Using Oracle GoldenGate 12c with SQL Server Databases
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Executive Overview

Business applications have become increasingly critical for transaction processing. As a result, end users must access, analyze, act on, integrate, store, and verify transactional data faster than ever—often in real time—and without system interruption or downtime. This demand for low-latency data is compounded by the exponential growth in transactional data volumes and an increasingly heterogeneous enterprise IT environment, creating a need for data integration and replication solutions that are easy to implement and have little to no impact on business-critical applications.

Oracle GoldenGate is used by major Fortune 500 companies and other industry leaders worldwide for real-time database synchronization to support mission-critical systems to achieve maximum availability and real-time integration in heterogeneous environments. Written for business project owners, key stakeholders, and the entire IT organization, this white paper provides a detailed look at Oracle GoldenGate 12c, its underlying technology architecture and how it works with Microsoft SQL Server.

Introduction to Oracle GoldenGate 12c

Oracle GoldenGate 12c offers a real-time, log-based change data capture (CDC) and replication software platform to meet the needs of today’s transaction-driven applications. The software provides capture, routing, transformation, and delivery of transactional data across heterogeneous databases in real time. Using this technology, customers can achieve continuous availability for critical systems and real-time data integration for fast, easy access to current and accurate data. See Table 1.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time data feeds</td>
<td>Provides continuous capture and delivery of data from sources to targets with end-to-end subsecond latency. Operates at high performance with low overhead even at high volumes.</td>
</tr>
<tr>
<td>Heterogeneity</td>
<td>Captures and delivers data between a variety of relational, open systems/open source, and legacy databases on all major platforms. Captures from, and delivers to, Java Messaging Service (JMS) based messaging systems.</td>
</tr>
<tr>
<td>Transactional integrity</td>
<td>Maintains the reliability and accuracy of transactional data as it is moved between systems by enforcing ACID properties and referential integrity.</td>
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</table>

Since 1995, Oracle GoldenGate has been time tested and stress tested by transaction-intensive applications across countless industries, including banking, financial services, healthcare, telecommunications, cable, media, retail, e-business, travel, hospitality, energy, utilities, and the public sector. Industry leaders worldwide have put their trust in Oracle to enable the movement and management of their critical, rapidly changing transactional data.
Architecture Overview
The Oracle GoldenGate 12c architecture consists of decoupled modules that can be combined across the enterprise to provide maximum flexibility, availability, and performance. This architecture facilitates the movement of transactional data in four simple, yet powerful steps.

Figure 1. Oracle GoldenGate’s modular architecture enables support for various use cases with high performance and reliability

Key Operational Steps
- **Capture.** Oracle GoldenGate captures changed data operations committed in the database transaction logs in a nonintrusive, high-performance, low-overhead implementation.
- **Route.** Oracle GoldenGate can use a variety of transport protocols, and it can compress and encrypt changed data prior to routing. Transactional data can be delivered via Open Database Connectivity–compliant databases or through a specialized adapter to a JMS message queue or topic.
- **Transform.** At any point prior to applying the data to the target system, Oracle GoldenGate can be used to execute a number of built-in functions, such as filtering and transformations.
- **Delivery.** Oracle GoldenGate applies the changed transactional data to one or more database targets with only subsecond latency, preserving transactional integrity.

Key Components
Oracle GoldenGate consists of four distinct modules and components:

- Oracle GoldenGate Capture
- Oracle GoldenGate Trail Files
- Oracle GoldenGate Delivery
- Oracle GoldenGate Manager

Oracle GoldenGate Capture
The Capture module grabs committed transactions resulting from insert, update, and delete operations executed against a database, and routes them for distribution.

