Oracle GoldenGate 12c Release 1
New Features Overview

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Executive Overview

With the ever-growing trend of IT being required to provide business data any place and without interruption, competitive advantages are measured by the speed of fast data. 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, available on-premises or in the cloud, and have little to no impact on business-critical applications.

Oracle GoldenGate 12c Release 1 improves businesses’ ability to manage transactional processing in complex and critical environments. Oracle GoldenGate 12c further advances Oracle’s leadership in real-time data replication technology with simplified configuration, extreme performance, and improved high availability solutions. The new release includes optimizations for Oracle Database 12c, intelligent and integrated delivery capabilities, integration with Oracle Data Guard Fast-Start Failover (FSFO), and tighter security. In addition, Oracle GoldenGate 12c offers expanded heterogeneity such as support for IBM Informix and new certified solutions for Oracle Coherence and Oracle Business Intelligence applications. The product delivers seamless transition to private cloud and real-time data replication between databases on public cloud and on-premises environments to meet businesses current and future-needs.
Introduction

Oracle GoldenGate 12c Release 1 is the most feature rich, robust, and flexible data replication product on the market today. The new key features include:

- Optimizations for Oracle Database 12c
- Integrated Delivery for Oracle Database
- Coordinated Delivery for Non-Oracle Database
- Streams to GoldenGate Migration Utility
- Improved Ease of Use
- Expanded Heterogeneity and Big Data Support
- Capture From and Delivery to Cloud-Based Systems
- Tighter Security
- Enhanced Reliability
- Repair capabilities in Oracle GoldenGate Veridata
- Improved Management and Monitoring
- Expanded Oracle Application and Technology Support

Written for business project owners, key stakeholders, and the entire IT organization, this white paper provides an overview of the new features in Oracle GoldenGate 12c Release 1.

For customers who are new to, or unfamiliar with Oracle GoldenGate, and want to learn more about the product, please visit the Oracle GoldenGate product website at [www.oracle.com/goto/goldengate](http://www.oracle.com/goto/goldengate) for more information.
Optimizations for Oracle Database 12c

Oracle GoldenGate 12c has been optimized to support new functionality available with Oracle Database 12c. Oracle GoldenGate 12c supports capture and delivery of the new 32K VARCHAR2 in Oracle Database 12c. However, VARCHAR2 columns with size greater than 4000 characters should not be the primary key of the table.

Oracle GoldenGate 12c also supports the new Oracle Multitenant Container Database (CDB), which allows a common pool of resources to handle multiple databases (known as containers). Containers with user data are called Pluggable Databases (PDBs). These PDBs can be unplugged from one CDB and plugged into another CDB.

Integrated Capture, first introduced with Oracle GoldenGate 11g Release 2, has been enhanced to provide support for the CDB feature. Oracle GoldenGate customers can mine multiple PDBs with a single Integrated Capture process and can write changes from multiple PDBs into a single Trail File. Capturing changed data at the container level rather than at the individual databases reduces overhead. Memory and processes are required at the CDB level only. In Oracle Database 12c, all of the PDBs in a CDB must have the same attributes, such as character set, locale, and case-sensitivity. The Integrated Capture process must be configured to run at the root container as a common user in order to interact with the log mining server.

The Delivery process can connect and apply changes to a single pluggable database. To configure replication from multiple source pluggable databases to multiple target pluggable databases, users can configure parallel Integrated Capture and Delivery streams, each handling data for one pluggable database. Alternatively, users can configure a single Integrated Capture that captures from multiple source pluggable databases and writes to one Trail File that is read by multiple Delivery processes, each applying to a different target pluggable database. Yet another alternative is to use one Integrated Capture writing to multiple Trails, each Trail File read by a Delivery process assigned to a specific target pluggable database as shown below.

Figure 1.0 – Oracle GoldenGate 12c Integrated Capture and Delivery for Multitenant Databases
Additionally, Oracle GoldenGate 12c for Oracle Database offers:

- **Edition-Based Redefinition** support which simplifies the upgrade effort by coordinating the upgrade and bringing the target database to the same edition-based version.
- **Classic Capture from Active Data Guard**, which allows Active Data Guard customers to capture change data with no impact on production system.
- **Column level character set support** which provides the ability to override the default character set & define a specific character set for a column.

