# Maximum Availability Architecture (MAA) with Oracle GoldenGate MicroServices in HUB Architecture

*Learn how to use Oracle GoldenGate to improve the availability, reliability, and scalability of your mission-critical systems*

**Lucia Hustatyova**

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## Dedicated to

*My beloved Family:*

*My husband* ***Slavomir*** *and my children*
***Alexander***, ***Viktoria*** *and* ***Simona***

# Foreword

**Mr. Rohit Rahi** (Vice President, Global Oracle Cloud Infrastructure Delivery, Oracle University | ex-AWS | ex-Azure), leads Oracle Cloud Infrastructure training and certifications. He has been part of the core team that launched Oracle Cloud Infrastructure in 2016. Previously, he worked at AWS and Microsoft Azure in various roles. Rohit has a Bachelor of Engineering degree from BIT, Mesra in India, and an MBA from Carnegie Mellon University in the US. Outside work, he likes hiking in the Pacific Northwest and reading non-fiction books.

This book will help in understanding the whole architecture design of the Oracle GoldenGate with MicroServices Architecture in HUB configuration, including High Availability (HA) and Disaster Recovery (DR) and how to use it for different purposes - for the upgrade/migration/data replication. How to setup/manage OGG deployments using REST API, what is the most powerful feature of OGG MA (in the Administration server)

The readers will be able to manage OGG deployments in different ways - via web portal, REST API and admin client.

# About the Author

**RNDr. Lucia Hustatyova,** MBA as Lead architect / Oracle Senior DBA, triple OCM (Oracle Certified Master), is working in the area of IT architecture, design, engineering and automation.

In her country, Slovakia, she is the first and still the only woman with the highest level of Oracle certification - OCM.

From the study perspective, she holds multiple degrees of education as a Doctor of Natural Sciences in Informatics (RNDr.), Magister of Science from Mathematics and Informatics (Mgr.) and Master of Business (MBA) in Project management. From the professional perspective and experiences, she holds multiple certifications but is mostly recognized as Oracle Certified Master from different versions of OCM 10g/11g/12c or Exadata specialist.

She has more than 15 years of experience with Oracle databases in multiple areas, such as database administration, performance tuning, different types of migrations, upgrades and patching, Data Guard, High Availability solutions, backup & recovery of databases or data manipulation and replication using Oracle Golden Gate in classic or microservice architecture.

Mostly, she is involved in projects related to consultancy, solving complex issues, on-boarding new customers, architecture design, implementation of new technology, database upgrades or migrations (e.g. to/from Exadata, to/from RAC, …), Data Guard implementation (classic DG databases, snapshot standby databases or active DG) together with the defining design and architecture, development/automation and implementation of the solution.

In the automation area, she is working with different tools, scripting and programming languages. All the time, she is trying to automate everything that is possible to simplify work for the daily operation, which is helping to avoid possible human errors. Automation is performed in different scripting languages such as bash, perl, python, ... or other programming languages such as java, html, php, java script, ajax, sql, pl/sql, ....

Outside of work, she presents at universities and teaches students.

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She has also participated in technical review and co-authored several books for other publications.

# Acknowledgements

When I was a child, I dreamed that one time I would write a book… It was still only in dreams. But I had never imagined that it would come to reality and I would be writing a book – the technical book.

When I first met Yenugula Venkata Ravi Kumar, we only discussed technical topics and how to handle them and this was the starting point for thinking about the book and what would be written and how it would help other people to understand the technical topics described in this book. I am grateful that I had this opportunity and that I met a few wonderful people around me to support me.

I strongly believe in the quote, "It is never too late to start with a new area and turn dreams into reality," and for me, writing this book is the new wonderful thing that I loved to its core. I want to thank each who helped me to achieve this, without whom this would not have been possible. I especially thank my family, my husband Slavomir and my three children - Alexander, Viktoria, and Simona. Sometimes it was really challenging for me, so really thanks for your patience and the time that I spent in writing this book.

Big thank to Yenugula Venkata Ravi Kumar and Mariami Kupatadze, you believed in me, motivated me, supported me and gave me courage to complete it. Because writing a book is harder than I expected. It was an honor for me, that you also accepted the role of technical reviewers.

At the end big thanks to the BPB Publications to support this book, release it and for turning my dream into reality.

