Replicating Transactions Between Microsoft SQL Server and Oracle Database Using Oracle GoldenGate

by Nikolay Manchev

Build a simple transaction replication example that spans these platforms, step by step.

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Most Oracle technology professionals who are interested in data replication are familiar with Oracle Streams. Until 2009, Streams was the recommended and most popular Oracle technology for data distribution.

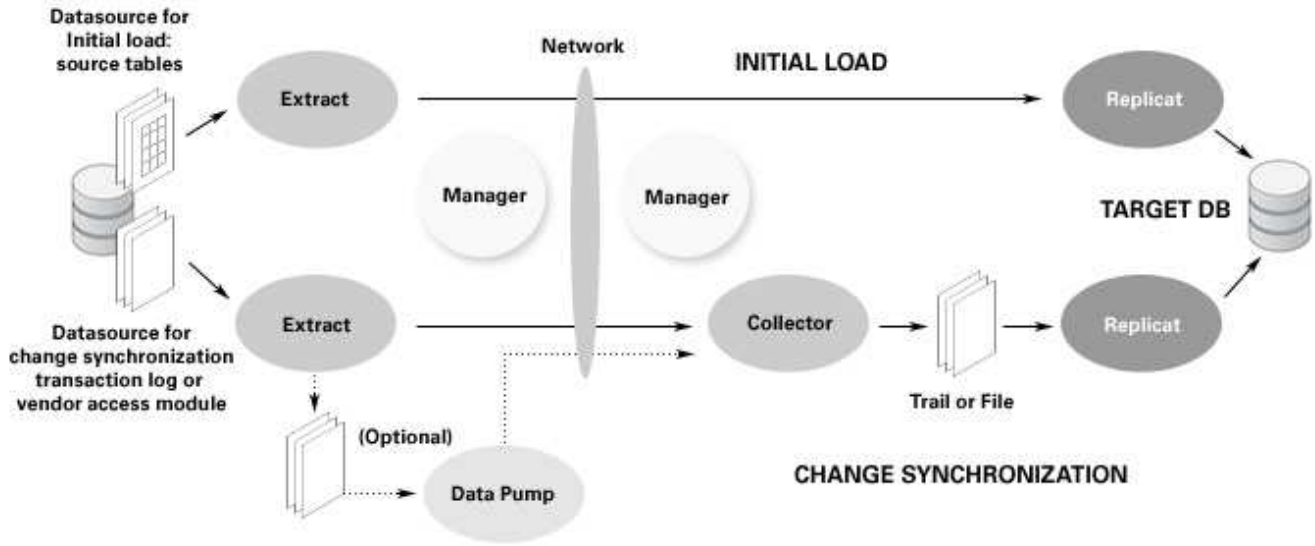
In July 2009, Oracle acquired GoldenGate, a provider of database replication software. The company is now encouraging its customers to use Oracle GoldenGate (which is part of the Oracle Fusion Middleware family) for their data replication needs in new applications. Oracle's statement of direction regarding Oracle Streams says that product "will continue to be supported, but will not be actively enhanced."

In this article we will build a simple transaction replication example using Oracle GoldenGate, in order to get acquainted with this new technology.

Oracle GoldenGate Architecture

GoldenGate v11 enables transaction level replication among heterogeneous platforms. It supports Oracle Database, IBM DB2, Microsoft SQL Server, MySQL, Teradata, and many other platforms. (It also supports access through a generic ODBC driver.)

The most important components that we need to be familiar with are the Extract and Replicat processes. The Extract process runs at the source system and captures the data changes. The Replicat is running at the target machine and is responsible for applying the changes to the target database.



There are two common configurations for the Extract process. The so called â€œinitial loadâ€ is used for populating the target database with an exact copy of the source data (i.e. Extract is fetching all data from the source database and typically runs only once). Then the â€œchange synchronizationâ€ can take place. In â€œchange synchronizationâ€ configuration the Extract is constantly monitoring the source database and captures all changes on the fly.

In this demonstration we will setup a Microsoft SQL Server 2008 as a source database, configure and perform an initial load and then start an Extract process in a change synchronization mode. In order to show that this replication is truly heterogeneous, we will run SQL Server on Windows XP and Oracle Database 11*g* Release 2 on Oracle Linux 5. As a prerequisite I will assume that you already have a clean installation of SQL Server 2008 on the Windows box and Oracle Database on the Linux machine.

We will start building the demonstration scenario by installing GoldenGate. Let's start with the Windows box.

GoldenGate for SQL Server Installation on Windows XP

First you need a copy of Oracle GoldenGate v11 for SQL Server. You can download it from http://edelivery.oracle.com (Oracle Fusion Middleware â†' Microsoft Windows x32 â†' Oracle GoldenGate for Non Oracle Database v11). The serial number of the media pack that you need is V22241-01.

