility Applet Type property is set to Sales Rep, the Siebel application uses the denormalized columns ACCNT_NAME and ACCNT_LOC of the S_ACCNT_POSTN table. Doing so allows the use of an index.

If the account name and location were stored in extension columns (for example, X_NAME and X_LOC), these columns would have to be used for sorting instead of NAME and LOC. Even if these extension columns were indexed, the application could not use an existing index to create the necessary joins and sort the data, because the index is on S_ORG_EXT and not on S_ACCNT_POSTN. Therefore, the result would be a significant decrease in performance.

Query Plan for My Accounts View

The first SQL statement is generated by the standard My Accounts view. The query plan shows that the database uses numerous indexes to execute the statement.

```
SELECT

      T1.LAST_UPD_BY,

      T1.ROW_ID,

      T1.CONFLICT_ID,

      .

      .

      .

      T10.PR_EMP_ID,

      T2.DUNS_NUM,

      T2.HIST_SLS_EXCH_DT,

      T2.ASGN_USR_EXCLD_FLG,

      T2.PTNTL_SLS_CURCY_CD,

      T2.PAR_OU_ID

   FROM

      SIEBEL.S_PARTY T1

         INNER JOIN SIEBEL.S_ORG_EXT T2 ON T1.ROW_ID = T2.PAR_ROW_ID

         INNER JOIN SIEBEL.S_ACCNT_POSTN T3 ON (T3.POSITION_ID = ?, 0.05)

      AND T2.ROW_ID = T3.OU_EXT_ID

         INNER JOIN SIEBEL.S_PARTY T4 ON (T4.ROW_ID = T3.POSITION_ID, 0.05)

         LEFT OUTER JOIN SIEBEL.S_PRI_LST T5 ON T2.CURR_PRI_LST_ID = T5.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_INVLOC T6 ON T2.PR_FULFL_INVLOC_ID =
      T6.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_EXT T7 ON T2.PAR_OU_ID = T7.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_EXT_SS T8 ON T1.ROW_ID = T8.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_INT_INSTANCE T9 ON T8.OWN_INST_ID =

      T9.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_POSTN T10 ON T2.PR_POSTN_ID = T10.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_USER T11 ON T10.PR_EMP_ID = T11.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ADDR_ORG T12 ON T2.PR_ADDR_ID = T12.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_INDUST T13 ON T2.PR_INDUST_ID = T13.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ASGN_GRP T14 ON T2.PR_TERR_ID = T14.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_POSTN T15 ON T3.POSITION_ID = T15.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_USER T16 ON T15.PR_EMP_ID = T16.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_SYN T17 ON T2.PR_SYN_ID = T17.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_BU T18 ON T2.BU_ID = T18.BU_ID AND

      T2.ROW_ID = T18.ORG_ID

         LEFT OUTER JOIN SIEBEL.S_PARTY T19 ON T18.BU_ID = T19.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_EXT T20 ON T18.BU_ID = T20.PAR_ROW_ID

   WHERE

      ((T2.INT_ORG_FLG != 'Y' OR T2.PRTNR_FLG != 'N') AND (T3.ACCNT_NAME >= ?))

   ORDER BY

      T3.POSITION_ID, T3.ACCNT_NAME

Query plan :
T3(S_ACCNT_POSTN_M1),T2(S_ORG_EXT_P1),T1(S_PARTY_P1),T15(S_POSTN_U2),T10(S_POSTN_
U2),T4(S_PARTY_P1),T12(S_ADDR_ORD_P1),T13(S_INDUST_P1),T7(S_ORG_EXT_U3),T16(S_USE
R_U2),T11(S_USER_U2),T17(S_ORG_SYN_P1),T6(S_INVLOC_P1),T5(S_PRI_LST_P1),T14(S_ASG
N_GRP_P1),T18(S_ORG_BU_U1),T19(S_PARTY_P1),T20(S_ORG_EXT_U3),T8(S_ORG_EXT_SS_U1),
T9(se)
```

Query Plan for My Accounts View—Different ORDER BY Clause

The second SQL statement generated in My Accounts, below, has a different ORDER BY clause. Even though the columns NAME and LOC of S_ORG_EXT are indexed, the database cannot use this index. Performance decreases from the use of a temporary table. The same behavior occurs if the ORDER BY clause uses the columns X_NAME and X_LOC instead of NAME and LOC.

```
SELECT

      T1.LAST_UPD_BY,

      T1.ROW_ID,

      T1.CONFLICT_ID,

      .

      .

      .

      T10.PR_EMP_ID,

      T2.DUNS_NUM,

      T2.HIST_SLS_EXCH_DT,

      T2.ASGN_USR_EXCLD_FLG,

      T2.PTNTL_SLS_CURCY_CD,

      T2.PAR_OU_ID

   FROM

      SIEBEL.S_PARTY T1

         INNER JOIN SIEBEL.S_ORG_EXT T2 ON T1.ROW_ID = T2.PAR_ROW_ID

         INNER JOIN SIEBEL.S_ACCNT_POSTN T3 ON (T3.POSITION_ID = ?, 0.05) AND

      T2.ROW_ID = T3.OU_EXT_ID

         INNER JOIN SIEBEL.S_PARTY T4 ON (T4.ROW_ID = T3.POSITION_ID, 0.05)

         LEFT OUTER JOIN SIEBEL.S_PRI_LST T5 ON T2.CURR_PRI_LST_ID = T5.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_INVLOC T6 ON T2.PR_FULFL_INVLOC_ID =

      T6.ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_EXT T7 ON T2.PAR_OU_ID = T7.PAR_ROW_ID

         LEFT OUTER JOIN SIEBEL.S_ORG_EXT_SS T8 ON T1.ROW_ID = T8.PAR_ROW_ID
         LEFT OUTER JOIN SIEBEL.S_INT_INSTANCE T9 ON T8.OWN_INST_ID =
      T9.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_POSTN T10 ON T2.PR_POSTN_ID = T10.PAR_ROW_ID
         LEFT OUTER JOIN SIEBEL.S_USER T11 ON T10.PR_EMP_ID = T11.PAR_ROW_ID
         LEFT OUTER JOIN SIEBEL.S_ADDR_ORG T12 ON T2.PR_ADDR_ID = T12.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_INDUST T13 ON T2.PR_INDUST_ID = T13.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_ASGN_GRP T14 ON T2.PR_TERR_ID = T14.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_POSTN T15 ON T3.POSITION_ID = T15.PAR_ROW_ID
         LEFT OUTER JOIN SIEBEL.S_USER T16 ON T15.PR_EMP_ID = T16.PAR_ROW_ID
         LEFT OUTER JOIN SIEBEL.S_ORG_SYN T17 ON T2.PR_SYN_ID = T17.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_ORG_BU T18 ON T2.BU_ID = T18.BU_ID AND
      T2.ROW_ID = T18.ORG_ID
         LEFT OUTER JOIN SIEBEL.S_PARTY T19 ON T18.BU_ID = T19.ROW_ID
         LEFT OUTER JOIN SIEBEL.S_ORG_EXT T20 ON T18.BU_ID = T20.PAR_ROW_ID
   WHERE
      ((T2.INT_ORG_FLG != 'Y' OR T2.PRTNR_FLG != 'N') AND
      (T3.ACCNT_NAME >= ?))
   ORDER BY
      T3.ACCNT_NAME, T3.POSITION_ID
Query plan : TEMPORARY TABLE
T3(S_ACCNT_POSTN_M1),T2(S_ORG_EXT_P1),T1(S_PARTY_P1),T15(S_POSTN_U2),T10(S_POSTN_
U2),T4(S_PARTY_P1),T12(S_ADDR_ORG_P1),T13(S_INDUST_P1),T7(S_ORG_EXT_U3),T16(S_USE
R_U2),T11(S_USER_U2),T17(S_ORG_SYN_P1),T6(S_INVLOC_P1),T5(S_PRI_LST_P1),T14(S_ASG
N_GRP_P1),T18(S_ORG_BU_U1),T19(S_PARTY_P1),T20(S_ORG_EXT_U3),T8(S_ORG_EXT_SS_U1),
T9(se)
```

Best Practices for Business Objects Layer

This section describes best practices for configuring selected elements in the business objects layer for optimal performance.

Using Cache Data Property to Improve Business Component Performance

To cache on the AOM the content of a business component for subsequent use in the same user session, the property Cache Data property should be set to TRUE for the business component.

Setting Cache Data to TRUE is appropriate for semi-static data that may be subject to repetitive queries, but that is unlikely to change during the user session.

For some business components, Cache Data is set to TRUE by default. This is done, for example, for the PickList Generic and Internal Product business components. (See "Using Properties to Improve Picklist Performance" on page 181.)

Cache Data should be FALSE for business components representing transactional data that may change within a user session.

Limiting the Number of Active Fields

Field object definitions are instantiated for each business component when the business component is instantiated, such as by a user navigating to a view containing an applet based on the business component. All such instantiated fields are included in the SELECT statements in generated SQL that is issued to the Siebel Database—even fields that are not represented in the user interface with a corresponding list column or other field control.