High-Speed, Low-Impact Data Capture
The Capture module does not require any changes to be made to the source database or the application it supports. To maintain optimal performance, the Capture module employs a range of CDC techniques against the source database. For instance, in databases that include transaction logs, such as Oracle Database; Microsoft SQL Server; IBM DB2 (LUW) and System z; Sybase ASE; MySQL; and those running on HP NonStop/Enscribe, SQL/MP, and SQL/MX, changes are captured through direct access to native database transaction logs (redo logs, if applicable). Oracle GoldenGate is also certified to support Oracle Exadata.
Transaction logs contain all changes made to the database and are automatically maintained by the database application independently of Oracle GoldenGate. Consequently, no additional tables are required to run the Capture module, and overhead is greatly reduced as compared with trigger-based capture techniques. Customers report only single-digit percentage overhead when running the Capture module on the source database. The Capture module can automatically adjust its transaction memory based on the size and number of the transactions it is capturing, which optimizes memory usage, allowing even lower overhead on the source systems. As mentioned before, when used with Oracle GoldenGate Application Adapters, the product also offers capabilities to capture from JMS-based messaging systems.

Table, Row, and Column Selectivity
When not all changed data from the source needs to be replicated to the target system—such as for real-time reporting purposes—the Capture module allows users to filter tables and rows based on user-defined criteria and ignores the entries in the transaction log that don’t meet the end-user’s needs. Users can optionally select and apply transformation rules to specific columns via built-in Oracle GoldenGate functions, user-supplied code, stored procedures, or Oracle Data Integrator Enterprise Edition.

Efficient Network Use and Large Data Volumes
The Capture module can route transactions over WANs and LANs as well as the internet, and it can reduce network bandwidth requirements in a number of ways. Typically, the amount of data transmitted is only a fraction of the data that is generated by the database and stored in transaction logs. Because only committed transactions are propagated, intermediate activities and rolled-back operations are not transferred. Traffic is optimized by bundling individual records into larger, more-efficient packets and avoiding record-at-a-time bottlenecks. Several levels of data compression are available to further reduce the amount of network bandwidth required for transmission. Depending on data types, data compression can reduce byte transfer by 75 percent or more.

For scenarios requiring very large changed data volumes, users can deploy multiple Capture modules to minimize the lag between source and target systems.

Checkpoints for Reliable Data Delivery
Oracle GoldenGate creates a checkpoint at the last changed transaction whenever a commit boundary is encountered. This enables the delivery of all committed records to the target, even in the event of a restart or cluster failover. Checkpoints store the current position as processed by both the Capture and Delivery modules. Following a network or system outage, Oracle GoldenGate restarts from the last good checkpoint. Oracle GoldenGate also persists uncommitted operations to disk to enable fast and simple data recovery for long running transactions in the event that the replication process is paused or interrupted.

Oracle GoldenGate Trail Files
Trail Files—Oracle GoldenGate’s unique queuing mechanism—contain the most recent changed data in a transportable, platform-independent format called the Oracle GoldenGate Universal Data Format, and can be converted to XML and other popular formats for consumption by different applications. The Capture module can create unique as well as overlapping sets of data in each Trail File. Based on the requirements of the implementation, users can store Trail Files on the target system, the source system, or both. Trail Files can be delivered to alternative queue types and application interfaces.

Flexible, Decoupled Architecture
A decoupled architecture addresses numerous problems inherent in tightly coupled alternatives. Process-to-process coupling creates a dependency between data capture and delivery. For example, if delivery is slower than capture,
capture activities must be held up. In the event of an unplanned outage, decoupling ensures that the nonimpacted system continues to operate.

Tightly coupled or process-to-process implementations can impose scalability challenges. A great deal of interprocess checkpointing needs to occur to ensure no data is lost, thereby creating many more messages and still more overhead. Network outages lasting more than a few minutes can also cause excessive resource consumption, because outstanding transactions need to be queued in memory and eventually swapped to disk. Neither the physical nor the virtual memory activities are persistent; therefore if the process fails, data inconsistencies—or even loss—ensues.

By staging data in Trail Files, Oracle GoldenGate decouples the data source and target for heterogeneous support. Unlike architectures that implement a tight process-to-process coupling, this decoupled architecture allows each module to perform its tasks independently.

Oracle GoldenGate also provides flexibility in the choice of hardware, operating system, and databases for sources and targets. For maximum flexibility and ease of use, customers can use different versions of Capture, Delivery, and Trail Files in the same implementation.