Select	Name	Part Number	Size (Bytes)
Download	Oracle GoldenGate V11.1.1.0.0 for DB2 9.1/ 9.5 on Windows 2003, 2008	V22696-01	10.0M
Download	Oracle GoldenGate V11.1.1.0.1 for Sybase 15 on Windows 2003, 2008	V22682-01	9.7M
Download	Oracle GoldenGate V11.1.1.0.1 for Sybase 12.5.4 on Windows 2003, 2008	V22687-01	9.7M
Download	Oracle GoldenGate V11.1.1.0.0 for SQL Server 2000, 2005, 2008 on Windows XP, 2003, 2008	V22241-01	9.8M
Download	Oracle GoldenGate V11.1.1.0.3 for MySQL 5.x on Windows 2003, 2008	V23460-01	13M
Download	Oracle GoldenGate V11.1.1.0.4 for TimesTen 7.x on Windows 2003, 2008	V23465-01	9.4M
Total: 6			

Extract the downloaded archive in a location where you want to have the Oracle GoldenGate installation (in this example â€“ C:\GG). Then open a command prompt, go to the directory, and launch GGSCI (the GoldenGate command interface):

```
C:\GG>ggsci

Oracle GoldenGate Command Interpreter for ODBC
Version 11.1.1.0.0 Build 078
Windows (optimized), Microsoft SQL Server on Jul 28 2010 18:55:52

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reserved.

GGSCI (MSSQL) 1>
```

Next execute the command `CREATE SUBDIRS` to create the Oracle GoldenGate working directories.

```
GGSCI (MSSQL) 1> CREATE SUBDIRS

Creating subdirectories under current directory C:\GG

Parameter files                C:\GG\dirprm: created
```

```
Report files                   C:\GG\dirrpt: created
Checkpoint files               C:\GG\dirchk: created
Process status files           C:\GG\dirpcs: created
SQL script files               C:\GG\dirsql: created
Database definitions files     C:\GG\dirdef: created
Extract data files             C:\GG\dirdat: created
Temporary files                C:\GG\dirtmp: created
Veridata files                 C:\GG\dirver: created
Veridata Lock files            C:\GG\dirver\lock: created
Veridata Out-Of-Sync files     C:\GG\dirver\oos: created
Veridata Out-Of-Sync XML files C:\GG\dirver\oosxml: created
Veridata Parameter files       C:\GG\dirver\params: created
Veridata Report files          C:\GG\dirver\report: created
Veridata Status files          C:\GG\dirver\status: created
Veridata Trace files           C:\GG\dirver\trace: created
Stdout files                   C:\GG\dirout: created


GGSCI (MSSQL) 2> EXIT

C:\GG>
```

According to the official documentation GGSCI supports up to 300 concurrent Extract and Replicat processes per Oracle GoldenGate instance. There is however a single process that is responsible for controlling the other processes; it's called the Manager process. Although you can run this process manually it is a good practice to install it as service - otherwise it will stop when the user that started it logs off.

To add the Manager process as a Windows service execute the `INSTALL ADDSERVICE` command within the GoldenGate installation directory.

```
C:\GG>INSTALL ADDSERVICE

Service 'GGSMGR' created.

Install program terminated normally.

C:\GG>
```

This pretty much completes the Windows installation. Let's move on to the Linux machine.

GoldenGate for Oracle Installation on Oracle Linux 5

Installing Oracle GoldenGate on Linux is not much different than the installation that you did on top of Windows XP. You will need to download the media pack of GoldenGate for Oracle on Linux (V22228-01). You create an installation directory and unzip the archive there. In this example, I use the /u01/app/oracle/gg directory, as our ORACLE_BASE is pointing to /u01/app/oracle. After this is done you have to set the PATH and LD_LIBRARY_PATH environment variables like this:

```
[oracle@oradb ~]$ export PATH=$PATH:$ORACLE_BASE/gg
[oracle@oradb ~]$ export LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_BASE/gg
```

Let's start GGSCI and execute `CREATE SUBDIRS`.

