Oracle E-Business Suite (EBS) in the World of Oracle Exadata Engineered Systems

As a proof-of-concept to evaluate the benefits of moving the Oracle E-Business Suite (EBS) database tier to the Oracle Exadata Database Machine, we ported a real world dataset comprising a sanitized copy of a leading credit services company's Global ERP instance to an Exadata engineered system.

The performance of this migrated EBS instance was compared to the original existing conventional production hardware to quantify real performance gains and cost benefits. With minimal tuning, critical batches ran an average of five to ten times faster. Front end access as measured by Oracle Application Testing Suite was twice as fast, with only one fifth of the application servers.

This paper elaborates the studied benefits of using Oracle Exadata to accelerate ERP solutions.
About the Authors

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Soumyajit Haldar currently works with the Exadata Center of Excellence for TCS. He is an experienced Oracle Consultant with seven years experience involving installation and maintenance of various Oracle products. Soumyajit holds a Bachelors Degree in Technology with specialization in Computer Science and Engineering from West Bengal University of Technology. He is an Oracle Certified Exadata Implementation Specialist.
Introduction

Faster access to data—and the ability to rapidly analyze, interpret, and act upon that data to make informed business decisions—is an active requirement of nearly every organization.

Oracle Exadata Database Machine, a complete hardware and software solution for high-performance data warehousing, online transaction processing (OLTP), and mixed workloads, significantly increases data access and analysis speed while reducing hardware costs, licensing fees, and maintenance and support costs.

From large Oracle enterprise resource planning (ERP) shops in need of a regular hardware refresh to smaller organizations looking for higher performance with a scalable platform, Oracle provides an Exadata based solution to fit. In addition, the introduction of the eighth rack configuration on the Oracle Exadata Database Machine offers flexibility and the ability to scale with the infrastructure-as-a-service (IaaS) model, which in turn increases the reach of Oracle’s engineered systems.

Using Oracle E-Business Suite (EBS) on Exadata can improve performance and reduce costs significantly. Even without Oracle Exalogic, Exadata remains a good option for a hardware refresh for an EBS install. Exadata Database File System (DBFS) has been used as a staging area for Oracle Data Pump to transfer data from non Exadata to Exadata systems, and provides excellent performance when compared to traditional file systems.

To demonstrate the benefits of deploying Exadata for EBS, we performed a test migration. In a model scenario using actual customer data, critical batch jobs ran an average of five times faster—and, on occasion, up to ten times faster. Response times were cut in half, and hardware configuration was downsized, leading to licensing cost benefits. Exadata also reduced the dependence on external storage, radically simplifying architecture as well as support considerations.

Oracle E-Business Suite Conventional Tuning

EBS as an ERP tool has been around since the 1980s, and has been fine-tuned via SQL hints and indexing to ensure good performance. The test instance had over a hundred thousand indexes, over half of which were related to general ledger tables.

Oracle discourages tampering with seeded code, including indexes. However, it is believed that normal database indexes are not desirable from an Exadata point of view, as they disable Smart Scan, one of Exadata’s signature features.

Why Smart Scan is Not Indispensable

Smart Scan, one of the headline features of Oracle Exadata, was created to help increase query processing speeds. It is designed to reduce data transfer volumes and increase processing efficiency.

However, Smart Scan is not a major contributor to performance improvement in Exadata for OLTP and mixed workloads such as EBS.

There are several reasons smart scans may not occur in an EBS Exadata scenario:

- Direct read access: For a smart scan to begin, a special type of access, known as a direct read, is required. Direct reads are not triggered if the size of the table being queried is smaller than the
' _small_table_threshhold_', around 2% of the database buffer cache, a component of the Oracle system global area (SGA) size.

Compared to conventional hardware, the SGA in Exadata tends to be larger to boost performance. But compared to data warehouse tables, EBS tables tend to be smaller. From a total of 155,000 objects (tables, indexes, and their partitions) in the EBS database, only 662 objects, or less than 0.5%, were eligible for Smart Scan in the test scenario.

- **Hints and indexes:** The presence of hints and indexes will cause the Oracle optimizer to choose against Smart Scan and adopt block retrieval optimizer paths. This behavior is visible as cell single block reads. Since there is a majority of single row retrieval operations, Smart Scan is not the optimal retrieval pattern.