Data Pumps

Depending on the configuration and environment, it might be preferable to create Trail Files on the source system and use a separate Oracle GoldenGate feature, called a Data Pump, to continuously push—or “pump”—the Trail Files from the source system to the target system(s). This configuration enhances the fault tolerance and reliability of the overall Oracle GoldenGate environment. In the event of a network failure (between the source and the target systems), Oracle GoldenGate can continue to capture transactions because the data can be queued up locally in the Trail Files on the source, enhancing the recoverability in case of database failures.

The Data Pump feature is strongly recommended if data needs to be distributed to multiple targets from the same source (one to many). Whereas the Capture module can focus solely on capturing transactions, individual Data Pumps can be set up to distribute the data to those targets, increasing the efficiency of the overall environment. Fault tolerance is also greatly increased in such a configuration because any failure associated with one target has no impact on the source capture or delivery to other targets—transactions will continue to be captured, routed, and applied to the other targets even when one of them is down. Data Pumps can also be used to route data through an intermediate system, even if that system doesn’t have a database installed.

Archival and Audit Capabilities

Trail Files can create an archive of purged information from the source database by transforming delete and update records into inserts in a different location. For auditing and compliance purposes, Oracle GoldenGate can also maintain a separate history table to track each update to individual records as they change.

Oracle GoldenGate Delivery

The Delivery module takes any changed transactional data that has been placed in a Trail File and immediately applies it to the target database. Supported target databases include Oracle Database; Microsoft SQL Server; IBM DB2 (LUW), System z, System i; Sybase ASE; those running on HP NonStop/Enscribe, SQL/MP, and SQL/MX, PostgreSQL, MySQL and TimesTen. Through the use of Oracle GoldenGate Application Adapters, Oracle GoldenGate also has the capability to publish changed data to a messaging system in XML or other formats, as well

1 Oracle GoldenGate’s Data Pump component is not related to the Oracle Database utility Oracle Data Pump.
as provide data in flat files for third-party products, including ETL systems and data warehouse appliances such as IBM Netezza, Greenplum.

Data Integrity and Transaction Consistency
The Delivery module applies each database change in the same order as it was committed in the source database to provide data and referential integrity. In addition, it applies changes within the same transaction context as they were on the source system for consistency on the target.

Column Mapping and Transformation
As with Capture, users can configure the Delivery module via user-defined criteria to not only specify target tables but also individual rows and columns. By default, the Delivery module populates any target table column with data from a source table column if the two columns share the same name, and this is also true of like-named tables. However, you can easily configure Oracle GoldenGate to move data from a single table into multiple target tables or vice versa. This can be used to normalize or denormalize data in a data warehouse or OLTP environment.

Users can also define explicit mapping and transformation rules, ranging from simple column assignments to more-complex transformations for which Oracle GoldenGate provides a suite of date, math, string, and utility functions. The module also supports the use of stored database procedures and functions and enables implicit mapping and explicit rules to be combined. If additional transformations, data quality, aggregation, and other functionality are required, Oracle GoldenGate 12c integrates tightly with Oracle Data Integrator Enterprise Edition 12c to support end-to-end data integration.

Optimized High-Speed, High-Volume Data Delivery
The Delivery module provides a variety of techniques to optimize the posting of changed transactions to the target database. Oracle GoldenGate’s posting processes, where possible, run local to the target database, maximizing throughput by avoiding network limitations. The Delivery module also minimizes disk I/O while preserving original transaction properties. In addition, where possible, updates are executed via native database interfaces rather than through middleware, and internal caches are used to ensure fast execution of repetitive statements.

Multiple Delivery modules can be deployed to minimize lag time in the event of high data volumes during peak processing times or seasonality. This capture-route-transform-apply process runs continuously, so that the most recent transactions committed at the source are immediately moved and delivered to the target.

Deferred Apply
For maximum flexibility, the Delivery module can apply data immediately or at a deferred time chosen by the user, without losing transactional integrity. This allows an additional layer of data protection when needed and keeps the secondary system at a consistent state behind the primary system. In this configuration, Oracle GoldenGate routes the changed data to the Trail File on the target server but does not deliver it to the target database until all captured changes have been delivered to the target Trail File. All changed data in the target Trail File can then be immediately applied to the target database, to bring it to a consistent state relative to the source, whenever the user chooses.