# Preface

This book provides step by step instructions, explanation about the whole architecture design for Oracle GoldenGate Microservices in HUB configuration including HA (High Availability) and DR (Disaster Recovery). This new technology is explained in the real project's examples for the database upgrade/migration, data replication using OGG MA in HUB configuration, using REST API, command line solutions or web interface. Everything is explained from the beginning of the architecture design until full installation and administration. Book contains also real example of the code, how to handle different activities via REST API. Via Cloud Control will be installed OGG plugin to monitor all components. Architecture designed is proven at the end of the book, where is explained via example/execution that solution works as designed in the DR and HA situation.

This book will help to understand whole architecture design of the OGG MA in HUB configuration including HA and DR and how to use it for different purposes - for the upgrade/migration/data replication. How setup/menage OGG deployments using REST API, what is the most powerful feature of OGG MA (in Administration server)

The reader will be able to manage OGG deployments in different ways - via web portal, via REST API, via admin client.

This book is divided into **14 chapters**. They will cover everything from the beginning until full administration, automation, and monitoring. Different readers will find different administration possibility, command line solutions or graphical interpretation, using REST API, admin client or Web GUI Interface. The details are listed below.

**Chapter 1: Introduction to Oracle GoldenGate in HUB Architecture -** Explanation of what is included in the book. Clear overview of the architecture design covering High Availability and Disaster Recovery for Oracle GoldenGate Microservices in HUB configuration. What kind of software will be used/installed. In this chapter, how OGG MA can be used in real projects will be described. This chapter will cover the components of OGG MA, what kind of requirements must be fulfilled and what are OGG MA's limitations, restrictions and what is supported/not supported in OGG MA.

**Chapter 2: Oracle GoldenGate MicroServices Architecture in HUB Configuration -** In this chapter, HLD (High-Level Design) and LLD (Low-Level Design) in the picture for different use cases, such as OGG MA used for upgrade or migration; OGG MA is used for data replication in one way/bi-directional or multi-target are explained in detail.

**Chapter 3: Installation Setup: OGG in HUB Architecture - Part GI and ACFS –** This chapter will cover the details of installation of the environment where OGG MA will be installed. How to install/prepare source and target environment. How to configure ACFS storage and replication using acfsutil. This chapter will cover GI and ACFS configuration for application and database servers.

**Chapter 4: Installation Setup: OGG in HUB Architecture – Part RDBMS –** This chapter is the follow-up of the previous chapter where Oracle Clusterware with ACFS storage is configured and installed. This chapter focuses on the database and configuration part.

**Chapter 5: Installation of OGG MA - OGG in HUB Infrastructure -** Details of the installation, step by step with description and screenshots, including the configuration of SSL with a self-signed certificate for secure communication, how to install and configure reverse proxy (NGINX), will be explained. The creation of the ACFS clusterware service and dependencies for other clusterware services will be discussed.

**Chapter 6: Uni-Directional Replication Setup: OGG in HUB Architecture –** In this chapter, how to use OGG MA to upgrade Oracle database (migration from non-multitenant to multitenant environment; using character set migration) will be discussed. How to replicate data into another database on the schema or object level. How to add/remove schema/object from the replication. This chapter will cover how the DMU tool can analyze data and how it is useful in the case of character set changes.

**Chapter 7: How to- DDL, Parallelism, and REST API for Automation -** How to setup DDL replication, parallelism and how to work with automation via REST API. Real examples of using REST API and comparison of how they are reflected in the GUI (Service manager).

**Chapter 8: Bi-Directional Replication Setup OGG in HUB Architecture - Setup and Preparation –** This chapter covers setting up the source and target databases, prerequisites and parameters. What is recommended to execute and check in the database before starting up with the OGG Replication. In this chapter, step by

step instructions on how to create a new deployment and reconfigure NGINX are explained.

**Chapter 9: Bi-Directional Replication Setup OGG in HUB Architecture –** This chapter contains step by step instructions on how to setup bi-directional replication, what is required to setup directly in the OGG Service manager and at the end bi-directional replication testing and automatic conflict detection and resolution (ACDR) is performed.

**Chapter 10: Monitoring - OGG in HUB Architecture – Setup Veridata –** In this chapter, installation of the Veridata, how to use it for data comparison and how to configure autostartup services are covered.