The set of fields that is instantiated includes those for which the Force Active property is set to TRUE. The Force Active setting of TRUE indicates to the system that it must obtain data for the field every time the business component is accessed, even if the field is not displayed in the current applet; this adds the field to the SQL query each time.

When Force Active is set to TRUE, there is an associated performance cost. Force Active affects performance more significantly when fields are based upon MVLs or joins, because the Siebel application has to create the relationships in the SQL query to retrieve data for these columns.

In most cases, the Force Active property is not required. In general, do not set Force Active to TRUE unless strictly necessary.

Use Force Active only when the field must be included in generated queries, but the field does not appear in the user interface. Even in this case, you can achieve the same result at somewhat less cost by setting Force Active to FALSE, but including a corresponding hidden control in an applet (by setting the Visible property set to FALSE). When you do this, the data does not have to be retrieved every time the business component is instantiated, only when the relevant applet is used.

NOTE: Generally, it is better to deactivate unused objects in Siebel Tools than to simply hide them. For more information, see "Setting Unneeded Object Definitions to Inactive Status" on page 158.

Guidelines for Using Calculated Fields

Calculated fields provide a convenient way to access and display data in the user interface that is not directly stored in a table. However, calculated fields have a cost associated with them. Consequently, it is important to use them appropriately to fulfill your requirements, and not to misuse them.

Each calculated field is evaluated whenever the business component is queried to provide a value for the field. Extensive use of calculated fields, or usage in certain contexts, may impact performance. Some guidelines are as follows:

- Use calculated fields sparingly. Be sure there is a valid business case for their usage.
- Minimize the complexity of the expressions defined in your calculated fields.

- Minimize the use of calculated fields that perform Sum, Min, or Max calculations, such as for detail records in an MVG business component. In particular, avoid using such fields in list applets, or in More Info form applets. The cost of using such expressions may be significant depending on the number of detail records.

  Whenever data is totaled there are performance implications. It is important to limit the number of records being totaled. For example, totaling the line items in a Quote or Expense report is not resource-consuming. However, summing the expected revenue for all Opportunities is resource-consuming.

  The latter occurs when you generate a chart. However, charts tend not to be generated frequently. Accessing the Opportunities list view for routine searches and data entry is done frequently.

  CAUTION: Never put a sum([MVfield]) in a list column. This requires that a separate query be executed for each record in the list, which is a significant performance issue.

- Avoid defining calculated fields using complex expressions that provide different values depending on the current language.
- Avoid using a calculated field to store a literal value; use business component user properties for this purpose instead.
- Avoid using a calculated field to directly copy the value of another field.
- Avoid including calculated fields in search specifications, particularly if the calculated fields use functions that are not supported by the underlying RDBMS.
  - If the RDBMS supports the function, it will have algorithms for performing the calculations efficiently and will return the calculated values with the result set. However, if functions such as EXISTS, Max, or Count are included, then multiple subqueries may be performed, impacting performance.

- If the function is *not* supported in the RDBMS, the Siebel application may have to rescan the entire result set to perform the desired calculation, considerably increasing the time it takes to obtain the results of the query.

In the first case, the calculations can take place before the results are returned, while, in the second case, they have to be performed in memory (on the Application Object Manager or client).

NOTE: Even if the calculated field is supported at the RDBMS level, there may be other reasons why a search specification on a calculated field may result in poor performance, such as the lack of an index (for example, when using the LIKE function) supporting the search specification. See "Managing Database Indexes in Sorting and Searching" on page 171.

Using Properties to Improve Picklist Performance

To cache the content of certain picklists for subsequent use in the same user session, the property Cache Data property should be set to TRUE for the PickList Generic business component. By default, this property is TRUE.

NOTE: Picklists based on PickList Generic display LOV data, which is unlikely to change during the user session and are thus suitable for caching. Picklists based on other business components display data that could change during a user's session and is thus generally unsuitable for caching.

Also set the Long List property to TRUE for each applicable Pick List object definition. When Long List is TRUE, the focus is not maintained on the current picklist record, thus improving performance for picklists with many records. The default setting of Long List varies for each Pick List object definition.

Using Primary ID Fields to Improve Performance

MVGs configured without Primary ID fields require separate queries to display each parent record and each set of child records. For example, for a list applet that displays 10 records and two MVGs per record, a total of 21 queries would be required to populate the applet: one query to populate the parent records and 20 additional queries (two per parent record) to populate the MVGs. The number of queries executed is many times the number actually required.

You can avoid unnecessary queries by configuring a Primary ID field on the master business component. The Primary ID field serves as a foreign key from a parent record to one primary child record in the detail business component. This allows the application to perform a single query using a SQL join to display values for the parent record and the primary child record in the applet. In other words, it defers having to perform additional queries for the MVG until the user opens the MVG and displays a list of all child records.

List applets receive the most performance benefit from using Primary ID fields because list applets typically access a large number of records and each record may have one or more MVGs associated with it. The Primary ID field avoids having to submit queries for each MVG for every parent record.

Form applets can also benefit from Primary ID fields, even though in form applets only one parent record is accessed at a time. A Primary ID field allows the application to submit a single query for each new parent record displayed, rather than having to perform multiple queries for every MVG on the form applet. This can improve performance as the user moves from one record to another.

In some circumstances, configuring a Primary ID field is not desirable or feasible:

- When Microsoft SQL Server is being used, and the creation of the primary join would create a double-outer-join situation prohibited by the Microsoft software
- When the only purpose of the multi-value field is to sum detail record values

For information on how to configure Primary ID fields, refer to *Siebel Tools Reference*.

How the Check No Match Property Impacts Performance

In most cases, the Check No Match property of a Multi Value Link object definition (used to implement Primary ID fields) should be set to FALSE. Setting the Check No Match property to TRUE could negatively impact performance, especially in situations where most parent records do not have child records defined in an MVG.

The Check No Match property defines whether a separate query should be used to populate an MVG when no child record is found through a primary join.

- When Check No Match is set to FALSE, the application does the following:
  - If a parent record's Primary ID field is invalid or has the value of NULL, a secondary query is performed to determine if there are child records in the MVG. If there are no child records, the Primary ID field is set to the value *NoMatchRowId*.
  - If a parent record's Primary ID field has the value *NoMatchRowId*, the application does not perform a secondary query, because NoMatchRowId indicates that there are no child records in the MVG. Avoiding these extra SQL queries improves performance.

  NOTE: NoMatchRowId is not a permanent setting—the Primary ID field can be updated after it is set to NoMatchRowId.

- When Check No Match is set to TRUE, a separate SQL query is executed for each parent record in which the primary join did not find a primary child record. Doing this ensures that the multi-value field does not appear blank unless there are no child records. But executing these extra SQL queries decreases performance.

It is appropriate to set the Check No Match property to TRUE in the following cases:

- When the multi-value group allows records to be added without having to go through the MVG. For example, account addresses might actually be inserted through the Business Address multi-value group on the Contact business component instead of the Account business component.
- When records can be added to a detail business component through Siebel EIM.

For more information about configuring Multi Value Link object definitions, refer to *Siebel Tools Reference*.

Best Practices for User Interface Objects Layer

This section describes best practices for configuring selected elements in the user interface objects layer for optimal performance.

Addressing Performance Issues Related to Grid Layout

The grid layout feature allows developers to create effective and usable form applets for Siebel views. However, performance may be adversely affected by certain applet design choices.

Typically, such performance problems relate to the alignment of user interface controls such as labels and fields, and stem from the total number of cells in the grid-based form applet, including spacer cells. Performance impact will depend on the number of user interface elements, the applet size, and other factors.

You can optimize user interface performance by:

- Making stacked sets of labels or fields the same width. Doing so may reduce the number of adjacent spacer cells you require.
- Aligning stacked sets of labels consistently.
- Making labels the same height as the adjacent fields.
- Eliminating horizontal or vertical spacer cells you deem unnecessary.

NOTE: Weigh all optional measures against possible usability concerns. Judicious use of spacing in your view layouts is generally appropriate for optimal usability.

For more information about using the grid layout feature, refer to *Siebel Tools Reference*.

Maintaining Performance When Using Applet Toggles

Applet toggles are a useful feature where multiple applets based on different business components occupy the same location in a view. Which applet displays at one time depends on a field value in a parent applet (dynamic toggle) or on a user selection (static toggle).

Dynamic toggle applets are based on the same business component, while static toggle applets may be based on different business components.

In general, when configuring applet toggles for your Siebel application, particularly dynamic toggles, you can reduce memory and CPU usage for user application sessions by minimizing the number of applet toggles and fields per applet.

It is important to be aware of potential performance impact of using applet toggles, particularly dynamic toggles:

- When a user selects a record in a parent applet for a dynamic applet toggle, the business component and fields for all of the applet toggles are instantiated and cached in memory, and all of these fields are queried.

  This query is used to populate other applet toggles that may be displayed when the user changes the relevant field value in the parent record. However, each time the user selects a different record in the parent applet, all of the fields in the toggle business component are required.

  Also note that view layout caching is not performed for views containing dynamic applet toggles.

