Performance Analysis for Oracle

Performance Analysis Agent

Hardware Guidelines & Considerations
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Abstract

Performance Analysis offers a comprehensive suite for diagnosing and tuning Oracle instance and application workloads. Through advanced diagnostic features and specially-designed interfaces, Performance Analysis transforms Oracle performance management into a faster, easier and more efficient experience.

Performance Analysis is a database real-time monitoring and historical analysis application. The Performance Analysis application uses the StealthCollect™ resource-light high sampling rate technology, with the capacity to bind between the (anonymous) database activities and the real users, programs and Oracle resource consumers (dimensions) in an intuitive user-friendly interface. Listings, reports, and graphical flows and charts grant you both a system-wide perspective and the ability to drill-down into any existing or user-defined unit.

Oracle instance performance monitoring by system and database administrators is immeasurably enhanced by the Performance Analysis ability to bring together in one screen and report all mission-critical performance data in a customizable manner.

Effective data collection and analysis is essential for identifying and correcting performance problems. Performance Analysis provides the means to comprehensively record Oracle instance activity for an unlimited period for analysis and diagnosis. With Performance Analysis you can:

Perform root cause analysis: Rapidly identify bottlenecks, anomalies, and application trends to the level of their causal factors. The analysis, supported by a unique graphical interface, reduces data sprawl and adds intelligence to facilitate quick and confident responses.

Focus on top resource consumers to easily drill down to the specific offending dimension domains (SQL statements, users, programs, machines, and so forth) and files.

The Hardware Guidelines and Considerations document is designed to assist with Performance Analysis agent deployment by providing the possible Performance Analysis agent configurations and the hardware settings required to meet the user's environment's needs.

The document centers on the agent's two main focal points: the middleware and the long term Performance Repository components.

Quest Software highly recommends that large deployments of Performance Analysis agents be planned and performed in conjunction with Quest Professional Services.
Performance Analysis Agent Architecture

Overview

Performance Analysis agent (also known as StealthCollect™) is a server-based agent that samples and collects (multiple times per second) performance data directly from the Oracle instance’s SGA (System Global Area) and from the operating system.

Figure 1 – Performance Analysis agent Architecture

The Performance Analysis agent architecture (Figure 1) comprises the following primary components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector</td>
<td>The component responsible for sampling performance data directly from the Oracle's SGA.</td>
</tr>
<tr>
<td>Middleware</td>
<td>The component responsible for the aggregation and storage of performance data to satisfy both short-term and long-term queries. Short-term performance data is stored and managed in an internal database allocated on raw operating system files. The Middleware component handles all data processing and Client communications.</td>
</tr>
</tbody>
</table>
### Component Description

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Repository</td>
<td>The Performance Repository is an additional Oracle instance, serving as a data warehouse for long-term historical performance data.</td>
</tr>
</tbody>
</table>

**Table 1 – Key Performance Analysis Agent Components**

### Single-Tier versus Multi-Tier Configurations

Performance Analysis agent supports the following types of installation architectures: Single-Tier Configuration and Multi-Tier Configuration.

The configuration chosen affects both product installation and the required hardware settings to host the agent.

**Note:** After the agent has been installed, changing the tier configuration is not automated and requires a manual procedure.

This document first reviews the nature of each configuration, followed-up with a relative comparison.

### Single-Tier Configuration

![Single-Tier Configuration Diagram]

**Figure 2 – Single-Tier Configuration**

In a single-tier configuration (Figure 2), all Performance Analysis agent components are installed on the monitored instance host. This is the simplest configuration.

The Performance Repository is located on a host other than the monitored instance.
This configuration imposes additional overhead on the monitored host.

**Note:** Locating the Performance Repository on the monitored host is not advisable.

## Multi-Tier Configuration

![Multi-Tier Configuration Diagram](image)

**Figure 3 – Multi-Tier Installation**

In a multi-tier installation (Figure 3), the Middleware component is installed on a host other than that of the monitored instance, providing optimal performance. The middle-tier platform and the monitored host platform are independent of one another, for example, a middle-tier can run on Windows while the Oracle instance runs on Sun Solaris.