**Chapter 11: Monitoring- OGG in HUB Architecture– Execute Veridata and Configure Cloud Control –** In this chapter, you will learn how to use Veridata and configure Veridata jobs for data comparison. All OGG processes should also be monitored, therefore the chapter also covers step by step instructions on how to install the OGG plugin to Oracle Cloud Control and how to monitor all OGG services.

**Chapter 12: Patching Oracle - OGG in HUB Architecture -** Step-by-step instructions on how to patch the whole environment **–** including WebLogic, Veridata and Oracle GoldenGate

**Chapter 13: Troubleshooting- OGG in HUB Architecture -** During the lifetime of the environment, some issues can arise with the components, which are a part of the architecture. This chapter covers some of the issues and how to analyze and solve them.

**Chapter 14: Disaster Recovery Setup- OGG in HUB Architecture –** This chapter will cover, the proof that architecture is correctly designed and works as expected. In case of an issue with any node or issue with the whole datacenter, all services are able to handle the situation and are able to survive.

# Code Bundle and Coloured Images

Please follow the link to download the
***Code Bundle*** and the ***Coloured Images*** of the book:

## https://rebrand.ly/kz00qx3

The code bundle for the book is also hosted on GitHub at **https://github.com/bpbpublications/Maximum-Availability-Architecture-with-Oracle-GoldenGate-MicroServices-in-HUB-Architecture**. In case there's an update to the code, it will be updated on the existing GitHub repository.

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# Chapter 1

# Introduction to Oracle GoldenGate in HUB Architecture

## Introduction

**Oracle GoldenGate Microservices Architecture** (**OGG MA**) replicates data from committed transactions between heterogeneous sources and targets without impacting system performance.

Oracle GoldenGate (**MA**) is a new microservices architecture that provides REST-enabled services as part of the Oracle GoldenGate environment. The REST-enabled services provide remote configuration, administration, and monitoring through a user-friendly environment (web interface), command line, and APIs.

It provides business continuity by replicating data, that is up to 6 times faster than traditional data movement solutions for high availability, disaster recovery, and zero downtime migrations.

OGG is capable of covering various topologies, as shown in the following *Figure 1.1:*

- One to one (Unidirectional)
- One to many (Distribution)
- Many to one (Consolidation)
- Many to many

- Peer-to-peer
- Cascading
- Bidirectional

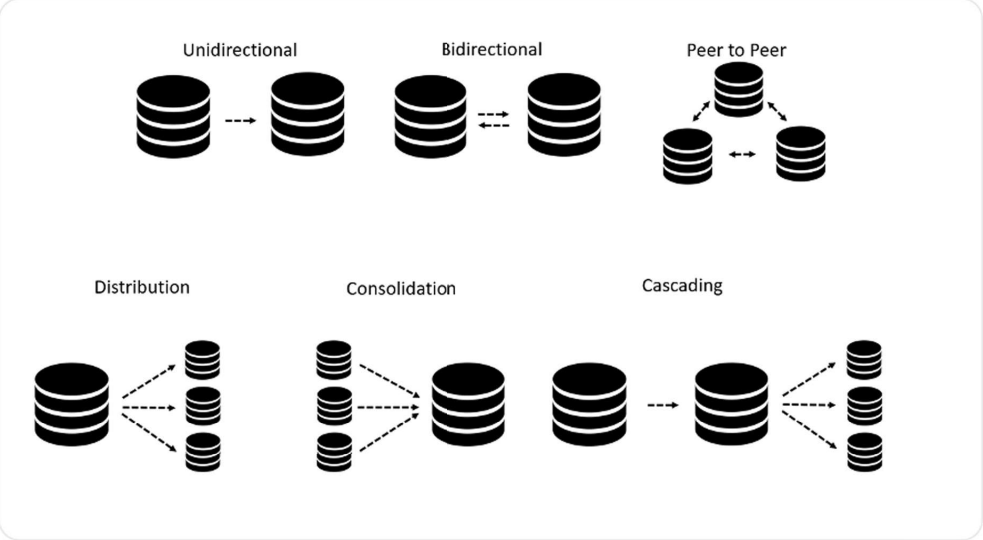


***Figure 1.1:*** *OGG replication technologies*

OGG MA can be used in both homogenous and heterogeneous environments, and it also includes character set conversion capabilities. OGG MA is very useful for multiple use cases:

- Data replication between databases
- Database upgrades
- Database migration (from on-prem to on-prem, from on-prem to Cloud)
- Data synchronization
- High availability

Using OGG MA, we can achieve zero downtime for database upgrades or migration.