**Integrated Delivery for Oracle Database**

Customers delivering data to an Oracle Database 11g Release 11.2.0.4 or Oracle Database 12c Release 12.1.0.1 and higher database, can improve performance and provide better scalability and load balancing by using Integrated Delivery. Minimal changes are required to implement this change, which leverages the database parallel apply servers for automatic dependency aware parallel apply. With Integrated Delivery, there is no need for users to manually split the delivery process into multiple threads and manage multiple parameter files.

The Oracle GoldenGate Delivery process continues to read the Trail File, just as it did before, however, with Integrated Delivery, it constructs Logical Change Records (LCRs) that are used to describe the changed data. The Delivery process then transmits these LCRs to the Inbound Server of the Oracle Database using a lightweight streaming API.

The Inbound Server consists of the Receiver, which reads the LCRs, along with the Preparer, Coordinator, and one or more Appliers. The Preparer computes dependencies between the transactions and then groups and sorts them in dependency order. Next, the Coordinator maintains the order between the transaction groups as they are handed off to multiple Appliers. The Database Apply processes perform all necessary changes for the assigned transactions, including conflict detection and error handling.

Supplemental logging of scheduling columns (primary key, unique index and foreign key) are needed to support the dependency aware apply processing at the target. Integrated Delivery can process non-Oracle database Trail Files as long as all of the scheduling columns are logged by the non-Oracle database and are available in the Trail File. The Integrated Delivery feature also provides support for the Oracle Multitenant Database feature at the Pluggable Database level. Just as shown in the prior section, multiple Integrated Delivery processes can read...
the same Trail File and apply changes to multiple PDBs at the target. The new Integrated Delivery includes dependency aware batching capabilities as well.

Users running on an Oracle Database version prior to 11.2.0.4 can still continue to use the Classic Delivery process in their Oracle GoldenGate deployments. However, Oracle GoldenGate recommends that users upgrade to Oracle Database 11.2.0.4 or higher to take advantage of the new Integrated Delivery process.

**Streams to GoldenGate Migration Utility**

Prior to the introduction of Oracle GoldenGate, Oracle Streams provided a popular method of data replication. Now, Oracle Streams users can easily transition to Oracle’s strategic, market-leading real-time data integration and replication technology with the help of a new migration utility. You can read more in the [Oracle Streams to Oracle GoldenGate Migration data sheet](#).

**Coordinated Delivery for Non-Oracle Databases**

Customers delivering data to non-Oracle data stores (or Oracle Database versions before 11.2.0.4) who find it necessary to split their delivery process into multiple threads can use the Coordinated Delivery feature available with Oracle GoldenGate 12c to eliminate the need to manage multiple parameter files. In addition to requiring a single parameter file for multiple Delivery processes, Coordinated Delivery also automatically provides coordination across selected events that require ordering, including DDL, primary key updates, Event Marker Interface (EMI) and SQLEXEC. Coordinated Delivery can be used with both Oracle and non-Oracle data stores.

![Coordinated Delivery](#)

**Expanded Heterogeneity and Big Data Support**

Oracle GoldenGate 12c Release 1 brings both new platforms and enhancements to existing supported platforms such as Oracle MySQL, Microsoft SQL Server, Sybase, Teradata, and IBM DB2.

Oracle GoldenGate 12c provides new support for IBM Informix. It provides capture from and delivery to Informix 11.5, 11.7 and 12.1 on all major 64bit OS platforms. GoldenGate can move DML operations (insert, delete, update and truncate), including bidirectionally with conflict detection and resolution. Oracle GoldenGate supports compression and encryption and provides batchSQL along with Coordinated deliver for parallel apply.
For Microsoft SQL Server databases GoldenGate now supports capture from and delivery to SQL Server 2014. For the MySQL database, support has been added to include capture and delivery for MySQL version 5.6 and MySQL Community Edition, as well as support for MySQL Cluster (NDBCluster) versions 7.1, 7.2, and 7.3. Sybase ASE support has been increased with Oracle GoldenGate 12c to include capture and delivery for Sybase version 15.7 and a new BatchSQL support. Also available with Oracle GoldenGate 12c is capture and delivery for SQL/MX 3.2, IBM DB2 (LUW) 10.1, IBM DB2 11/zOS 2.1 and Teradata 14.10.