- **System context:** Many EBS queries are dependent on the system context as part of the selection criteria, and such functions cannot use Smart Scan for filtering.

- **Full scans:** Full table scans and index fast full scans are less prevalent in EBS code, as these do not perform well on non-Exadata hardware.

Other OLTP features, listed as follows, take the forefront in a majority of Oracle seeded code:

- Smart read-write flash cache
- Smart flash logging to ensure the fastest log commits
- The high speed infiniband network to reduce I/O latency

**Methodology for Test Scenario**

The real world dataset of a leading credit services company’s global ERP instance was used for the test scenario. The customer’s original system consisted of five application nodes and five database nodes, each with four quad core processors.

After being sanitized and scrambled, the customer’s data was imported into the Exadata CoE laboratory X2-2 quarter-rack database machine at TCS. The instance is approximately 2 terabytes in size, and hosts an EBS global unified ERP instance. It includes all the major financial modules, HRMS, and iRecruitment, involving multiple countries across different continents.

The performance benchmarking results of several important batch programs of EBS that we recorded are listed in **Table 1**. Multiple iterations were executed to explore various conditions, and the comparison results of all iterations have been provided.

The benchmarking focused on six functionalities within EBS, namely:
1. Customer Interface
2. Auto Invoice (run for two separate organizational units within the instance)
3. Scoring Engine
4. Strategy Management
5. Service Contract Main Billing
6. AR Reconciliation Report
A load test of 100 and 150 concurrent users, respectively, was carried out using the Oracle load testing module from the Oracle Application Testing Suite. The results of this test are displayed in Table 2. The following procedure was carried out to set up and run the test:

1. Identified the listed online business activities.
2. Generated load testing scripts with the OpenScript IDE provided with Oracle Application Testing Suite, by navigating through the required Oracle Forms and web pages.
3. Marked each step in the scenarios with appropriate logical divisions. For example, logging into the application would have a step group called ‘login’.
4. Parameterized the recorded scripts using variables, so that the scripts became dynamic and could be run in different sessions simultaneously.
5. Transferred the scripts to the repository folder of the Oracle Application Testing Suite ‘injector’, which was used to create a transaction mix (a scenario in which multiple users perform different business activities for a variable number of iterations within a specified time frame). The injector allowed users to choose how many times each scenario was to be executed, and at what interval. This allowed for simulation of a real-life scenario: a user could test the load on the application under test (AUT), and thereby the performance of the system.
6. Created two scenarios in the injector by choosing all the required load test scripts and by mixing both business cases with web and forms:
   a. 100 concurrent users, 30-minute run
   b. 150 concurrent users, 30-minute run
7. Ran the scenarios through injector and monitored the run details and server use.
8. After successful completion, generated different metrics of the run in graphical format, and analyzed system responses and the behavior when subjected to a typical load of business activities.

<table>
<thead>
<tr>
<th>Batch Name</th>
<th>Exadata (Mins)</th>
<th>Non-Exadata (Mins)</th>
<th>Gain (x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Interface</td>
<td>78.33</td>
<td>789.47</td>
<td>10.08</td>
</tr>
<tr>
<td>Auto Invoice (Country1)</td>
<td>113.83</td>
<td>534.52</td>
<td>4.70</td>
</tr>
<tr>
<td>Scoring Engine</td>
<td>91.5</td>
<td>317.33</td>
<td>3.47</td>
</tr>
<tr>
<td>Strategy Management</td>
<td>276.28</td>
<td>386.68</td>
<td>1.40</td>
</tr>
<tr>
<td>Auto Invoice (Country2)</td>
<td>85.23</td>
<td>480.6</td>
<td>5.64</td>
</tr>
<tr>
<td>Service Contract Main Billing</td>
<td>223.13</td>
<td>485.19</td>
<td>2.17</td>
</tr>
<tr>
<td>AR Reconciliation Report</td>
<td>27.63</td>
<td>142.68</td>
<td>5.16</td>
</tr>
</tbody>
</table>

Table 1: Data for a Particular Month-End Batch Run

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In all the cases, high CPU usage for all batches was observed. Database CPU time is a measure of the CPU-bound nature of a batch. For this reason, programs with lower CPU time showed greater gains due to reduction in I/O waits.