Using the Oracle Veridata tool, we can be sure, that data are 1:1 replicated. With this tool, we can set up multiple jobs to compare data inside the database. We can also see possible inconsistencies in data and then repair and fix reported issues/inconsistencies. Veridata is a Java-based application that runs within the Oracle WebLogic server.

# Structure

In this chapter, we will go over the following topics:

- Minimal hardware requirements for the OGG MA HUB server
- Software requirements for the OGG MA HUB server
- Oracle GoldenGate Microservices in HUB architecture
- Service Manager
- Administration server
- Performance Metrics server
- Distribution server
- Receiver server
- OGG MA limitations and restrictions
- Oracle Real Application Clusters
- Oracle Clusterware
- Oracle Grid Infrastructure Agents (XAG)
- Oracle Database Files System (DBFS)
- Oracle Advances Cluster File System (ACFS)

# Objectives

This chapter gives step-by-step instructions on how to install the whole Oracle GoldenGate Microservices Architecture in the HUB configuration. It means that nothing will be installed on the database servers (as a source and target database system/servers). The reason is not only to offload the source and target server and consume server resources but to manage all migrations or replications from one place. Everything can also be monitored via a plugin in Cloud Control. There is a possibility to see reports and parameter files and restart the extract or replicat process.

For this purpose, a separate server will be installed with all required software:

- **Oracle GoldenGate Microservice architecture (OGG MA)**
  - Binaries are required for all Oracle database versions, which we want to cover for replication or upgrade of the database. (Downloaded will be only one latest version of the OGG MA software, but binaries will be installed for each Oracle database version).
- **Oracle database**: The database is required as a repository for Veridata.

- **Oracle Weblogic server**
- **Oracle Veridata server**

For a secure connection, a self-signed certificate will be used (in the production, it is recommended to use a real certificate signed by the certification authority).

# Minimal hardware requirements for OGG MA HUB server

**Hardware** (**HW**) requirements are only scaled for testing purposes. In the real configuration, of course, it is advised to use a more powerful setup in the real scenario. Refer to the following *Table 1.1:*

| | | | |
|---|---|---|---|
| **OS** | Operating System | Linux x86-64 (used for demonstration in the book)<br>Windows x86-64 | The best is to use the latest certified version of the OS for the OGG. To check certification, please visit the Oracle page. |
| **Storage** | Product | 80GB | Oracle database software<br>Veridata SW<br>Veridata agents<br>OGG MA |
| | Trail files | | Based on the data to be replicated |
| **Memory** | | 16GB | OGG MA (1GB + The amount of memory that is required for Oracle GoldenGate depends on the amount of data being processed)<br>Veridata Agent (1GB per agent (agent is started for each database in scope, for example, replication between two databases requires two running agents))<br>This is the calculation for demonstration – minimum for testing. |

| | | | |
|---|---|---|---|
| **Privileges** | | Read/write privileges on the installation directory; trail files location | Another common OS user should not have privileges to access OGG files, trail files, … |

***Table 1.1:*** *Minimal hardware requirements for OGG MA HUB server*

# Software requirements for OGG MA HUB server

The software requirements for OGG MA HUB server are given in the following *Table 1.2:*

| | **Software** | **Version** | **Note** |
|---|---|---|---|
| **Database** | Oracle database | 19c | LTS = Long Time Supported version<br>Oracle Multitenant architecture<br>Character set: AL32UTF8 |
| **Application** | Java JDK | 1.8 | Or later |
| | Weblogic server | 14c | |
| | Oracle Veridata server | 12.2.1.4.0 | Version: 12.2.1.4.0 190913 release build 19 |
| | Oracle Veridata agent | 12.2.1.4.0 | Required for the connection to the databases; each database requires to have started own agent to setup communication between Veridata and the database. |
| | Oracle GoldenGate Agent | 12.2.1.4.0 | |
| | Oracle GoldenGate Microservices | 21.3.0.0 | |
| | | 19c | |

***Table 1.2:*** *Minimal software requirements for OGG MA HUB server*