- When a user navigates to a view containing a static applet toggle, the business component and fields for the default displayed applet is instantiated and cached in memory, and these fields are queried. Other business components are instantiated and cached, and other queries performed, when the user navigates to the other applets in the toggle.

In each case, cached objects remain in memory until the user navigates to a different screen.

Monitoring Siebel Application Performance 9

The Siebel Application Response Measurement (Siebel ARM) feature captures timing data useful for monitoring the performance of the Siebel application.

When enabled, Siebel ARM records and saves data in binary file format. The Siebel ARM post-processing tool, accessed from the command line, converts binary files to a readable format and includes different types of analysis options. Review the Siebel ARM post-processing tool output to monitor the performance of the Siebel application.

For tasks associated with enabling, running, and analyzing Siebel application performance using the Siebel ARM feature, see the following sections:

- "Process for Enabling and Configuring Siebel ARM" on page 187
- "Enabling and Configuring Siebel ARM on Siebel Server" on page 188
- "Enabling and Configuring Siebel ARM on Web Server" on page 192
- "About Siebel ARM Parameters and Variables" on page 194
- "Converting Siebel ARM Files" on page 196
- "About Siebel ARM Data" on page 205

Process for Enabling and Configuring Siebel ARM

The process for enabling and configuring Siebel ARM involves setting parameters on the Siebel Server and setting environment variables on the Web server. There is no specific order for these tasks.

Perform the following tasks to enable and configure Siebel ARM:

- Set parameters on the Siebel Server. You can do this at the Siebel Server level or the server component level. For details, see "Enabling and Configuring Siebel ARM on Siebel Server" on page 188.
- Set environment variables on the Web server. For details, see "Enabling and Configuring Siebel ARM on Web Server" on page 192.

For information on the Siebel ARM parameters and variables, see "About Siebel ARM Parameters and Variables" on page 194.

Enabling and Configuring Siebel ARM on Siebel Server

Enabling and configuring Siebel ARM on the Siebel Server requires the setting of three parameters at the Siebel Server or individual server component level:

- Setting the parameters at the Siebel Server level enables and configures Siebel ARM for all components on that Siebel Server.
- Setting the parameters at the server component level enables and configures Siebel ARM only for that particular component.

Use the Server Manager GUI or Server Manager command-line interface to set the Siebel ARM parameters.

For further details on using the Server Manager GUI and command-line interface, and on administering server parameters, refer to *Siebel Server Administration Guide*.

For background information on the individual Siebel ARM parameters, see:

- "SARM Enabled (Alias SARMEnabled)" on page 194
- "SARM Memory Size Limit (Alias SARMMaxMemory)" on page 194
- "SARM Data File Size Limit (Alias SARMMaxFileSize)" on page 194

The following tasks are part of "Process for Enabling and Configuring Siebel ARM" on page 187.

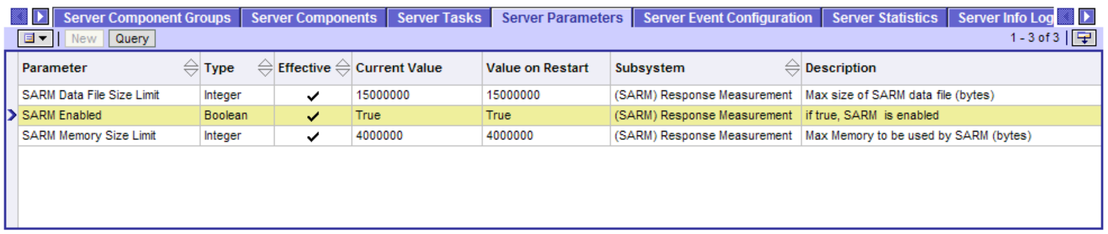
Enabling and Configuring Siebel ARM at Siebel Server Level

The following procedures describe how to enable and configure Siebel ARM at the Siebel Server level. Procedures are provided using the Server Manager GUI and the Server Manager command-line interface.

To enable and configure Siebel ARM on the Siebel Server with Server Manager GUI

1. Navigate to the Siebel Servers screen.
2. Click the Server Parameters view tab.
3. In the Siebel Servers list, select the Siebel Server you want to modify.
4. In the Server Parameters list, change the Current Value field of the parameter SARM Enabled (alias SARMEnabled) to TRUE.
5. Modify the parameters SARM Memory Size Limit (alias SARMMaxMemory) and SARM Data File Size Limit (alias SARMMaxFileSize) if required.
6. For changes to take effect, stop and restart the Siebel Server. For details on this procedure, refer to *Siebel Server Administration Guide*.

Figure 7 shows an example of setting the Siebel Server parameters for Siebel ARM.



Parameter	Type	Effective	Current Value	Value on Restart	Subsystem	Description
SARM Data File Size Limit	Integer	✓	15000000	15000000	(SARM) Response Measurement	Max size of SARM data file (bytes)
SARM Enabled	Boolean	✓	True	True	(SARM) Response Measurement	if true, SARM is enabled
SARM Memory Size Limit	Integer	✓	4000000	4000000	(SARM) Response Measurement	Max Memory to be used by SARM (bytes)

Figure 7. Setting the Siebel Server Parameters for Siebel ARM

To enable and configure Siebel ARM on a Siebel Server using the Server Manager command-line interface

1. Start Server Manager command-line interface (srvrmgr program).

   For details on this procedure, refer to *Siebel Server Administration Guide*.

2. To enable Siebel ARM at the Siebel Server level, enter:

```
change parameter SARMEnabled=TRUE for server siebel_server_name
```

NOTE: If required, configure the parameters SARMMaxMemory and SARMMaxFileSize with separate commands or in the same command using a comma-delimited list. For further details on parameter administration using the Server Manager command-line interface, refer to *Siebel Server Administration Guide*.

---

3. For the changes to take effect, stop and restart the Siebel Server as follows:

   Enter: `shutdown appserver` *`siebel_server_name`*

   Enter: `startup appserver` *`siebel_server_name`*

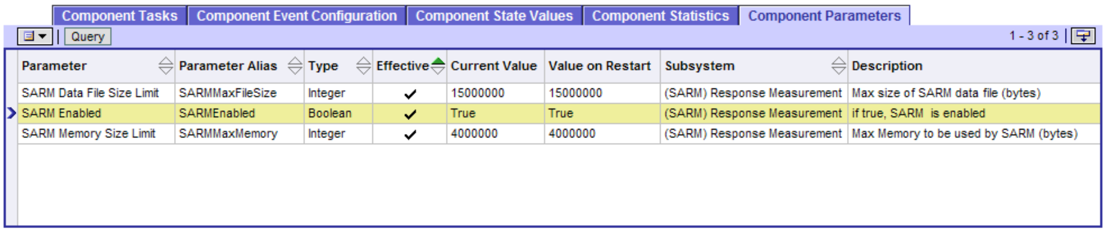
Enabling and Configuring Siebel ARM at Server Component Level

The following procedures describe how to enable and configure Siebel ARM at the server component level. Procedures are provided using the Server Manager GUI and the Server Manager command-line interface.

To enable and configure Siebel ARM on a server component with Server Manager GUI

1. Navigate to the Components screen.
2. Click the Component Parameters view tab.
3. In the Server Components list, select the component you want to modify.
4. In the Component Parameters list, change the Current Value field of the parameter SARM Enabled (alias SARMEnabled) to TRUE. (To make the parameter dynamic, check the Effective Immediately? flag.)
5. Modify the parameters SARM Memory Size Limit (alias SARMMaxMemory) and SARM Data File Size Limit (alias SARMMaxFileSize) if required. (To make the parameters dynamic, check the Effective Immediately? flag.)
6. For changes to take effect, stop and restart the server component. For details on this procedure, refer to *Siebel Server Administration Guide*.

Figure 8 shows an example of setting the server component parameters for Siebel ARM.



Parameter	Parameter Alias	Type	Effective	Current Value	Value on Restart	Subsystem	Description
SARM Data File Size Limit	SARMMaxFileSize	Integer	✓	15000000	15000000	(SARM) Response Measurement	Max size of SARM data file (bytes)
SARM Enabled	SARMEnabled	Boolean	✓	True	True	(SARM) Response Measurement	if true, SARM is enabled
SARM Memory Size Limit	SARMMaxMemory	Integer	✓	4000000	4000000	(SARM) Response Measurement	Max Memory to be used by SARM (bytes)

Figure 8. Setting the Siebel Server Component Parameters for Siebel ARM

To enable and configure Siebel ARM on a server component using the Server Manager command-line interface

1 Start Server Manager command-line interface (srvrmgr program).

For details on this procedure, refer to *Siebel Server Administration Guide*.

2 To enable Siebel ARM at the server component level, enter:

```
change parameter SARMEnabled=TRUE for component
component_alias_name for server siebel_server_name
```

NOTE: If required, configure the parameters SARMMaxMemory and SARMMaxFileSize with separate commands or in the same command using a comma-delimited list. For further details on parameter administration using the Server Manager command-line interface, refer to *Siebel Server Administration Guide*.