Oracle GoldenGate Manager
To give users control over Oracle GoldenGate processes, the Manager module provides a command-line interface to perform a variety of administrative, housekeeping, and reporting activities, including

» Setting parameters to configure and fine-tune Oracle GoldenGate processes
» Starting, stopping, and monitoring the Capture and Delivery modules
» Critical, informational event, and threshold reporting
» Resource management
» Trail File management

The Manager module executes requests on demand as well as unattended. For example, it can be used to restart Oracle GoldenGate components, as well as monitor latency. The command-line interface enables to perform a variety of administrative, housekeeping, and reporting. The module also automatically recycles Trail File data when no longer needed, providing insurance against inadvertent disk-full conditions and offering an alternative to error-prone manual housekeeping procedures. Oracle GoldenGate 12c offers increased transaction tracing flexibility to easily identify bottlenecks and tune the Oracle GoldenGate implementation for optimum performance.

For enhanced management of Oracle GoldenGate 12c processes and solutions, customers should consider adding the Management Pack for Oracle GoldenGate.

Flexible Topology Support and Bidirectional Configurations

Oracle GoldenGate easily supports a wide variety of topologies. These include one-to-one, one-to-many, many-to-one, and many-to-many—for both unidirectional and bidirectional configurations.

For unlimited scalability, cascading topologies can be created to eliminate any potential bottlenecks. By staging specific sets of database changes on the source or target system, different requirements can be met through a single pass on the data source. Each set of staged data can contain unique or overlapping sets of data.

![Topologies Diagram](image)

Figure 2: Oracle GoldenGate supports numerous data propagation solutions to support real-time visibility across the enterprise.

Associated Products

There are two primary products that augment Oracle GoldenGate to enhance your real-time information platform:

» **Management Pack for Oracle GoldenGate.** Provides components that enable designing, configuring, managing, and monitoring Oracle GoldenGate core replication processes implemented across the enterprise.

» **Oracle GoldenGate Veridata.** Quickly compares data between two online databases, and reports and repairs any discrepancies (can run as a standalone product). It supports heterogeneous databases.

Management Pack for Oracle GoldenGate

Management Pack for Oracle GoldenGate is a centralized, server-based graphical enterprise application that offers an intuitive way to monitor, manage and report Oracle GoldenGate processes. It leverages the management
services of the core Oracle GoldenGate platform to help users reduce the deployment time for their continuous availability and real-time data integration configurations.

Management Pack for Oracle GoldenGate minimizes human error and enables the rapid production of multi-server solutions from a central location to improve productivity and responsiveness, lower costs, and increase return on investment. The Oracle Management Pack for Oracle GoldenGate license includes 3 products:

» **Oracle Enterprise Manager Plug-in.** Provides secure viewing, management, and alerting capabilities for Oracle GoldenGate while leveraging the Oracle Enterprise Manager framework.

» **Oracle GoldenGate Monitor.** A standalone product that provides secure viewing, management, and alerting capabilities for Oracle GoldenGate with end-to-end topology solution displays and customizable topology views.

» **Oracle GoldenGate Director.** A stand-alone product for basic configuration, management, monitoring, and alerting for legacy Oracle GoldenGate deployments.

Oracle GoldenGate Veridata
Oracle GoldenGate Veridata is a high-speed, low-impact data comparison and repair solution that identifies, reports, and fixes data discrepancies between heterogeneous databases, without interrupting those systems or the business processes they support. A standalone product, Oracle GoldenGate Veridata does not depend on the presence of Oracle GoldenGate’s core components.

Using this application, companies can audit and verify large volumes of data shared across different business applications with absolute certainty. Oracle GoldenGate Veridata reduces the amount of time and the number of resources required to compare and repair data, minimizes the impact of human errors, and accelerates the discovery of potential problems for rapid resolution.

Oracle GoldenGate Veridata supports cross-database comparison between Oracle, DB2, SQL Server, Teradata, HP Enscribe, and HP SQL/MP databases; and it supports repair between Oracle, DB2, SQL Server and Teradata databases.

