An Oracle White Paper
January 2010

Query Offloading for Improved Performance and Better Resource Utilization

Executive Overview

Businesses increasingly need access to real-time data from production systems for reporting and other ad hoc information requirements. Unfortunately, running queries directly against production databases has a negative impact on system performance. To maintain efficient and effective operations, IT departments must reduce the impact of these queries while delivering seamless access to real-time information. This white paper focuses on the use of Oracle GoldenGate—a log-based, real-time change data capture (CDC) solution—to enable real-time reporting using a low overhead solution that minimizes the impact on IT infrastructure.

The Need for Real-Time, Low-Impact Reporting

Businesses require reporting with real-time data to make better and faster decisions. This fresh, low-latency intelligence enables effective execution, improved customer service, and operational efficiency—all of which results in a sustainable competitive advantage.

Several user community surveys have highlighted the importance of using real-time or near-real-time data in reporting. A recent survey of Oracle Applications Users Group (OAUG) members indicates the extent to which companies need data that is actually just a few seconds old (see Figure 1).[1]

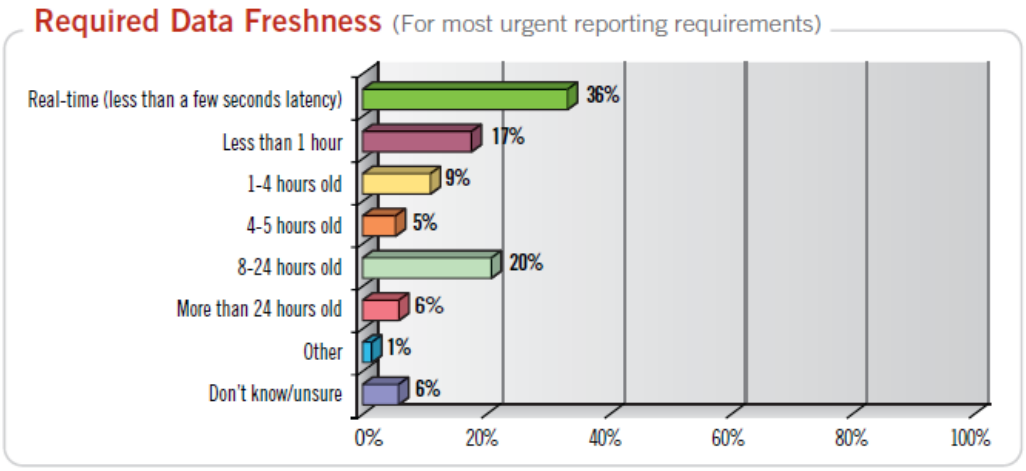


Figure 1. Based on a survey of the OAUG, there is a growing enterprise demand for real-time reporting.

According to the OAUG survey, 72 percent of companies run reports against production online transaction processing (OLTP) systems to obtain accurate information. However, for 57 percent, this activity creates overhead on the source system, and slows down transaction processing performance. Performance degradation can result in tangible usability issues, especially for mission-critical systems, due to the resulting impact on system response time.

To overcome this issue, some companies move data from OLTP systems to a separate system for reporting through a variety of data integration solutions, such as extract, transform, and load (ETL) products or custom scripts for moving data in batches. However, as will be discussed

[1] Unisphere Research, Joseph McKendrick, *Live Reporting in the Emerging Real-Time Enterprise*, June 2007.

later, these batch methods cannot provide real-time data for reporting, and running batch processes more frequently during the day creates significant overhead on production systems.

The Challenge of Offloading Reporting from Source Systems

The most common method for creating a reporting database is to use an ETL product or a custom script to extract data from one or more production systems, and then deliver it in batches to a reporting infrastructure. In this scenario, the data integration solution must perform full scans of the production databases more frequently, which can have a business impact, especially during peak hours. These solutions are typically configured to perform full source extract processes several times throughout the day, typically every four to six hours. Although this is an improvement over once-daily batch routines, it is still not real time.

Some organizations have attempted to circumvent batch processing limitations by changing the ETL product or script so that rather than extracting the entire contents of a database, the system captures and delivers only the changed data in minibatches. This approach results in data that is more current and causes less network overhead. However, capturing the changed data requires considerable modification to the existing databases, such as time stamps, to identify which tables have been changed since the last query. Most databases were not designed to accommodate these issues, and changing the schema can create issues for source applications.

These types of configurations can also place a burden on production systems, because complex queries would need to be run frequently across the entire database to identify changes. Moreover, because of the time required to run queries for changed data and to perform the rest of the processing through a system that is optimized to process data in batches, this method is not able to deliver changed data in real time, especially in environments with large volumes of data.

To leverage real-time data for reporting or ad hoc queries, a better solution is needed—one that enables businesses to offload reporting from the production database, yet still provide access to real-time data.