The power of Oracle GoldenGate 12c not only expands upon current versions of the databases that are supported, but improves upon the supported features of those databases: UNITEXT data types for Sybase are supported; and for SQL Server, native SQL Server compressed transaction log backups are now supported, giving customers a solution that allows both Oracle GoldenGate capture and log backup compression to coexist.

In addition to relational databases, Oracle GoldenGate Application Adapters product enables GoldenGate customers to feed real-time transactional data into big data environments. Oracle GoldenGate Adapter for Java enables integration with Oracle NoSQL, Apache Hadoop, Apache HDFS, Apache HBase, Apache Storm, Apache Flume, Apache Kafka, and others, and allows real-time, non-invasive data streaming into big data solutions targets to gain new insights into business and improve customer experience.

### Improved Ease of Use

Oracle GoldenGate 12c not only includes new database platform support and feature functionality as mentioned above, but also includes new ‘ease of use’ enhancements that improve upon existing functionality within GoldenGate.

Features such as automatic discard file generation, which in prior versions of Oracle GoldenGate require explicit parameterization to enable, come standard in the new Oracle GoldenGate 12c release. Discard file generation is a major need in problem diagnostics and conflict management, so much so that Best Practices documentation always includes the recommendation to enable discard files, and starting with Oracle GoldenGate 12c each process generates these discard files by default, rolling them over to produce sequential discard files, similar to the way that process report files are generated.

Another improvement upon an existing Oracle GoldenGate feature is the use of the SHOWSYNTAX parameter. SHOWSYNTAX is typically used in problem diagnostics and is a valuable parameter in viewing transactional data interactively, prior to applying it to the target database. Previous implementations required multiple extra parameter settings along with the SHOWSYNTAX parameter to enable this information, but with Oracle GoldenGate 12c, the requirements have been reduced and in general only require the SHOWSYNTAX command to interactively view literal SQL statements executed by the Delivery process.

With Oracle GoldenGate 12c, an enhancement over previous wildcard functionality, such as with TABLE and MAP statements, has been made to include schema wildcarding for all supported databases. GGSCI, DEFGEN, Capture (Extract processes) and Delivery (Replicat processes) can all take advantage of the new ability to filter by schema wildcards. And for the new Oracle Database 12c multi-tenant databases and SQL/MX, filtering based on catalog wildcarding is now available. New parameters such as SOURCECATALOG, SCHEMAEXCLUDE, and CATALOGEXCLUDE are included to accomplish filtering based on the customer’s needs.
**Tighter Security**

In previous versions of Oracle GoldenGate, the username and password were either stored as plain text or lightly encrypted. With Oracle GoldenGate 12c, the product is integrated with Oracle Credential Store and Oracle Wallet. An alias can be created in the Oracle Wallet and Credential Store which is then associated with a username and password. With these security enhancements an alias can also be created for the ASM user and a user could even go so far as creating an alias for use in DDL replication.

When Oracle GoldenGate is installed and set-up, a default credential store can be created. Once created, the Oracle GoldenGate administrator can then create aliases and associate them with a username and password. The alias is then referenced in the GoldenGate parameter files rather than the actual username and password. Below is an example of creating the credential store during setup and how the alias would appear in the extract parameter file.

**GGSCI Commands:**

```
GGSCI> ADD CREDENTIALSTORE
GGSCI>
GGCSI> ALTER CREDENTIALSTORE ADD USER ggadmin PASSWORD ggadmin ALIAS ggadminalias In extract.prm:
USERIDALIAS ggadminalias
```

Finally, Oracle GoldenGate 12c improves upon the database user permissions setup for Oracle Database 11.2.0.4 and above, by utilizing the “DBMS_GOLDENGATE_AUTH.GRANT_ADMIN_PRIVILEGE” package to simplify the implementation of permissions for the Oracle GoldenGate database user.

**Capture From and Delivery to Cloud-Based Systems**

As organizations and individual departments adopt cloud applications, in many cases they create point-to-point connections that bypass well-established integration principles. Lack of centralized monitoring and management causes extra work for system administrators, especially as cloud data and functions are shared with on-premise information systems. Data integration solutions play a vital role in migrating data simply, efficiently, and reliably to the cloud. They are also essential to platform-as-a-service (PaaS) implementations because they support cloud deployments with data-layer application integration between on-premise and cloud environments.