**One Platform, Many Solutions**
This single real-time data movement platform enables companies to easily and successfully implement a variety of solutions for improving the availability, accessibility, performance, and integration of critical data across the enterprise. The most commonly implemented use cases for the Oracle Database include:

» Zero Downtime Migrations and Consolidation to Cloud

» Query Offloading

» Disaster Recovery and Data Protection

» Active-Active Database Replication for Continuous Availability

» Operational Reporting and Real-time Data Warehousing

» Data Distribution and Synchronization for OLTP Systems (on Premises or Cloud)

Many industry leaders, such as MGM Mirage, Retail Decisions, Haggen and Visa, have implemented Oracle GoldenGate for their SQL Server databases in high availability and real-time data integration use cases.

**Zero Downtime Migrations and Consolidation to Cloud**
With its real-time heterogeneous replication capabilities, Oracle GoldenGate enables zero-downtime database, hardware, OS migration and consolidation. Through bidirectional data movement and synchronization between old and new systems, Oracle GoldenGate enables switchover from the existing system to the new system, when the new system is ready—without ever denying access to the application. The solution can support heterogeneous
environments for cross-platform upgrades and database migrations from non-Oracle databases to Oracle databases including Oracle Exadata. This flexible migration and consolidation capability allows companies to move to cloud environments faster and with minimized risk. In addition, the solution provides robust failback contingencies by keeping the old and new environments in sync in real time. By simultaneously using Oracle GoldenGate Veridata, users can identify and report data discrepancies across systems before switchover, without impacting the production environment.

Oracle GoldenGate provides zero-down time rolling upgrades from SQL Server 2008 to SQL Server 2012. In addition, Oracle GoldenGate is certified to offer zero downtime application upgrades for Oracle’s Siebel CRM and JD Edwards applications.

Query Offloading
Oracle GoldenGate’s real-time data integration capabilities enable users to offload queries and read-only activity from production databases to a dedicated reporting server. With its support for heterogeneous systems GoldenGate can enable customers to offload read-only access from OLTP systems running on major databases Oracle, SQL Server, IBM DB2, HP NonStop, Sybase ASE and more, to heterogeneous systems. This solution maximizes performance of the production system, reduces cost of ownership, and enables to optimize the secondary reporting database for read-only activities.

![Diagram](image)

Figure 3 Oracle GoldenGate improves OLTP performance by offloading read-only access to a dedicated reporting database.

Disaster Recovery and Data Protection
When configured for disaster recovery and data protection, Oracle GoldenGate provides a continuous availability solution that significantly improves recovery time for mission-critical systems. Oracle GoldenGate’s disaster recovery and data protection configuration offers continuous availability via Active-Passive and Active-Active bidirectional database synchronization (see next section), for Oracle and non-Oracle databases including SQL Server 2008 and SQL Server 2012. Oracle GoldenGate delivers up-to-the-second data to the backup system and enables immediate failover to the new system if an outage occurs. It also immediately initiates real-time data capture from the standby database to update the primary system, once it is online, with any new data processed by the standby system.
Active-Active Database Replication

Oracle GoldenGate enables highest availability and performance on critical systems by keeping two or more active databases in-sync as they support ongoing transactions. The product provides loop detection and conflict detection/resolution capabilities to provide support real-time data movement between active databases. This solution provides continuous availability for supported databases, better use of existing server assets, and improved system performance and scalability.

Operational Reporting and Data Warehousing

Many operational reporting activities ideally seek to use the latest data available, and that often means running reports against production databases, which degrades performance. With Oracle GoldenGate, a secondary, cost-effective system can be deployed to serve the purposes of real-time, operational reporting, freeing up the resources of the critical source systems. Oracle GoldenGate 12c is certified to support operational reporting solutions for major
Oracle applications including Oracle E-Business Suite, JD Edwards, PeopleSoft and Siebel CRM.

Oracle GoldenGate can also be used for feeding data warehousing solutions with timely data. GoldenGate complements Oracle Data Integrator (ODI) and other ETL solutions by providing log-based change data capture capabilities. The tightly integrated solution can be used to capture real-time data from source systems without performance impact and loading DW tables with timely information. Oracle Data Integrator enables Extract, Load, Transform (E-LT) architecture that further improves performance and reduces cost of ownership by eliminating middle-tier transformation server.