The Performance Repository can be located either on the middle-tier host or on a separate tier.

## Architecture Comparison

As demonstrated by the above illustrations, the multi-tier configuration facilitates a deployment of the Performance Analysis agent Middleware component to a host other than that of the monitored instance.

The following table presents the relevant comparison issues between the two architecture types:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Single Tier</th>
<th>Multi Tier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topic</td>
<td>Single Tier</td>
<td>Multi Tier</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CPU and RAM footprint</td>
<td>−</td>
<td>+</td>
<td>The Middleware component is Performance Analysis agent's primary processing unit. It deals with the entire performance data lifecycle, including: Aggregating real-time and historical data. Purging aged-out data. Tracking sessions and cursors. Running user-defined collections. Handling Client queries and communication. Using a separate middle-tier host offloads the CPU and memory footprint from the production system.</td>
</tr>
<tr>
<td>I/O footprint</td>
<td>−</td>
<td>+</td>
<td>Availability and cost of disk space The Middleware component stores short-term data in raw operating system files. The total data files size requirement averages approximately 2 GB per monitored instance. Free space in production environments tends to be scarce and more expensive. A separate middle-tier host with a separate storage system may utilize a cheaper storage space. I/O Load and Capacity The Middleware component manages the short-term historical data in a set of raw operating system files. These procedures generate an I/O load of approximately 2 MB per minute (for each monitored instance). Even though such loads are negligible for most production environments, a separate middle-tier host (provided that storage is not shared) will also eliminate the I/O footprint from the production environment.</td>
</tr>
<tr>
<td>Manageability</td>
<td>−</td>
<td>+</td>
<td>A single middle-tier host in a multi-tier configuration can serve many monitored instances, reducing the administration and maintenance costs of managing multiple middleware components on multiple middle-tier hosts. For example: Middleware components executable patches should be applied only once. Simpler backup policies.</td>
</tr>
<tr>
<td>Ease of installation</td>
<td>+</td>
<td></td>
<td>Single-Tier installations are easier to deploy as they involve less hosts and therefore less configuration</td>
</tr>
</tbody>
</table>
and user input.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Single Tier</th>
<th>Multi Tier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>–</td>
<td>?</td>
<td>When evaluating the solution's cost, several considerations are involved. There are no definitive guidelines for determining which solution is cheaper. Cost should be evaluated on a per-system basis. The multi-tier configuration requires an additional host, increasing the solution's initial costs. CPU, I/O and RAM resources, when allocated from the production environment's capacity, tend to be marginally more expensive than when allocated from an additional tier.</td>
</tr>
</tbody>
</table>

Table 2 – Comparison of Single-tier versus Multi-tier architectures

The multi-tier architecture is superior to the single-tier architecture in almost any aspect, hence is the recommended solution for deploying Performance Analysis agents to production environments.
Hardware Considerations

Performance Analysis agent is designed to monitor any production environment workload, based on adequate hardware allocation. As per the above, the multi-tier installation model, although beneficial, requires an additional host to serve the Performance Analysis agent Middleware component.

Choosing the proper hardware configuration therefore involves the following considerations:

Should the Performance Repository be installed on the middle-tier host?

How should the middle-tier hardware size and settings be determined?

Middle-tier Host & Performance Repository Location

Assuming the multi-tier configuration is employed, the Performance Repository can be located either on the same host as the Middleware component or on a third host. Both approaches are valid; the decision should, however, be based on factors such as hardware availability and costs.