3 For the changes to take effect, stop and restart the server component as follows:

Enter: `shutdown component` *`component_alias_name`* `for server` *`siebel_server_name`*

Enter: `startup component` *`component_alias_name`* `for server` *`siebel_server_name`*

Enabling and Configuring Siebel ARM on Web Server

Enabling and configuring Siebel ARM on the Web server requires the creation and setting of three environment variables on the machine that hosts the Web server.

NOTE: If you are running the Web server and the Siebel Server on the same machine, the value of the Siebel ARM environment variable overrides the Siebel ARM parameter value of the Siebel Server.

For background information on the individual Siebel ARM environment variables, see:

- "SIEBEL_SarmEnabled" on page 195
- "SIEBEL_SarmMaxFileSize" on page 195
- "SIEBEL_SarmMaxFileSize" on page 195

The following tasks are part of "Process for Enabling and Configuring Siebel ARM" on page 187.

To enable and configure Siebel ARM for the Web Server on Microsoft Windows

1. Choose Start > Settings > Control Panel > System.
2. Click the Advanced tab, then click Environment Variables.
3. In the System variables section, click New to create a new environment variable.

4. Create three new environment variables with the following values for the Variable name and Variable value fields:

Variable Name	Variable Value
SIEBEL_SarmEnabled	TRUE
SIEBEL_SarmMaxMemory	4000000
SIEBEL_SarmMaxFileSize	15000000

   The values for SIEBEL_SarmMaxMemory and SIEBEL_SarmMaxFileSize are default values and may require modifications based on your requirements.

5. Restart the machine for the environment variables to take effect.

To enable and configure Siebel ARM for the Web Server on UNIX

1. Log in as the Siebel Service owner user.
2. Run the siebenv.sh or siebenv.csh script to set Siebel environment variables. For more information on these scripts, refer to the *Siebel Server Installation Guide* for the operating system you are using.
3. Enter the following command to set the environment variable enabling Siebel ARM:

```
setenv SIEBEL_SARMEnabled true
```

4. Enter the following two commands to set the environment variables configuring Siebel ARM:

```
setenv SIEBEL_SarmMaxMemory 4000000
```

```
setenv SIEBEL_SarmMaxFileSize 15000000
```

   The values for SIEBEL_SarmMaxMemory and SIEBEL_SarmMaxFileSize are default values and may require modifications based on your requirements.

5. Restart the machine for the environment variables to take effect.

About Siebel ARM Parameters and Variables

Three parameters on the Siebel Server and three environment variables on the Web server enable and configure the Siebel ARM feature. For descriptions of the Siebel Server parameters, see "About Siebel Server Siebel ARM Parameters" on page 194. For descriptions of the Web server environment variables, see "About Web Server Siebel ARM Environment Variables" on page 195.

For details on enabling Siebel ARM using these parameters and variables, see "Process for Enabling and Configuring Siebel ARM" on page 187.

About Siebel Server Siebel ARM Parameters

The following three parameters enable and configure Siebel ARM on the Siebel Server. For details on this process, see "Enabling and Configuring Siebel ARM on Siebel Server" on page 188.

SARM Enabled (Alias SARMEnabled)

A Boolean value that enables or disables the Siebel ARM feature. A value of TRUE enables the Siebel ARM feature. The default value is FALSE.

SARM Memory Size Limit (Alias SARMMaxMemory)

The current Siebel ARM framework uses a buffered data generation mechanism. Siebel ARM collects data and stores it in memory. After the in-memory data size reaches a threshold defined by SARMMaxMemory, Siebel ARM outputs the data to a physical disk. The parameter is specified in bytes. The default value is 4000000 bytes (4 MB).

For example: if SARMMaxMemory is 4 MB and there are five instances (processes) of the component, then the total memory used is 20 MB.

SARM Data File Size Limit (Alias SARMMaxFileSize)

Specifies how large a file gets before Siebel ARM creates a new file stored on the physical disk. The parameter is specified in bytes. The default value is 15000000 bytes (15 MB).

Until the specified size is reached, Siebel ARM continues to append file segments to the current file. When the file limit is reached, Siebel ARM creates a new file. Siebel ARM maintains at most five files. The number of files maintained by Siebel ARM is not configurable. When Siebel ARM creates a fifth file (because the fourth exceeded the SARMMaxFileSize limit), Siebel ARM removes the first (that is, the oldest) when the fifth file reaches the SARMMaxFileSize limit. Therefore, the maximum amount of disk space used is approximately 5 times SARMMaxFileSize bytes. This amount of memory is per-process (per component instance).

For example, if SARMMaxFileSize is 15 MB and there are 5 instances (processes) of the component, then the maximum amount of disk space consumed is 375 MB (15MB per file, times 5 files per process, times 5 processes (instances of component)).

About Web Server Siebel ARM Environment Variables

The following three environment variables enable and configure Siebel ARM on the Web server. For details on this process, see "Enabling and Configuring Siebel ARM on Web Server" on page 192. The function of the Web server environment variables is the same as the parameters on the Siebel Server. For a functional description of the Siebel ARM Web server environment variables, see "About Siebel Server Siebel ARM Parameters" on page 194.

SIEBEL_SarmEnabled

For a functional description of this environment variable, see "SARM Enabled (Alias SARMEnabled)" on page 194. The default value is FALSE.

SIEBEL_SarmMaxMemory

For a functional description of this environment variable, see "SARM Memory Size Limit (Alias SARMMaxMemory)" on page 194. The default value of the environment variable is 4000000 bytes (4 MB).

SIEBEL_SarmMaxFileSize

For a functional description of this environment variable, see "SARM Data File Size Limit (Alias SARMMaxFileSize)" on page 194. The default value of the environment variable is 15000000 bytes (15 MB).

Converting Siebel ARM Files

Running the Siebel ARM post-processing tool converts binary Siebel ARM files into readable output for analysis. For further description of the Siebel ARM post-processing tool, see "About Siebel ARM Post-Processing Tool" on page 198. For further information on Siebel ARM files, see "About Siebel ARM Files" on page 197.

To run the Siebel ARM post-processing tool, use the executable program sarmanalyzer.exe on Microsoft Windows or sarmanalyzer on UNIX. Use one or more command-line flags depending on the desired type of output analysis.

For a listing of flags used with the Siebel ARM post-processing tool, see Table 7. For descriptions of the types of analysis output, see "About Siebel ARM Post-Processing Tool Output" on page 199.

Table 7. Siebel ARM Post-Processing Tool Flags

Flag	Description
`-help`	Use this flag with the Siebel ARM post-processing tool to list and describe the available flags.
`-f`	Use this flag with a Siebel ARM file argument to run a performance aggregation analysis. For details, see "Running Performance Aggregation Analysis" on page 200.
`-xml`	Use this flag with a Siebel ARM file argument to run a call graph generation analysis. For details, see "Running Call Graph Generation" on page 201.
`–w`	Use this flag with a Siebel ARM file argument from the Web server as part of a user session trace analysis. For details, see "Running User Session Trace" on page 202.
`-s`	Use this flag with a Siebel ARM file argument from the Siebel Server as part of a user session trace analysis. For details, see "Running User Session Trace" on page 202.
`-u`	Use this flag with a User ID argument as part of a user session trace analysis. For details, see "Running User Session Trace" on page 202.
`-csv`	Use this flag to run a comma-separated value analysis. For details, see "Running Siebel ARM Data CSV Conversion" on page 202.

Table 7. Siebel ARM Post-Processing Tool Flags

Flag	Description
`-sarm`	Use this flag with a Siebel ARM file argument as part of a comma-separated value analysis. For details, see "Running Siebel ARM Data CSV Conversion" on page 202.
`-prop`	Use this flag with a Siebel ARM file argument from the Web server as part of a user session trace analysis. For details, see "Running User Session Trace" on page 202.

For a particular type of analysis output, see the following sections on running the Siebel ARM post-processing tool:

- "Running Performance Aggregation Analysis" on page 200
- "Running Call Graph Generation" on page 201
- "Running User Session Trace" on page 202
- "Running Siebel ARM Data CSV Conversion" on page 202

About Siebel ARM Files

Siebel ARM files are binary files of the format *sarm_naming_convention*.sarm.

When enabled, the Siebel ARM feature saves Siebel ARM files in the log subdirectory in the Siebel Server root directory and in the log directory of the *SWSE_ROOT* directory. For information on the Siebel ARM feature, see "Monitoring Siebel Application Performance" on page 187.

The Siebel ARM feature names the binary data files like the following example:

```
S01_P12345_N0000.sarm
```

where:

`S01` = Constant value.

`P12345` = Siebel Server process ID number.

`N0000` = File number. Starts at 0000 and increments until it reaches 9999, at which point it wraps around to 0000.

`.sarm` = Siebel ARM file extension.

To analyze the data contained in the binary Siebel ARM files, you must convert the Siebel ARM files using the Siebel ARM post-processing tool—a command-line program—into readable output.

For more information on the Siebel ARM post-processing tool, see "About Siebel ARM Post-Processing Tool" on page 198. For more information on running the Siebel ARM post-processing tool, see "Converting Siebel ARM Files" on page 196.

NOTE: The Siebel ARM feature creates empty Siebel ARM files before populating them with data. It begins storing data to these files after the feature reaches the value of the SARM Memory Size Limit parameter. For details on this process, see "SARM Memory Size Limit (Alias SARMMaxMemory)" on page 194.