Query Offloading Using Oracle GoldenGate

Oracle GoldenGate provides log-based, real-time CDC to move high volumes of transactional data between heterogeneous databases with subsecond latency. By reading data from transaction logs rather than the database tables themselves, Oracle GoldenGate has a negligible impact on the source systems. This low-impact architecture facilitates real-time reporting by offloading queries and reporting activities to a secondary database, which is synchronized with the primary database in real time for up-to-the-second reporting and lookups. Using this solution, only the committed transactions are moved and transaction integrity is maintained throughout the process—transactions are applied to the target system in the same order that they are committed

at the source system. Oracle GoldenGate can move only selected tables, rows, or columns, and perform transformations at the capture or delivery steps.

When Oracle GoldenGate is used for offloading queries, the secondary database can be a different database or platform from the source. This helps the IT group manage overall costs and more-readily take advantage of new, lower-cost technologies. As a result, the primary system can operate at a much-higher performance level, while the needs for real-time reporting are met via the new target database.

Functional Overview

The Oracle GoldenGate software platform consists of decoupled modules for capturing, transforming, routing, and delivering transactional data in real time across heterogeneous environments. Oracle GoldenGate supports live reporting through the following capabilities.

Data Capture

The Oracle GoldenGate Capture module is a nonintrusive component that resides on the source database and continually captures any new transactions (see Figure 2). The captured data is immediately posted to Oracle GoldenGate's Trail Files, which use a database- and platform-independent universal data format. The independent structure of Trail Files enables heterogeneity within the infrastructure and also reduces the risk of data loss or corruption, in the event of an outage at the source or target site.

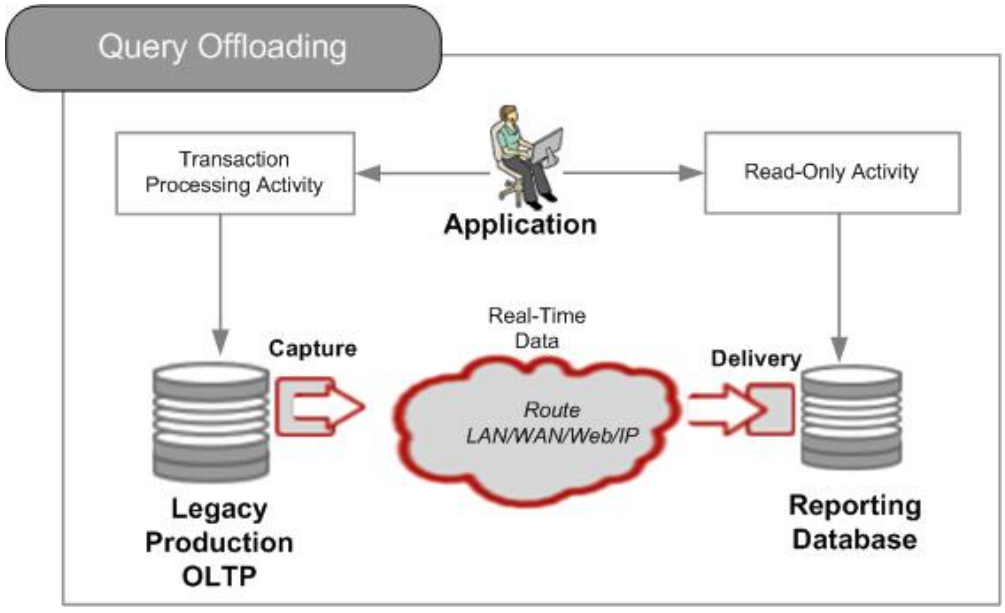


Figure 2. Oracle GoldenGate captures changed data at the source and immediately applies it to a reporting database for read-only queries

Data Delivery

At the secondary reporting system, the Oracle GoldenGate Delivery module applies the changed data from the Trail Files to the target system while maintaining transaction integrity. Thousands of transactions can be continuously moved from source to target with subsecond latency.

Transformation Support

Oracle GoldenGate provides built-in functions to support row-level transformations. In addition, for high-performance in-database transformations, Oracle GoldenGate works seamlessly with Oracle Data Integrator Enterprise Edition.

Heterogeneity

Oracle GoldenGate's heterogeneous support makes it easy to leverage a variety of reporting systems. The application supports a range of database vendors including Oracle Database, SQL Server, IBM DB2 (zSeries and LUW), Sybase, Enscribe, SQL/MP and SQL/MX, as well as Teradata running on Linux, UNIX, Windows, Oracle's Solaris, and HP NonStop, and can deliver data additionally to MySQL, Netezza, Greenplum, or any Open Database Connectivity compliant database.

Flexibility

Companies can quickly incorporate new or different database source and target systems in their real-time reporting solution by adding new Capture and Delivery processes. For example: one Capture module could apply to many targets (one-to-many relationship). Oracle GoldenGate can also deliver data to messaging systems and ETL solutions to support multiple architectures.

With filtering capabilities at the row, column, and table levels, Oracle GoldenGate can move only the relevant parts of the source system to the reporting database. Depending on the implementation of the reporting system, the secondary system can also serve as a ready-to-go failover database, in the event of an outage or interruption at the source.