<table>
<thead>
<tr>
<th>Business Process</th>
<th>Non-Exdata</th>
<th>Exadata</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Avg. Response Time (Sec)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asset Addition</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Create AP Invoice</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td>Create AR Transaction</td>
<td>13</td>
<td>7.5</td>
</tr>
<tr>
<td>Create Supplier</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Create Receipt</td>
<td>12</td>
<td>6.5</td>
</tr>
<tr>
<td>Employee Hire</td>
<td>18</td>
<td>9.5</td>
</tr>
<tr>
<td>View Pay Slip</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2: Response Times of 150 Concurrent Users for Online Business Activities

Figure 1: Flash Cache Hit Ratio
Testing Tool (Oracle Application Testing Suite)

Oracle Application Testing Suite is an ideal solution for testing web applications, Oracle packaged applications, and Oracle front-end-technologies like Oracle Forms—mainly because it was developed and designed with Oracle technologies in mind.

To test Oracle Forms for functional or load testing, the Oracle applications testing accelerator may be used. Oracle Forms support in Oracle Application Testing Suite was developed in conjunction with the EBS development team (EBS uses both a web and forms front-end). It contains several useful features, such as:

- **Functional Testing:** All solutions in the market use the forms label to identify forms objects. However, this method is not ideal, as the labels may change from language to language or from version to version of the application. The Oracle solution identifies the forms objects based on the object name, making identification of objects more robust and avoiding problems later in the process.

- **OpenScript:** OpenScript is the only scripting environment used for both functional test scripting and load and performance test scripting. OpenScript is based on Eclipse, and the scripts are available for editing both graphically and as Java code. The language used is Java.

- **Load Testing:** The accelerator can perform tests based on http/https/nca. It has predefined correlation rules and works with web forms 6i, 10g, and 11g.

For these reasons, Oracle load testing simulates forms traffic more accurately than other tools. All test cases mentioned here have been developed using this suite of tools.

Cost Benefits of the Exadata Solution

The cost of each of the five database servers replaced by Exadata is approximately USD15,000. The cost of conventional SAN is roughly USD 1.5 per gigabyte per month. Over a 5-year period, assuming a requirement of four terabytes of user data including database and FRA backup space, the cost of the conventional system amounts to USD 435,000.

The Exadata quarter-rack HP delivers six terabytes of disk space and has a list price of USD 330,000. Therefore, the hardware cost benefit is USD 105,000.

The conventional system used by this customer requires 40 Oracle database licenses for the 80 cores of the database nodes, because Oracle’s core licensing factor is 0.5 for Intel-based hardware. Exadata requires only 12 database licenses so using Exadata yields savings of 28 database licenses at a list price of USD 47,500 per license.

In addition, Exadata requires a license for the Exadata storage software that is USD 10,000 per disk drive for an additional license cost of USD 360,000 for a quarter rack. The difference in licensing costs of the conventional system versus the Exadata system thus is USD 970,000 in total, excluding any discounts.

In summation, the total cost benefit is about USD 105,000 in hardware and USD 970,000 in software.
Conclusion

Exadata's X2 incarnation has benefits when used for ERP processing with EBS. An Exadata quarter rack with 24 cores comprehensively outperformed a conventional source system with 80 high-performance Intel cores in an Oracle Real Application Clusters setup. As most of Exadata's benefits are derived from flash cache and Infiniband I/O, these will increase over time with the new X3 family of Exadata machines, which have increased flash cache capacity.

Performance improvements afforded by using EBS on Exadata are independent of application server benefits provided by other engineered systems such as Exalogic. Also, Exadata's signature performance feature, Smart Scan, is not the major contributor to performance in Exadata for OLTP and mixed workloads such as EBS.

Oracle Application Testing Suite is the most user-friendly means of defining a test bed for EBS.

Substantial cost savings can be realized with the Exadata solution. No issues were encountered when porting and optimizing the EBS solution to run on Exadata. The end result: Exadata enables faster access to data—thus offering the ability to more quickly analyze data to make informed business decisions—as it reduces hardware costs, licensing fees, and maintenance and support costs.

Further Reading and Related Research Documents

- Deploying Oracle E-Business Suite on Oracle Exalogic Elastic Cloud and Oracle Exadata Database Machine (MOS Doc# 1460742.1)
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