About Siebel ARM Post-Processing Tool

The Siebel ARM post-processing tool parses the files created by the Siebel ARM feature and generates extensible markup language (XML) analytic results or comma-separated value (CSV) results. Run the Siebel ARM post-processing tool manually at the command-line. For details on how to run the Siebel ARM post-processing tool, see "Converting Siebel ARM Files" on page 196.

This command-line utility resides in the bin subdirectory of the Siebel Server root directory as the executable program sarmanalyzer.exe on Microsoft Windows or sarmanalyzer on UNIX.

NOTE: The post-processing tool is platform specific (Windows or UNIX) and only converts files generated on that platform.

About Siebel ARM Post-Processing Tool Output

The Siebel ARM post-processing tool produces output in either XML or CSV formats based on the type of execution. For details on how to run the Siebel ARM post-processing tool for various output formats, see "Converting Siebel ARM Files" on page 196.

For a description of the types of Siebel ARM analysis output, see the following sections:

- "About Performance Aggregation Analysis" on page 199
- "About Call Graph Generation" on page 200
- "About User Session Trace" on page 200
- "About Siebel ARM Data CSV Conversion" on page 200

About Performance Aggregation Analysis

Performance aggregation analysis is a compilation of the data contained in a Siebel ARM binary file. Siebel ARM files group performance data based on the instrumented areas. For information and a listing of instrumented areas, see "About Siebel ARM Architecture" on page 215.

For details on creating this format of Siebel ARM output, see "Running Performance Aggregation Analysis" on page 200.

To view performance aggregation data, run the Siebel ARM post-processing utility using the performance aggregation analysis option to convert a single Siebel ARM file.

For details on reviewing and analyzing the data from a performance aggregation analysis, see "About Performance Aggregation Data" on page 205.

About Call Graph Generation

A call graph generation analysis constructs a map of call references. Each node in the call map represents an instrumentation instance, that is, response times for an individual request through an instrumented area. For information on instrumented areas, see "About Siebel ARM Architecture" on page 215.

For details on creating this format of Siebel ARM output, see "Running Call Graph Generation" on page 201.

For details on reviewing and analyzing the data from a call graph generation analysis, see "About Call Graph Generation Data" on page 210.

About User Session Trace

The user session trace analysis creates an XML output file, which contains detailed information on each of the Siebel Web Engine (SWE) requests the user has made. If the user logs onto the system multiple times, the output shows that there are multiple sessions. The SWE requests are grouped into specific login sessions and sorted by the time the requests were made. For further details on the Siebel ARM architecture, see "About Siebel ARM Architecture" on page 215.

For details on creating this format of Siebel ARM output, see "Running User Session Trace" on page 202.

For details on reviewing and analyzing the data from a user session trace analysis, see "About User Session Trace Data" on page 212.

About Siebel ARM Data CSV Conversion

CSV format is a comma-separated file without any interpretation or aggregation. Use third-party software tools to view this output, for example, a spread sheet. For details on creating this format of Siebel ARM output, see "Running Siebel ARM Data CSV Conversion" on page 202.

For further details on the Siebel ARM architecture, see "About Siebel ARM Architecture" on page 215.

Running Performance Aggregation Analysis

Use the following procedure to obtain performance aggregation analysis output. For a description of this output type, see "About Performance Aggregation Analysis" on page 199.

To run a performance aggregation analysis

1. Navigate to the binary subdirectory within the Siebel Server root directory.
2. Run the Siebel ARM post-processing tool using the following command:

   ```
   sarmanalyzer -f sarm_file_name.sarm output_file_name.xml
   ```

   where:

   `sarm_file_name.sarm` = the name and path of the binary Siebel ARM file.

   `output_file_name.xml` = the name and path of the output file. This argument is optional. If not used, Siebel ARM stores the file in the same directory as the Siebel ARM post-processsing tool with the name `sarm.xml`.

3. Review the XML output. For further information on analyzing the performance aggregation analysis XML output, see "About Performance Aggregation Data" on page 205.

For further information on running the Siebel ARM post-processing tool and running the Siebel ARM post-processing tool for other types of analysis, see "Converting Siebel ARM Files" on page 196.

Running Call Graph Generation

Use the following procedure to obtain call graph generation analysis output. For a description of this output type, see "About Call Graph Generation" on page 200.

To run a call graph generation analysis

1. Navigate to the binary subdirectory within the Siebel Server root directory.
2. Run the Siebel ARM post-processing tool using the following command:

   ```
   sarmanalyzer -xml sarm_file_name.sarm
   ```

   where:

   `sarm_file_name.sarm` = the name and path of the binary Siebel ARM file.

3. Review the XML output in the file named *sarm_file_name*.xml, located in the same directory as the Siebel ARM post-processing tool. For further information on analyzing the call graph analysis XML output, see "About Call Graph Generation Data" on page 210.

For further information on running the Siebel ARM post-processing tool and running the Siebel ARM post-processing tool for other types of analysis, see "Converting Siebel ARM Files" on page 196.

Running User Session Trace

Use the following procedure to obtain user session trace analysis output. For a description of this output type, see "About User Session Trace" on page 200.

To run a user session trace analysis

1. Navigate to the binary subdirectory within the Siebel Server root directory.
2. Run the Siebel ARM post-processing tool using the following command:

   ```
   sarmanalyzer –w websrvr_.sarm -s siebsrvr_.sarm -u user_name
   ```

   where:

   *websrvr_*.sarm = the name and path of the Siebel ARM file on the Web server.

   *siebsrvr_*.sarm = the name and path of the Siebel ARM file on the Siebel Server.

   user_name = the User ID of the session you want to trace.

3. Review the XML output in the file named *user_name*.xml, located in the same directory as the Siebel ARM post-processing tool. For further information on analyzing user session trace XML output, see "About User Session Trace Data" on page 212.

For further information on running the Siebel ARM post-processing tool and running the Siebel ARM post-processing tool for other types of analysis, see "Converting Siebel ARM Files" on page 196.

Running Siebel ARM Data CSV Conversion

Use the following procedure to obtain a comma-separated value (CSV) analysis output. For a description of this output type, see "About Siebel ARM Data CSV Conversion" on page 200.

To run a Siebel ARM data to CSV conversion analysis

1. Navigate to the binary subdirectory within the Siebel Server root directory.
2. Run the Siebel ARM post-processing tool using one of the following commands:

   ```
   sarmanalyzer -csv -sarm sarm_file_name.sarm output_file_name.csv
   ```

   or

   ```
   sarmanalyzer -csv -prop sarm_file_name.sarm output_file_name.csv
   ```

   where:

   `sarm_file_name``.sarm` (specified with the `-sarm` flag) = the name and path of the binary Siebel ARM file to be converted to CSV.

   `sarm_file_name``.sarm` (specified with the `-prop` flag) = the name and path of the binary Siebel ARM file to be converted to CSV, but without timing information.

   `output_file_name``.csv` = the name and path of the output file.

3. Review the CSV output. For further information on analyzing CSV data, see "About Siebel ARM to CSV Conversion Data" on page 214.

For further information on running the Siebel ARM post-processing tool and running the Siebel ARM post-processing tool for other types of analysis, see "Converting Siebel ARM Files" on page 196.

Best Practices for Converting Siebel ARM Files

Review the following information as recommendations of best practice when converting Siebel ARM files.

- Make sure the Siebel ARM feature has flushed data to the Siebel ARM file before converting the file. The Siebel ARM feature creates empty Siebel ARM files before data is flushed to the file. For details on this process, see "SARM Memory Size Limit (Alias SARMMaxMemory)" on page 194.

- Change the value of the SARM Memory Size Limit (Alias SARMMaxMemory) to a lower setting if the Siebel ARM files remain empty on a consistent basis. For details on this process, see "SARM Memory Size Limit (Alias SARMMaxMemory)" on page 194.
- Make sure the Siebel ARM file name and path name, as necessary, are correct when referencing the Siebel ARM files in the commands.
- Concatenate Siebel ARM files to increase the amount of performance data for a given process. For example, as the Siebel ARM feature saves five Siebel ARM binary files for each process, concatenate these files to view performance data for multiple requests for this process. (For details on the number of files saved, see "SARM Data File Size Limit (Alias SARMMaxFileSize)" on page 194.)

  TIP: Use a third-party utility to concatenate Siebel ARM files on Windows. Use the command `cat list_of_files filename.sarm` to concatenate Siebel ARM files on UNIX.

  NOTE: Only concatenate Siebel ARM files of the same process.

- Gather performance analysis data on your Siebel application before customizing the application. These baseline measurements provide a good reference when monitoring the performance of your Siebel application after any customizations.
- Run a user session trace analysis if there are performance problems for an individual user during a particular session. The user trace session trace data identifies each request the user made and identifies which request required the longest time when compared to a base line.
- Use the performance aggregation data to diagnose performance at a given point in time or for a certain process. Reviewing the data by group can diagnose the area that is performing poorly. After reviewing a high-level view of the performance data, extrapolate a more detailed review by running the comma-separated value analysis. For details on running this analysis, see "Running Siebel ARM Data CSV Conversion" on page 202.
- Compile performance aggregation data over a period of time to determine a trend analysis.