Case Study: Reliance Communications

Reliance Communications (RCOM), the flagship company of the Reliance Anil Dhirubhai Ambani Group, is India's foremost integrated telecommunications service provider and the largest private telecommunications company in India. RCOM serves more than 48 million customers including in excess of 1.4 million individual overseas retail customers.

RCOM's corporate clientele includes 800 Indian and 250 multinational corporations and more than 200 global carriers. RCOM owns and operates the world's largest next-generation IP-enabled connectivity infrastructure, comprising 175,000 km of fiber-optic cable systems in India, the United States, Europe, the Middle East, and the Asia Pacific region. The business

encompasses a complete range of telecommunications services, including mobile and fixed-line telephony covering 15,000 towns and 400,000 villages in India. It includes broadband, national, and international long distance services and data services, along with an exhaustive range of value-added services and applications. RCOM's objective is to achieve customer satisfaction by enhancing the productivity of the enterprises and individuals it serves.

RCOM has a reliable, high-capacity, integrated and convergent digital network. It is capable of delivering a range of services spanning the entire information and communication value chain, including infrastructure and services—for enterprises as well as individuals.

The Challenge

RCOM was founded to harness the true power of information and communication, by providing the associated infrastructure to the common individual at affordable rates. With that goal in mind, the company knew it would have to conquer many challenges along the way. Primarily, according to RCOM's initial plan, the company was experiencing a surge in business volume as users from all over India were turning to it for their telecom needs. RCOM's current customer relationship management (CRM) system consists of

- Call centers at Navi Mumbai and Chennai; more than 2,000 retail outlets all over India
- More than 500,000 customers serviced per day by 10,000 users during peak hours
- 24/7 operations with online integration with other IT systems in RCOM

With the increase in customers, RCOM had to augment its staff to handle customer service calls and requests. This resulted in technology challenges on both the CRM system—which administers customer acquisition, customer care, service changes, and profile changes—andthe operations support system (OSS), a next-generation provisioning system.

First, the challenge with the OSS application meant that the company's primary system was becoming overloaded with requests for various lookups and business reports, and second, the company had no Plan B, in case of a system outage or natural disaster. With the primary OSS application system experiencing a 30□ 50 percent load because of the volume of users accessing it for daily reporting needs, RCOM knew it needed to find a solution. Key decision-makers in the IT group had heard about Oracle GoldenGate's capabilities.

The Solution

With Oracle GoldenGate, RCOM was able to capture all of the changed data transactions from the primary Oracle9i Database and move them to a secondary server dedicated for reporting. The OSS system has approximately 1.8 TB of data, which is offloaded for reporting and analysis to support various business users throughout the organization. Additionally, the secondary system now also serves as a hot standby, so that in the case of a disaster or system outage, all users can point to the secondary database for continuous access to the OSS.

The second project at RCOM involved the CRM application, which has been in production for more than five years. The initial need was to enable better reporting for all business users. Apart from the normal functions for which the CRM system was developed, various data extractions and reports are run in accordance with business needs. Reliance was using in-house data extraction that led to heavy resource use during peak hours and, as a result, the performance of the system depreciated considerably.

Before deploying Oracle GoldenGate for operational reporting, RCOM conducted a manual sync at the end of each business day, which took approximately four to six hours to complete and left employees with day-old data from which to run reports. With Oracle GoldenGate, the delay decreased dramatically, and business reports are in sync with the current real-time production data. Some online functionality such as interactions and case creation for call centers are now routed to the target system, which has reduced the load on the CRM production server.

RCOM uses Oracle GoldenGate to move transactional data to a reporting instance for its

- Consumer wireless business
- Corporate/enterprise wireless group
- Call center
- Fraud management and revenue assurance teams
- Management reporting

The Result

RCOM has achieved tremendous success with Oracle GoldenGate. Specifically, it has been able to use Oracle GoldenGate to selectively pick specific tables, rows, and columns and move only those to the target system. Furthermore, Oracle GoldenGate not only supports a wide range of databases, hardware, and operating systems, but it is extremely flexible in its ability to move only specific data for reporting purposes.

Conclusion

Today, IT organizations must increase the timeliness of data for reporting and other queries, while minimizing the impact of reporting on OLTP systems. Oracle GoldenGate provides a proven solution that gives companies the best of both worlds: a return to better performance on the primary system by offloading reporting-related processing demands and access to real-time data for reporting and analytics. With Oracle GoldenGate, organizations can operate more efficiently and begin to realize the benefits of real-time, operational business intelligence for sustained advantage in today's competitive marketplace.



Query Offloading for Improved Performance and Better Resource Utilization
January 2010
Author: Irem Radzik

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200
oracle.com



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

Copyright © 2009, 2010, Oracle and/or its affiliates. All rights reserved. This document is provided for information purposes only and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document and no contractual obligations are formed either directly or indirectly by this document. This document may not be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without our prior written permission.

Oracle is a registered trademark of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners.

0109