The following guidelines summarize the major considerations when deciding upon the Performance Repository's location:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
</table>
| Middle-tier Host Capacity | Generally, locating the Performance Repository instance on a host other than that of the Middleware component results in a more scalable solution. Such configuration allows each of the Performance Analysis agent components to be separately scaled.  
This document contains hardware recommendations that distinguish between hosts containing only the Performance Analysis agent Middleware component and hosts that contain the Performance Repository as well.  
Assuming the required hardware is available, no technical reason prevents installing the Middleware component and the Performance Repository on the same host. |
| Manageability   | Locating the Performance Repository on a third host complicates the environment, thereby increasing the management costs.                                                                                     |
| Cost            | The hardware requirements of a host that serves both the Middleware component and the Performance Repository are obviously higher. The cost of hardware tends to be non-linear to the hardware specification, so the cost of a host that would serve both the Middleware component and the Performance Repository might be higher than the cost of two separate hosts (each with lower capacity).  
This, however, should be evaluated on a per-case basis. |

Table 3 – Key Considerations for Performance Repository Location
Middle-tier Hardware Settings

For the sake of simplicity, this document distinguishes between two types of monitored environments:

- **Typical** – an all-purpose database instance in the service of a common SMB (small-to-medium business) environment.

A typical Middleware component is designed to serve up to five monitored instances. Such an environment is adequately addressed with a commonly recommended middle-tier host configuration, regardless of the nature of the application and its associated load.

- **Extreme/Custom** – high-end environment either
  - monitoring large number (more than five) of instances.
  - or
  - serving excessive workloads or large numbers of executing sessions and SQL statements.

For the purpose of the below discussion, an environment is considered extreme when it follows any of the below activity measurements:

- Extremely large number of database sessions (> 1,000), many of which are active
- A large number of concurrent open cursors (> 50,000)

Such environments require planning and sizing of the supporting hardware. The following sections will provide the guidelines for hardware requirements of the above environment types.

Guidelines for a Typical Middle-tier Host Hardware Specifications

The table below contains the specification of a typical middle-tier host for an installation that does not employ a Performance Repository instance. This middle-tier can be used for common sites consisting of up to approximately five monitored instances.
Typical Middle-tier Host Hardware Specification (without Performance Repository)

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Server class (recommended) / Workstation class</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>[Server] 1 x Core 2 Duo Intel® Xeon – 2.6 GHz</td>
</tr>
<tr>
<td></td>
<td>[Workstation] 1 x Pentium 4 - 2.6 GHz</td>
</tr>
<tr>
<td>Memory</td>
<td>2 GB RAM</td>
</tr>
<tr>
<td>Hard drive</td>
<td>[Server] 1 x 72 GB 15,000 rpm</td>
</tr>
<tr>
<td></td>
<td>[Workstation] 1 x 72 GB 10,000 rpm</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows 2003 Server</td>
</tr>
</tbody>
</table>

Table 4 – Typical Middle-tier Host Hardware Specification (without Performance Repository)

The following table contains the specification of a typical middle-tier host for an installation that employs a Performance Repository instance. This middle-tier can be used for common sites consisting of up to approximately five monitored instances.

Typical Middle-tier Host Hardware Specification (with Performance Repository)

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Server class</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>2 x Core 2 Duo Intel® Xeon – 2.6 GHz</td>
</tr>
<tr>
<td>Memory</td>
<td>4 GB RAM</td>
</tr>
<tr>
<td>Hard drive</td>
<td>3 x 72 GB 15,000 rpm</td>
</tr>
<tr>
<td></td>
<td>RAID configuration recommended (striping)</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows 2003 Server</td>
</tr>
</tbody>
</table>

Table 5 – Typical Middle-tier Host Hardware Specification (with Performance Repository)

Guidelines for Extreme/Custom Middle-tier Host Specifications

The specification of a typical middle-tier host should suffice for typical environments. However, when planning the deployment of a large quantity of Performance Analysis agents or when monitoring extreme environments, prior planning is required to optimally size the hosting hardware.

Quest facilitates this task by offering a Performance Analysis sizing spreadsheet, which enables obtaining a recommendation for the middle-tier host specification, based on the monitored instances' characteristics. The spreadsheet uses an analytical methodology to propose optimal recommendation for hardware requirements.
Follow the steps below to size your middle-tier:

1. Obtain the sizing spreadsheet *PAO_Middleware_Sizing_Assistant.xls*, available through Quest Support or Quest Professional Services.