About Siebel ARM Data

Running the Siebel ARM post-processing tool produces output files of either extensible markup language (XML) or comma-separated value (CSV) format depending on the type of Siebel ARM file conversion.

For details on converting Siebel ARM files and running the Siebel ARM post-processing tool, see "Converting Siebel ARM Files" on page 196. For details on the type of output analyses available when converting Siebel ARM files, see "About Siebel ARM Post-Processing Tool Output" on page 199.

Use an XML editor or Web browser to view the XML output files, which result from a number of types of analyses. Values of timing measurements are included among the XML tags.

Use third-party software—for example, a spreadsheet program—to view the output files that result from the conversion of Siebel ARM files to CSV files. Tags and values of timing measurements are included.

All timings included in both the XML and CSV output are dependent on the operating system in use (microseconds for Windows, nanoseconds for UNIX).

For details on analyzing Siebel ARM output specific to each type of data analysis, see the following sections:

- "About Performance Aggregation Data" on page 205
- "About Call Graph Generation Data" on page 210
- "About User Session Trace Data" on page 212
- "About Siebel ARM to CSV Conversion Data" on page 214

For a scenario of analyzing Siebel ARM post-processing tool output, see "About Siebel ARM Post-Processing Tool" on page 198.

About Performance Aggregation Data

Running a performance aggregation analysis of a Siebel ARM file results in an extensible markup language (XML) output file. This file contains timing data for the areas detailed in Table 11 on page 216.

The XML output file contains the following tag schema, which records the details of the timing data.

```
<Group>
   <Name>
   <ResponseTime>
      <Total>
      <Average>
      <NonRecursiveCalls>
      <RecursiveCalls>
      <Max>
      <Min>
   <ExecutionTime>
      <Total>
      <Calls>
      <Average>
      <Max>
      <Min>
   <Parents>
      <ParentGroup>
         <Name>
         <TotalContributingTime>
         <Calls>
         <Average>
         <ContributingTimePercent>
         <ContributingCallPercent>
   <Children>
      <ChildGroup>
         <Name>
         <TotalContributedTime>
         <Calls>
         <Average>
         <PercentageTime>
         <PercentageCalls>
```

For descriptions on each of the tags, see Table 8.

Table 8. Performance Aggregation Analysis Tags

Tag	Description
`Group`	Specifies each area that Siebel ARM captures performance data. Siebel ARM currently captures data for the following areas: SARM I/O, SWSE, Server Thread (SMI), Database Connector, Scripting Engine, Workflow, and SWE. For details on these areas, see "About Siebel ARM Instrumentation Areas" on page 217.
`ResponseTime`	Specifies the time spent for a request to enter and exit an instrumentation area (layer). Also called inclusive time in other commercial profiling tools. Other tags in this area include: ■ `Total`—Total time spent for a request to enter and exit an instrumentation area (layer). ■ `Average`—Average response time for a request. This value is calculated by dividing total time (`Total`) by number of requests (`NonRecursiveCalls`). ■ `NonRecursiveCalls`—Number of times an instrumentation area is called. This tag helps identify how fast it takes a layer to respond to a request. ■ `RecursiveCalls`—One of the key features of the tool is the capability to handle recursion. An example of a recursive call is if a workflow step calls an Application Object Manager (AOM) function, which also invokes another workflow step. When accounting for the number of times the workflow layer is called, Siebel ARM uses two metrics: RecursiveCalls and NonRecursiveCalls. In the previous example, RecursiveCalls is 1 and NonRecursiveCalls is also 1. When calculating the response time, only the root-level call is accounted for, that is, the first workflow call to the AOM function. When calculating execution time, both calls are accounted for. ■ `Max`—Maximum time for a request to enter and exit an instrumentation area (layer). ■ `Min`—Minimum time for a request to enter and exit an instrumentation area (layer).

Table 8. Performance Aggregation Analysis Tags

Tag	Description
`ExecutionTime`	Specifies the total time spent in a particular instrumentation area, not including the time spent in the descendant layers. It is also called exclusive time in other commercial profiling tools. Other tags in this area include: ■ `Total`—Total time spent for a request to enter and exit an instrumentation area (layer). ■ `Calls`—Total number of calls including both recursive and non-recursive calls. ■ `Average`—Average time spent for a request to enter and exit an instrumentation area (layer). ■ `Max`—Maximum time for a request to enter and exit an instrumentation area (layer). ■ `Min`—Minimum time for a request to enter and exit an instrumentation area (layer).

Table 8. Performance Aggregation Analysis Tags

Tag	Description
`Parents`	Specifies the parents of the group. This information helps identify the caller or callers of a group and the total time and number of calls the group contributed to its parent's response time. Other tags in this area include: ■ `Name`—Name of the parent group. A group is an area of instrumentation (also known as layer). ■ `TotalContributingTime`—Specifies the total time a group contributed to the parent's total time. For example, SWE calls Workflow, Workflow spends a total of 10 seconds, then the Total Contributing Time is 10. If Scripting Engine also calls Workflow, and Workflow spends 40 seconds when called by the Scripting Engine, then the Contributing Time Percentage of SWE to Workflow is (10/50) *100% = 20%. ■ `Calls`—Number of times a parent group is called. ■ `Average`—Average time average time spent in the parent. ■ `ContributingTimePercent`—Percentage of the time in this group when the group is called by the current parent. ■ `ContributingCallPercent`—Percentage of the calls in this group when the group is called by the current parent.

Table 8. Performance Aggregation Analysis Tags

Tag	Description
`Children`	Specifies the areas called by a parent group. Expanding a group's children information determines response time break downs within each of the children. Other tags in this area include: ■ `Name`—Name of the child group. A group is an area of instrumentation (also known as layer). ■ `TotalContributedTime`—Total time a group contributed to the parent's total time. The sum of all the times (response time) contributed by the children added to the area's execution time is the total response time for the area. ■ `Calls`—Number of calls made to a child group. ■ `Average`—Average time spent on a child group. ■ `PercentageTime`—Percentage of the current child group among all the children time. ■ `PercentageCalls`—Percentage of the current child group among all the children calls.

For further information on performance aggregation analysis, see "About Performance Aggregation Analysis" on page 199.

For further information on running a performance aggregation analysis, see "Running Performance Aggregation Analysis" on page 200.

About Call Graph Generation Data

Running a call graph generation analysis of a Siebel ARM file results in an extensible markup language (XML) output file. For a given Siebel ARM file, the Siebel ARM post-processing tool constructs a map with call references. Each node in the call map represents an instrumentation instance. Using this option generates an XML file containing all the calls made by each component (if that component captures response time data).

For descriptions of the SARM IDs that reference an instrumented component, see "About Siebel ARM Architecture" on page 215 and Table 11 on page 216.

The XML output file contains the following tag schema, which records the details of the calls. For descriptions on each of the tags, see Table 9.

```
<Node>
   <SarmID>
   <ParentID>
   <RootID>
   <SenderSrvID>
   <SenderProcID>
   <Area>
   <SubArea>
   <StartTime>
   <Duration>
   <UserInt1>
   <UserInt2>
   <UserString>
   <Node>
```

Table 9. Call Graph Generation Analysis Tags

Tag	Description
`Node`	Each instance of an instrumented area is a node. Each node can have zero to many nodes as its descendants.
`SarmID`	A unique number representing a Siebel ARM instrumentation point.
`ParentID`	A unique number representing the caller of an instrumentation point within the same request. The caller is another instrumented area.
`RootID`	A unique number assigned to a request submitted from the SWSE to the Siebel Server. RootID is also known as Request ID.
`SenderSrvID`	Reserved for future use.
`SenderProcID`	Reserved for future use.
`Area`	Instrumentation element within the Siebel architecture. The seven elements that collect response time information are: SarmIO, SWSE, Server Thread (SMI), SWE, Workflow, Scripting Engine, and Database Connector.

Table 9. Call Graph Generation Analysis Tags

Tag	Description
`SubArea`	Detailed instrumentation within an area of the Siebel architecture. For example, Siebel ARM captures response time for invoking a method (Invoke Method) or executing a step (Step Execution) within a Workflow execution.
`StartTime`	Internal representation of the Siebel ARM record timestamp.
`Duration`	Total time to execute the instrumented area.
`UserInt1`	Context information captured at the point of instrumentation. The value depends on the instrumented area.
`UserInt2`	Context information captured at the point of instrumentation. The value depends on the instrumented area.
`UserString`	Context information captured at the point of instrumentation. The value depends on the instrumented area. For example, name of the method invoked or workflow process initialized.

For further information on call graph generation, see "About Call Graph Generation" on page 200.

For further information on running a call graph generation analysis, see "Running Call Graph Generation" on page 201.

About User Session Trace Data

Running a user session trace analysis using Siebel ARM files from the Web server and the Siebel Server results in an extensible markup language (XML) output file. The XML output file contains detailed information on each of the SWE requests made by the user identified when running the Siebel ARM file conversion.