Data Distribution and Synchronization for OLTP Systems (On Premises or Cloud)

Due to its multi-directional, real-time data movement capabilities Oracle GoldenGate enables data distribution and synchronization for distributed systems. Its multi-directional replication configuration keeps data centers in synch for access to timely, accurate data across enterprise systems. Since Oracle GoldenGate’s replication does not have distance limitations, typically customers implement Oracle GoldenGate for data distribution between data centers located in different regions and continents. With its ability to support public and private cloud environments, Oracle GoldenGate is used for data synchronization between enterprise systems that are hosted on premises or cloud. The product’s heterogeneity enables real-time synchronization between different databases and OS platforms.

Oracle GoldenGate for Microsoft SQL Server

As mentioned earlier, Oracle GoldenGate has two primary processes, Capture and Delivery, which interact with a SQL Server database in order to capture and deliver committed transactions only. The Capture component (extract.exe executable) reads directly from the physical SQL Server transaction log file(s) and transaction log backups. The Delivery component (replicat.exe executable) reads from the Trail Files produced by Capture or a Data Pump, and delivers them to a target SQL Server database as operations that appear like any other user or application executing DML.

Features for the SQL Server Database

Some of the key capabilities of Oracle GoldenGate for SQL Server are as follows:

» Oracle GoldenGate now supports Capture from SQL Server 2012 beginning with 12.1.2.0.1.

» Oracle GoldenGate for SQL Server can be configured for tables without Primary Keys.
» Oracle GoldenGate 12c for SQL Server supports SQL Server native backup compression and includes the optional configuration to never have to read from transaction log backups, which enables any log backup utility to be used.
» Capture process can work in conjunction with native SQL Server transactional replication, and Change Data Capture.
» GoldenGate for SQL Server can provide real-time data to heterogeneous target databases, and receive real-time data from heterogeneous databases.
» When delivering to a SQL Server target database, GoldenGate supports OLE DB to provide better throughput than ODBC and allows usage of the ‘Not for Replication’ option for Identity columns, table triggers, and foreign key and check constraints.

Requirements

SQL Server Instance
» For SQL Server 2008/2008 R2 and SQL Server 2012, GoldenGate Capture requires SQL Server Enterprise Edition, whereas Delivery can be against a Standard instance.
» SQL Server Express editions are not supported for Capture or Delivery.

For Operating Systems
» Windows OS requires Visual C++ 2010 SP1 redistributable package.
» Windows 2008 R2 and Windows 2012 User Account Control settings, if enabled, may require starting the GoldenGate Manager service from the services.msc snap-in rather than via GoldenGate Command Interface (GGSCI), and starting GGSCI by right clicking the executable and selecting ‘Run as administrator’.

Oracle GoldenGate Installation
» Install Oracle GoldenGate Capture on the source database server. Share level read access of the transaction log requires that Capture be installed on the local database server and not a remote server. Installation of Oracle GoldenGate Delivery can be on a server other than the target database server as long as the SQL Server client drivers are present on that server and connection to the target database can be established.
» Each GoldenGate Capture and Delivery component is configured for only one database and cannot span capture or delivery from/to multiple databases.
» Information such as path location to the log file(s) and log backup files, current LSN, and other required metadata is accessed via a System DSN connection to the SQL Server database for the Capture component.
» The Delivery component also utilizes a System DSN to determine metadata information as needed, as well execute the captured DML against the database. DML executed against a target database is absolute and not issued as a statement. For example, “DELETE FROM TABLE dbo.TestTable WHERE FirstColumn = 1” will be issued rather than “DELETE FROM TABLE dbo.TestTable”.

Accounts and Security
» The Manager process (mgr.exe executable) runs as either a Windows service or interactively within a user’s session and the account used to run Manager must be a member of the local server’s Administrators group.
» A System DSN has to be created with either a SQL Server authenticated or Windows authenticated login for both Capture and Delivery.
» For Capture, the account used in the DSN connection must be a member of the SQL Server sysadmin server role. If using Windows authentication, ensure that the account used for the Manager process has been added to the sysadmin server role within SQL Server as Capture will connect to SQL Server with the Manager’s account.
» For Delivery, the account used in the DSN connection must at least be a member of the SQL Server db_owner database role for the target database. If using Windows authentication, ensure that the account used for the Manager process has been added to at least the db_owner database role for the target database as Delivery will connect to SQL Server with the Manager’s account.
Supplemental Logging is enabled within the GGSCI command interface with the command, ADD TRANDATA. The user running the GGSCI executable must be a member of the SQL Server sysadmin server role if using a Windows authenticated DSN.