**Consolidating into Private Cloud**

Oracle Data Integrator and Oracle GoldenGate can connect on-premise enterprise systems to a private cloud by moving data in bulk or as real-time transactions across geographies. GoldenGate’s real-time and bidirectional data replication capabilities between heterogeneous systems enable companies to consolidate data without interrupting business operations. The new Oracle Database 12c release introduced new multitenant architecture, which simplifies the process of consolidating databases onto the cloud, enabling customers to manage many databases as one - without changing their applications. Oracle GoldenGate 12c is optimized for Oracle Database 12c and supports its new multitenant architecture, making it a perfect solution for consolidation without impacting business operations. A failback option allows the IT team to test the target environment as long as necessary, minimizing risk.
Integrating Public Cloud Environments with On Premises Systems

Some of the key requirements in keeping the data fresh in hybrid environments include – minimal latency, reliability and security. Data must remain fresh. As data ages it becomes less relevant and less valuable—day-old data is often insufficient in today’s competitive landscape. Reliability must be guaranteed despite system or connectivity issues that can occur between the cloud and on-premises instances.

Oracle GoldenGate offers real-time data replication between on premises databases and databases hosted on public cloud environments to enable reliable, secure and timely data integration. Oracle GoldenGate 12c is SOCKS5 compliant and leverages customers’ SOCKS compliance setting for data transfer, enabling customers to replicate between on-premises and cloud environments without an extra private VPN connection open.

Security is a key concern when replicating between cloud-based and on-premises instances. There are three options to consider, which are outlined below. Depending on the options selected, the configuration of Oracle GoldenGate 12c may vary.

Option 1 – Secured network established between the cloud and on-premises

A secured network is established between the cloud and on-premises, which enables the database instances hosted in the cloud and on-premises to have seamless connectivity between each other irrespective of where they are physically located.

Option 2 – Restricted network established between the cloud and on-premises

A restricted network is established between the cloud and on-premises instances which enables certain ports (required by replication) to be opened on both the cloud and on the on-premises instances and white lists the IP addresses of the cloud and on-premises instances.
Option 3 – Restricted network access from on-premises and cloud through HTTP proxy

This option can be considered when the ports required by the applications (including replication software) are not open and the cloud instance is not white listed on the on-premises instance. This option of tunneling through the HTTP proxy may only be considered when proper security exceptions are obtained.

Figure 4.2 – Restricted networks using HTTP proxy

For more information please review the knowledge article (ID - 1588484.1) titled ‘Replicating between Cloud and On-Premises using Oracle GoldenGate’.

Enhanced Reliability

Integration with Oracle Data Guard FSFO provides automated and transparent failover of Oracle GoldenGate components with the failover/switchover of the primary database so replication can continue without any manual intervention. In the instance of a failover/switchover, Oracle GoldenGate processes are started on the standby system during the role transition and insure that no data is lost during the failover/switchover. Below is an example that illustrates a typical configuration before and after a planned or unplanned failover.

Figure 5.0 - Normal Operations
Oracle GoldenGate Downstream Integrated Capture is able to utilize the Data Guard redo transport mechanism to process transactions off-source. Compared to an implementation where the Capture is running locally on the source database machine, Downstream Integrated Capture reduces the potential data loss by using the Data Guard redo transport mechanism to ship redo to a downstream / remote machine where GoldenGate Capture processes are installed. If a failure occurs on the source database, the Database LogMining Server will continue to process the redo log data that has been sent to it until the Capture process needs to fetch data from or query the source database.