The XML output file contains the following tag schema, which records the details of user session trace. The user session trace data also contains the tag schema of the performance aggregation analysis.

For details on those tags, see "About Performance Aggregation Data" on page 205.

```
<Session>
   <SessionID>
   <LoginName>
      <SWERequests>
         <SWERequest>
         <ReqID>
         <ClickID>
         <ReqTimeStamp>
         <RequestBody>
         <TotalServerTime>
         <WebServerTime>
         <InfraTime>
         <SiebSrvrTime>
         <DatabaseTime>
         <DatabaseCalls>
         <SiebsrvrDetail>
```

For descriptions on each of the tags specific to the user session trace analysis, see Table 10. For descriptions of the tags that are also a part of the performance aggregation analysis, see Table 8 on page 207.

Table 10. User Session Trace Tag Descriptions

Tag	Description
`Session`	Specifies a specific user session.
`SessionID`	Refers to a unique user session ID in hexadecimal format. The first component of the Session ID refers to the Server ID, the second refers to the Process ID, and the last section to the Task ID. For example: `!1.2b40.182b` Server ID = `!1` Process ID = `2b40` (`2b40` is `11072` in decimal format and represents the Operating System Process ID `11072`) Task ID = `182b`
`LoginName`	The login name of the user.
`ReqID`	An incremental numeric value to count the requests.
`ClickID`	Reserved for future use.
`ReqTimeStamp`	The time when the request was made.

Table 10. User Session Trace Tag Descriptions

Tag	Description
`RequestBody`	Shortened string of the Request Body of the SWE Request.
`TotalServerTime`	Total request time on the servers (includes Web server, Siebel Server, and network time).
`WebServerTime`	Total time spent on the Web server for a given request.
`InfraTime`	Total time spent between the Web server and the Siebel Server. This time may also include some Siebel infrastructure time routing the request to the handling Siebel Server task.
`SiebSrvrTime`	Time spent on the Siebel Server.
`DatabaseTime`	The time spent on the network when communicating to the database.
`DatabaseCalls`	Number of calls to the Siebel Server database connector layer.
`SiebsrvrDetail`	Response time and execution time for each of the architectural areas of instrumentation for a given session.

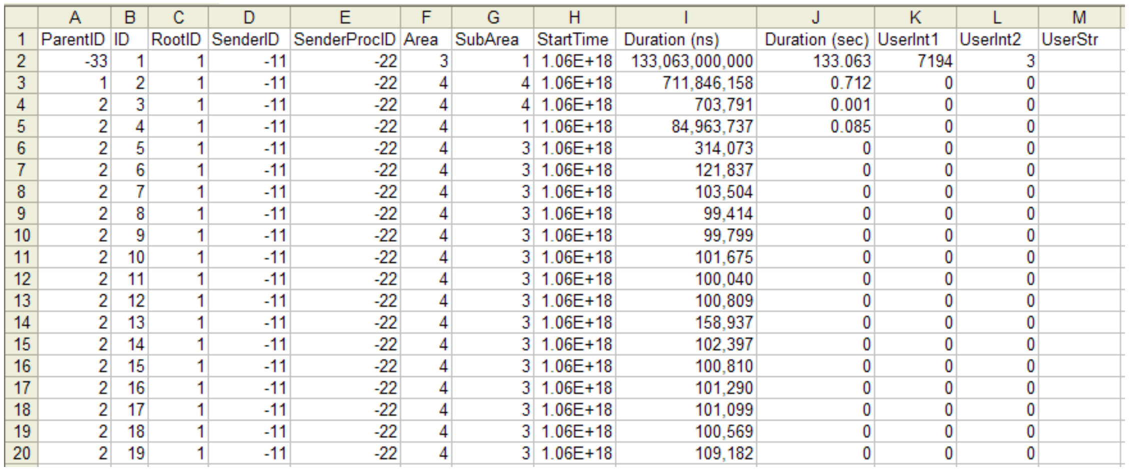
For further information on user session trace analysis, see "About User Session Trace" on page 200.

For further information on running a user session trace analysis, see "Running User Session Trace" on page 202.

About Siebel ARM to CSV Conversion Data

Running a Siebel ARM to CSV conversion analysis results in a comma-separated value file (CSV). The CSV file contains data organized under column headers.

For a listing and description of these column headers, see the definitions of the tags for the call graph analysis in "About Call Graph Generation Data" on page 210. Information can be reviewed and organized by these columns. See Figure 9 for an example of CSV data.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ParentID	ID	RootID	SenderID	SenderProcID	Area	SubArea	StartTime	Duration (ns)	Duration (sec)	UserInt1	UserInt2	UserStr
2	-33	1	1	-11	-22	3	1	1.06E+18	133,063,000,000	133.063	7194	3	
3	1	2	1	-11	-22	4	4	1.06E+18	711,846,158	0.712	0	0	
4	2	3	1	-11	-22	4	4	1.06E+18	703,791	0.001	0	0	
5	2	4	1	-11	-22	4	1	1.06E+18	84,963,737	0.085	0	0	
6	2	5	1	-11	-22	4	3	1.06E+18	314,073	0	0	0	
7	2	6	1	-11	-22	4	3	1.06E+18	121,837	0	0	0	
8	2	7	1	-11	-22	4	3	1.06E+18	103,504	0	0	0	
9	2	8	1	-11	-22	4	3	1.06E+18	99,414	0	0	0	
10	2	9	1	-11	-22	4	3	1.06E+18	99,799	0	0	0	
11	2	10	1	-11	-22	4	3	1.06E+18	101,675	0	0	0	
12	2	11	1	-11	-22	4	3	1.06E+18	100,040	0	0	0	
13	2	12	1	-11	-22	4	3	1.06E+18	100,809	0	0	0	
14	2	13	1	-11	-22	4	3	1.06E+18	158,937	0	0	0	
15	2	14	1	-11	-22	4	3	1.06E+18	102,397	0	0	0	
16	2	15	1	-11	-22	4	3	1.06E+18	100,810	0	0	0	
17	2	16	1	-11	-22	4	3	1.06E+18	101,290	0	0	0	
18	2	17	1	-11	-22	4	3	1.06E+18	101,099	0	0	0	
19	2	18	1	-11	-22	4	3	1.06E+18	100,569	0	0	0	
20	2	19	1	-11	-22	4	3	1.06E+18	109,182	0	0	0	

Figure 9. Example of CSV Analysis Data

For further information on Siebel ARM CSV analysis, see "About Siebel ARM Data CSV Conversion" on page 200.

For further information on running a Siebel ARM Data CSV conversion, see "Running Siebel ARM Data CSV Conversion" on page 202.

About Siebel ARM Architecture

Siebel ARM is a framework for capturing critical performance data in Siebel eBusiness Applications. Siebel ARM captures response times at key monitoring points within the Siebel Server infrastructure. These Siebel ARM monitoring points are classified in the following distinct areas within the Siebel infrastructure:

- **Web Server Time.** Time duration a request has spent on the Web server.
- **Infra-Network Time.** Time duration between a request from the Web server and the Siebel Server (including the network time).

- **Siebel Server Time.** Time duration for the request to be processed by the Siebel Server and Database Server (time between Server Thread (SMI) and any database-layer calls).
- **Database Time.** Time for any Siebel Database-layer calls.

A high-level representation of the Siebel ARM architecture and the four distinct areas of measurement are available in Figure 10.

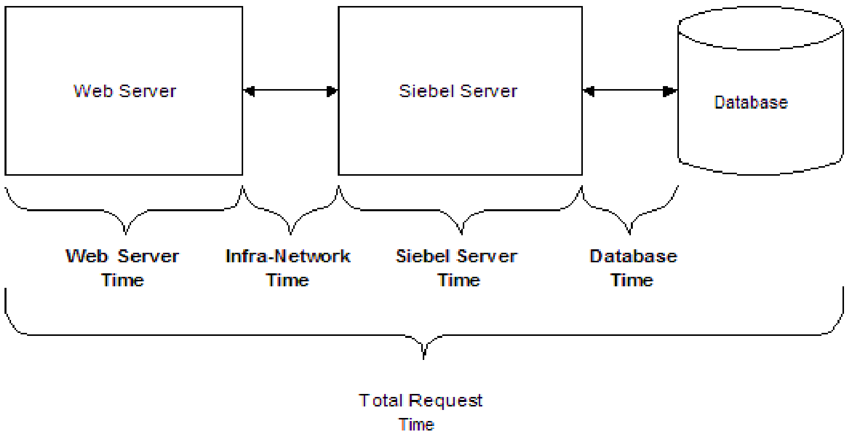


Figure 10. High-Level Representation of Siebel ARM Architecture

The individual areas that contain Siebel ARM instrumentation and the infrastructure events that are captured are listed in Table 11. For descriptions of the Siebel ARM instrumentation areas, see "About Siebel ARM Instrumentation Areas" on page 217.