SQL Server Database

Oracle GoldenGate Capture and Delivery processes support only user databases and user tables, and do not support system databases and system tables.

The source database must be in the FULL recovery model and the log chain needs to be intact. This means that at least one full database backup must have been taken after the database was set to FULL recovery and that the log chain has not been broken since (and will not be broken) by setting the database to SIMPLE recovery or by backing up the transaction log with the NO_LOG or TRUNCATE_ONLY options.

The target database can be in any recovery model desired and is in a full read/write state. Oracle GoldenGate does not set the state of the target database to read-only; however SQL Server security practices can be utilized to grant consumers of the target data read-only access if so desired. Further, any indexes and maintenance plans for the target database can be created and managed entirely separate than those of the source database, except for the primary key or unique index of a table, whichever is used by Capture. This may be useful in instances where the target database is to be used as a reporting database and special indexing needs are required for additional query performance.

When Capture is optionally configured to allow reading data from transaction log backups, the transaction log backups for the source database must be done natively by SQL Server as third party vendor backup utilities are not supported. The transaction log backups should be unencrypted, written to disk, not striped across multiple devices, and must be one backup per device.

Supplemental Logging must be enabled for all tables that are to be captured from, which is required in order to instruct SQL Server to write the full before and after images of transactions to the transaction log so that Oracle GoldenGate Capture can obtain a complete record needed for delivery.

Best Practices & Special Considerations for Microsoft SQL Server

Oracle GoldenGate for SQL Server does not require any specific service packs or cumulative updates to be applied to a SQL Server instance. However for Delivery for SQL Server 2012, using the SQL Server Native Client 11.0 OLE DB driver may lead to a memory leak issue (Microsoft article 2881661). Microsoft has provided a fix in SQL Server 2012 SP1 CU7 (Microsoft article 2894115). To avoid a possible memory leak, choose one of the following options for Delivery:

- Use ODBC mode
- Upgrade the SQL Native Client 11.0 driver to SP1 CU7

Oracle GoldenGate for SQL Server can coexist with SQL Server Replication and SQL Server Change Data Capture for a database; however the following consideration should be given when the database is already configured with one of these replication technologies:

- Ensure all GoldenGate Capture processes for the database contain the TRANLOGOPTIONS NOMANAGESECONDARYTRUNCATIONPOINT parameter, allowing SQL Server to manage the truncation point with either the Log Reader Agent or CDC capture job.

- When using SQL Server Transactional Replication Publications and Oracle GoldenGate Capture, ensure that at least one Publication is setup for the database prior to enabling GoldenGate Supplemental Logging, otherwise you may see the error “Invalid object name ‘dbo.syspublications’”.

  To fix this problem:
  - Disable Supplemental Logging for all tables configured with it.
  - Execute the following stored procedure: EXEC sp_removedbreplication ’<dbname>’
  - Create the desired Transactional Publication(s).
  - Re-enable Supplemental Logging for the desired tables.
Caution should be given to modifying existing tables enabled with Supplemental Logging as some operations, especially when performed through Management Studio, will actually drop and recreate the table, which disables Supplemental Logging. See Doc ID 1326044.1 for more details.

**Conclusion**

By using Oracle GoldenGate for Microsoft’s SQL Server, companies can move changed data across the enterprise to other SQL Server databases or other major heterogeneous databases. Oracle GoldenGate allows users to move, filter, and transform data between disparate systems with only sub-second latency.

Oracle GoldenGate enables the world’s largest enterprises to improve the availability, performance, and accessibility of the transactional data that drives mission-critical business processes. Oracle GoldenGate’s wide variety of use cases includes real-time business intelligence, query offloading, zero-downtime upgrades and migrations, disaster recovery, and active-active databases for data distribution, data synchronization, and high availability.