Repair Capabilities in Oracle GoldenGate Veridata

Many Oracle GoldenGate customers use the add-on products Oracle GoldenGate Veridata for database comparison for validating data consistency in replicated environments. Companies who replicate critical databases, with or without Oracle GoldenGate, can leverage Oracle GoldenGate Veridata’s ability to quickly identify and report on data discrepancies between heterogeneous databases. And it performs this fast comparison without interrupting database availability. Many organizations use Oracle GoldenGate Veridata to help ensure data consistency before switching over to a new system, to have confidence that their standby systems for high availability has the same data as the primary system, or to validate data for regulatory reporting. With the new version, Oracle GoldenGate Veridata 12.1.3 now offers the ability to repair data discrepancies between replicated databases. IT organizations can achieve now even higher productivity and minimize the negative outcome of inconsistent data, as they can quickly repair data discrepancies before affecting business operations extensively. You can read more in Oracle GoldenGate Veridata 12c Data Sheet
Improved Management and Monitoring

Oracle GoldenGate Management Pack includes Oracle GoldenGate Monitor and the Oracle Enterprise Manager Plug-In, and Oracle GoldenGate Director products. The new Oracle GoldenGate Monitor 12.1.3 release offers capabilities to control GoldenGate’s Capture and Delivery processes as well as ability to edit configuration files. Moreover, the new release offers a more secure single sign on, support for monitoring Oracle GoldenGate instances running on IBM DB2 for z/OS, and variety of new metrics that provide timely and comprehensive view into the health of GoldenGate solutions.

Oracle Enterprise Manager Plug-in version 12.1.3, which has the ability to start and stop Oracle GoldenGate processes, edit parameter files, collect information about operations, and diagnose issues easily.

You can learn about the new features and product capabilities for these critical add-on products via Oracle Management Pack for Oracle GoldenGate data sheet.

Expanded Oracle Application and Technology Support

In addition to the exciting new features added to Oracle GoldenGate 12c, several Oracle products have integrated Oracle GoldenGate with their applications to expand capabilities and provide new solutions. These new capabilities and solutions are not dependent upon Oracle GoldenGate 12c and can be implemented using Oracle GoldenGate 11g Release 2 and higher.

Oracle Coherence HotCache

Third-party updates to the database can cause Coherence applications to work with data that could be out-of-date. HotCache solves this problem by monitoring the database and pushing changes into the Coherence cache.

HotCache works by processing database change events delivered by GoldenGate and maps those changes onto the affected objects in the Coherence cache. It is able to do this through the use of Java Persistence API (JPA) mapping metadata. JPA is the Java standard for object-relational mapping in Java and it defines a set of annotations (and corresponding XML) that describe how Java objects are mapped to relational tables.
Key Features & Benefits
» Propagates database changes to corresponding objects in Coherence Cache
  » Oracle GoldenGate for database change capture
  » TopLink Grid to map database changes to cached objects
» Improves application data consistency
» Can be added to ANY existing Coherence application
» Efficient ‘update on change’ operation
» Adapter configuration completely declarative
  » XML only configuration supported

For more information, please visit [http://www.oracle.com/coherence](http://www.oracle.com/coherence).

Oracle Business Intelligence - Source Dependent Data Store (SDS)
In a conventional ETL scenario, data is loaded from source online transaction processing (OLTP) schemas, which in many cases support full-time transactional systems with constant ongoing updates. Contention can arise during complex extracts from these sources, particularly in cases where significant OLTP data changes have occurred which must be processed and loaded by ETL processes.

To relieve this contention, a source dependent data store (SDS) can be implemented to replicate OLTP schemas in the same database as the Oracle Business Analytics Warehouse schema. The SDS is a separate schema usually stored on the same database as the Oracle Business Analytics Warehouse, which contains data extracted from an OLTP schema on a separate machine. The OLTP schema is treated as the source and the SDS schema as the target of the Oracle GoldenGate processes which maintain the replicated SDS.

Key Features & Benefits
» Oracle GoldenGate eliminates resource intensive ETL batches from source OLTP system
» Faster ETL performance
» Data Warehouse ETL can be scheduled when the business needs the data
» Multiple ETL loads can now be executed several times a day for fresher DW data

Conclusion

Oracle GoldenGate 12c Release 1 improves upon the real-time, heterogeneous data replication capabilities to which customers have grown accustomed. With new features and capabilities such as Integrated Delivery and enhancements to globalization, security and performance, extensibility, manageability, and heterogeneity, Oracle GoldenGate 12c Release 1 is the most feature rich, robust, and flexible data replication product on the market today. Customers can continue to rely on Oracle GoldenGate for data integration and replication solutions in their most complex and critical environments.
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