Table 11. Infrastructure Events Captured by Siebel ARM

Area	Area Number	Subarea 1	Subarea 2	Subarea 3	Subarea 4
SARM I/O	1				
SWSE	2	Login	SWE Request	Session Manager	

Table 11. Infrastructure Events Captured by Siebel ARM

Area	Area Number	Subarea 1	Subarea 2	Subarea 3	Subarea 4
Server Thread (SMI)	3	Request Handling			
Database Connector	4	Execute Query	Write Record	Fetch Next Record	Prepare Statement
Scripting Engine	5	VB Script Execute	VB Script Compilation	eScript Execution	eScript Compilation
Workflow	7	Invoke Method	Process Init	Process Resume	Stop Execution
SWE	8	Process SWE Command	Build View		

About Siebel ARM Instrumentation Areas

The Siebel ARM feature monitors system performance in the following areas:

- **SARM I/O.** This area measures the time it takes to write the Siebel ARM data from memory to disk.
- **SWSE.** This area measures the time duration between an entry to the Siebel Web Server Extension (SWSE) and any messages sent to the Siebel Server. This area also measures time spent in the Siebel Gateway Name Server and with the Resonate Central Dispatch load-balancing application. Subareas of measurement within this area are the following:
  - **Login.** Time spent to request a user login.
  - **SWE Request.** Time for SWSE to handle a request.
  - **Session Manager.** Time for the Session Manager to handle a request.
- **Server Thread (SMI).** Server Thread (SMI) is the area in the Siebel architecture that handles all Siebel Server requests. This area is the entry point of a request from the Web server to the Siebel Server. The time indicates the duration it takes the Siebel Server to handle a request. The subarea of measurement within this area is:
  - **Request Handling.** Total time to handle a request on the Siebel Server.

- **Database Connector.** This area measures the total time required for a given request when calling the Database Connector layer. There is no measurement of internal database operations. Subareas of measurement within this area are the following:
  - **Execute Query.** Time to execute a select statement.
  - **Write Record.** Time to execute a delete, update, or insert statement.
  - **Fetch Next Record.** Time to fetch a record from a query.
  - **Prepare Statement.** Time to prepare an SQL statement.
- **Scripting Engine.** This area measures the time required to execute a script. Subareas of measurement within this area are the following:
  - **VB Script Execute.** Time to execute a VB script.
  - **VB Script Compilation.** Time to compile a VB script.
  - **eScript Execution.** Time to execute an eScript script.
  - **eScript Compilation.** Time to compile an eScript script.
- **Workflow.** This area measures the time required to execute a Workflow process. Subareas of measurement within this area are the following:
  - **Invoke Method.** Time required to invoke a method.
  - **Process Init.** Time required to initialize a process (workflow).
  - **Process Resume.** Time required to resume a process (workflow).
  - **Step Execution.** Time required to execute a step within a process (workflow).
- **SWE.** The Siebel Web Engine (SWE) executes within the context of the Application Object Manager (AOM). Therefore, any time spent in the SWE is a subset of the total AOM time. Subareas of measurement within this area are the following:
  - **Process SWE Command.** Time required to process a request submitted to SWE.

- **Build View.** The SWE assembles the Siebel view using Web templates. The AOM then sends the Siebel view to the Web server and SWSE, which then passes it to the Web browser. This metric reflects the time required to assemble and build the view.

Example of Analyzing Siebel ARM Output

This topic gives one example of how to analyze Siebel ARM output. You may use Siebel ARM output differently, depending on your business model.

After running a performance aggregation analysis, the Siebel ARM post-processing tool produces the following XML output:

```
-<xml>
-<Group>
   <Name>SMI</Name>
      -<ResponseTime>
         <Total>325577844947</Total>
         <Average>1839422852</Average>
         <NonRecursiveCalls>177</NonRecursiveCalls>
         <RecursiveCalls>0</RecursiveCalls>
         <Max>133062957179</Max>
         <Min>3293465</Min>
      </ResponseTime>
      <ExecutionTime>
      <Parents />
      -<Children>
</Group>
-<Group>
   <Name>Database</Name>
      -<ResponseTime>
         <Total>28846037763</Total>
         <Average>2804943</Average>
         <NonRecursiveCalls>10284</NonRecursiveCalls>
         <RecursiveCalls>106</RecursiveCalls>
         <Max>3623108101</Max>
         <Min>47397</Min>
      </ResponseTime>
      +<ExecutionTime>
      +<Parents>
      +<Children>
</Group>
-<Group>
   <Name>SarmIO</Name>
      -<ResponseTime>
```

```
            <Total>756465475</Total>
            <Average>6200536</Average>
            <NonRecursiveCalls>122</NonRecursiveCalls>
            <RecursiveCalls>0</RecursiveCalls>
            <Max>181488478</Max>
            <Min>730255</Min>
         </ResponseTime>
         +<ExecutionTime>
         +<Parents>
         <Children/>
   </Group>
   -<Group>
      <Name>SWE</Name>
         -<ResponseTime>
            <Total>167202095979</Total>
            <Average>966486103</Average>
            <NonRecursiveCalls>173</NonRecursiveCalls>
            <RecursiveCalls>16</RecursiveCalls>
            <Max>51087996109</Max>
            <Min>141423</Min>
         </ResponseTime>
         -<ExecutionTime>
         -<Parents>
         -<Children>
   </Group>
   -<Group>
      <Name>Scripting Engine</Name>
         -<ResponseTime>
            <Total>42078467851</Total>
            <Average>825067997</Average>
            <NonRecursiveCalls>51</NonRecursiveCalls>
            <RecursiveCalls>0</RecursiveCalls>
            <Max>40459460508</Max>
            <Min>852767</Min>
         </ResponseTime>
         +<ExecutionTime>
         +<Parents>
         +<Children>
   </Group>
   -<Group>
      <Name>Workflow Engine</Name>
         -<ResponseTime>
            <Total>41809855132</Total>
            <Average>10452463783</Average>
            <NonRecursiveCalls>4</NonRecursiveCalls>
            <RecursiveCalls>14</RecursiveCalls>
            <Max>40450981149</Max>
            <Min>635413</Min>
         </ResponseTime>
         +<ExecutionTime>
         +<Parents>
         +<Children>
   </Group>
   </xml>
```

As a first step in analyzing this output, review the response time of each group, noting the group with the highest response time. The results of this review appear in Table 12.

Table 12. Response Times Per Group

Group	Response Time (Nanoseconds)	Response Time (Seconds)
Server Thread (SMI)	325,577,844,947	325
Database	28,846,037,763	28
SARM I/O	756,465,475	.75
SWE	167,202,095,979	167
Scripting Engine	42,078,467,851	42
Workflow Engine	41,809,855,132	41

The Server Thread (SMI) group had the largest response time. Reviewing the SMI group in further detail reveals:

- On average, it took 1.8 seconds to process a Server Thread (SMI) request.
- The maximum time to process a Server Thread (SMI) request was 133 seconds.
- The minimum time to process a Server Thread (SMI) request was .003 seconds.

Therefore, the Server Thread (SMI) request that took much longer than the average (133 seconds) could indicate an area for performance improvement. To investigate further, expand the Server Thread (SMI) group, which produces the following output:

```
-<xml>
-<Group>
   <Name>SMI</Name>
```

```
      -<ResponseTime>
      +<ExecutionTime>
      <Parents />
      -<Children>
      -<ChildGroup>
         <Name>Database</Name>
         <TotalContributedTime>10052385093</TotalContributedTime>
         <Calls>7378</Calls>
         <Average>1362481</Average>
         <PercentageTime>5.65</PercentageTime>
         <PercentageCalls>96.62</PercentageCalls>
      </ChildGroup>
      -<ChildGroup>
         <Name>SarmIO</Name>
         <TotalContributedTime>695242267</TotalContributedTime>
         <Calls>85</Calls>
         <Average>8179320</Average>
         <PercentageTime>0.39</PercentageTime>
         <PercentageCalls>1.11</PercentageCalls>
      </ChildGroup>
      -<ChildGroup>
         <Name>SWE</Name>
         <TotalContributedTime>167202095979</TotalContributedTime>
         <Calls>173</Calls>
         <Average>966486103</Average>
         <PercentageTime>93.96</PercentageTime>
         <PercentageCalls>2.27</PercentageCalls>
         </ChildGroup>
      </Children>
</Group>
+<Group>
+<Group>
</xml>
```

The SWE area's contribution time was the highest with 167 seconds, against 10 seconds for the Database area and .6 seconds for the SarmIO area.

The total number of calls spent on the children groups is only 2.27% (173 / (7378 + 85 + 173)) of the calls (PercentageCalls) were made to SWE. However, those 2.27% accounted for 93.96% (167202095979 / (10052385093 + 695242267 + 167202095979)) of the execution time (PercentageTime) within the children groups.

Although there are very few calls within the SWE child group, the percent of time (93.96%) spent on those SWE calls was very high. With this information, a further review of the SWE area is necessary.

After further review and isolation, this output file indicated the SWE and scripting engine areas experienced higher response times. These areas indicate that some of the application views may be too complex. For further analysis and to refine the source of longer response times:

- Run the user session trace analysis. For further details on this analysis, see "Running User Session Trace" on page 202.
- Run the Siebel ARM to CSV data analysis. For further details on this analysis, see "Running Siebel ARM Data CSV Conversion" on page 202.

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