   The purpose of this spreadsheet is to provide a ‘best estimates’ infrastructure to support the targeted Performance Analysis installation. Quest Software highly recommends using this tool and the analysis of its results in conjunction with Quest Professional Services.

2. Fill-in all requested information regarding the Oracle instances that are to be monitored by the same middle-tier host.

The spreadsheet will automatically calculate the CPU power, memory size and disk space requirements suitable for the specified environment.

**Utilizing Scalability Presets**

When planning a massive deployment of Performance Analysis agents on multiple instances some instances may be more critical than others. For such instances, complete monitoring coverage is required. For non-mission critical instances the agent resource consumption (RAM and CPU) can be significantly decreased by reducing the granularity and/or completeness of the collected data. To address this need, Performance Analysis offers several predefined configuration presets that can be chosen during the installation, as follows:

- **Recommended Default resource Consumption and data collection** (default) - this preset provides the recommended granularity of data sampling and level of resource consumption on the middle-tier host. This preset should meet the needs of the majority of the users.

- **Increased Resource Consumption with complete data collection** – this preset provides complete data collection while consuming additional resources on the middle-tier host.

- **Minimal Resource Consumption with partial data collection** – This preset consumes the fewest system resources at the expense of data collection completeness. Choose this option to allow the same middle-tier host to serve more monitored instances.

- **Custom** – features all individual resource-saving options for advanced manual customization.

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**Note:** The above presets can also be changed after the installation via the Agent Administration utility.
Performance Repository Considerations

The Performance Repository is designed to serve multiple installations, monitoring multiple Oracle instances. As such, it can scale for large amounts of data, given optimal environmental factors:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Repository Host</td>
<td>The Performance Repository can be installed on any host which is SQL*Net accessible from the middle-tier host, including the middle-tier host itself. Placing the Performance Repository on a third host improves the application’s scalability and is highly recommended for environments in which the same Middleware component serves more than 10 monitored instances.</td>
</tr>
<tr>
<td>I/O Configuration</td>
<td>The Performance Repository itself is a database instance; hence general Oracle I/O tuning guidelines apply. If the Performance Repository is intended to support more than five monitored instances, it is recommended to install the Performance Repository instance on a RAID array and to utilize striping.</td>
</tr>
<tr>
<td>Instance Configuration</td>
<td>A typical Oracle installation (performed using the Oracle Configuration Assistant) will suffice. Choose the Data Warehouse configuration option when creating the Oracle database. The value of the following init.ora parameters should be adjusted as follows: query_rewrite_enabled=true star_trasformation_enabled = true sort_area_size = 3145728 The size of the Performance Repository instance’s undo area should be at least 10% of the aggregated size of all monitored instances SYSTEM tablespace.</td>
</tr>
<tr>
<td>Performance Repository Capacity</td>
<td>The Performance Repository instance can handle up to 40 monitored instances. For supporting more than 40 monitored instances, the repository has to be partitioned (see section Partitioned Performance Repository Configuration).</td>
</tr>
</tbody>
</table>

Table 6 – Performance Repository Considerations

Partitioned Performance Repository Configuration

For customers configuring a single Performance Repository database to serve large quantity (>40) of installations, an advanced Partitioned Repository option can be used. The Performance Repository partitioning allows utilizing Oracle’s partitioning capabilities to configure repositories that enable concurrent processing for multiple monitored instances.
Using this configuration allows better consumption of database resources by multiple installations, thereby enabling improved repository scalability.

Using Partitioned Performance Repository requires further steps:
Planning the amount of installations to be served by the Performance Repository
Manually installing the partitioned Performance Repository database using supplied scripts.
Installing the agents and configuring them to use the partitioned Performance Repository database.
Adding new partitions to the repository (optional - upon a need to serve additional monitored instances).

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**Note:** For detailed description of using Partitioned Performance Repository, please see the document Performance Analysis for Oracle – Repository Partitioning Option.pdf, located under the Others tab of the Document Library in Quest Performance Analysis for Oracle website (http://www.quest.com/performance_analysis_for_oracle/).