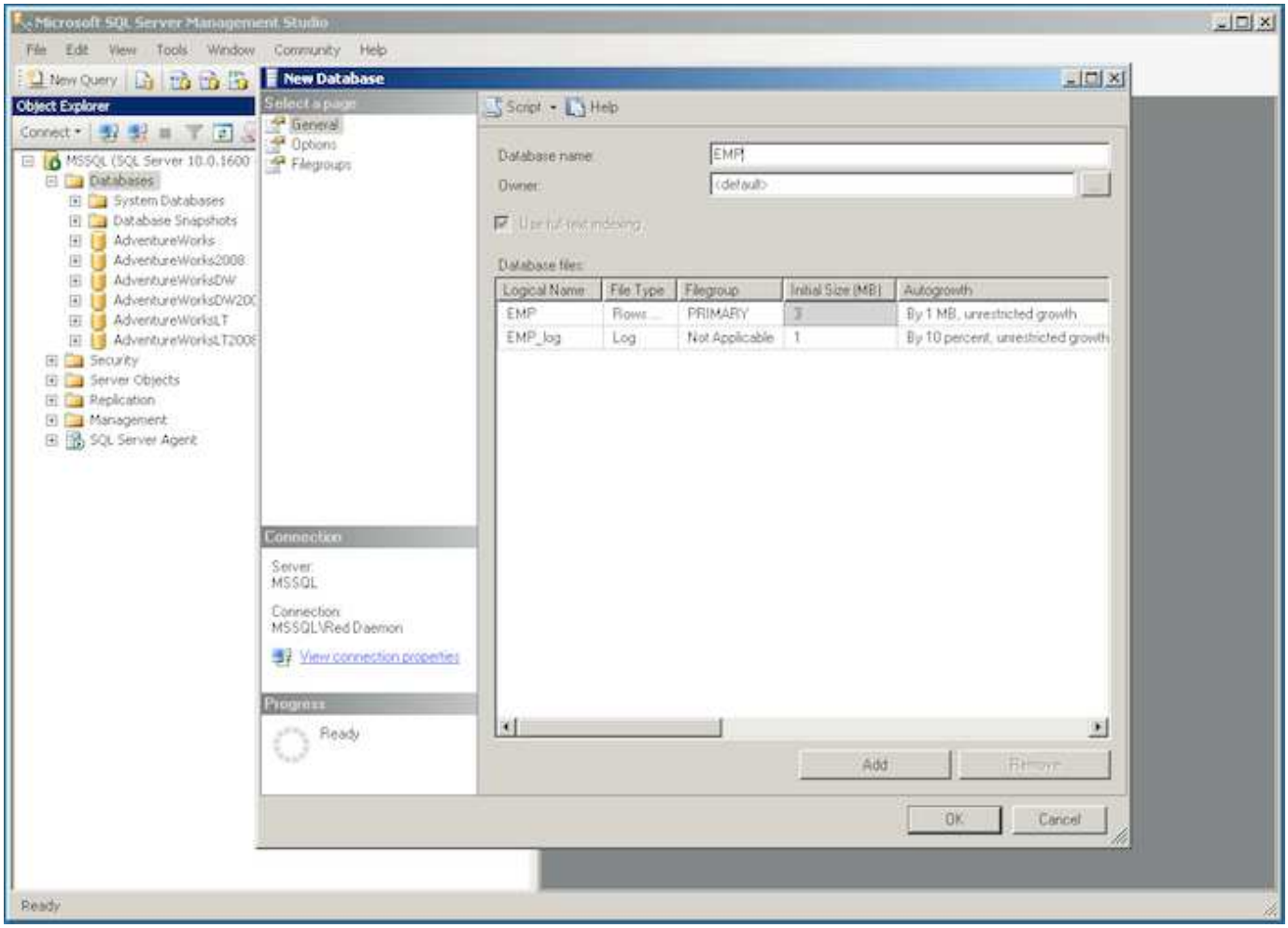
```
[oracle@oradb ggs]$ cd $ORACLE_BASE/gg
[oracle@oradb gg]$ ./ggsci

Oracle GoldenGate Command Interpreter for Oracle
Version 11.1.1.0.0 Build 078
```

```
Linux, x86, 32bit (optimized), Oracle 11 on Jul 28 2010 13:22:25

Copyright (C) 1995, 2010, Oracle and/or its affiliates. All rights
reserved.


GGSCI (oradb) 1> CREATE SUBDIRS

Creating subdirectories under current directory /u01/app/oracle/gg

Parameter files                /u01/app/oracle/gg/dirprm: created
Report files                   /u01/app/oracle/gg/dirrpt: created
Checkpoint files               /u01/app/oracle/gg/dirchk: created
Process status files           /u01/app/oracle/gg/dirpcs: created
SQL script files               /u01/app/oracle/gg/dirsql: created
Database definitions files     /u01/app/oracle/gg/dirdef: created
Extract data files             /u01/app/oracle/gg/dirdat: created
Temporary files                /u01/app/oracle/gg/dirtmp: created
Veridata files                 /u01/app/oracle/gg/dirver: created
Veridata Lock files            /u01/app/oracle/gg/dirver/lock: created
Veridata Out-Of-Sync files     /u01/app/oracle/gg/dirver/oos: created
Veridata Out-Of-Sync XML files /u01/app/oracle/gg/dirver/oosxml: created
Veridata Parameter files       /u01/app/oracle/gg/dirver/params: created
Veridata Report files          /u01/app/oracle/gg/dirver/report: created
Veridata Status files          /u01/app/oracle/gg/dirver/status: created
Veridata Trace files           /u01/app/oracle/gg/dirver/trace: created
Stdout files                   /u01/app/oracle/gg/dirout: created


GGSCI (oradb) 2> EXIT
[oracle@oradb gg]$
```

Installation on the Linux machine is now completed.

Preparing the Source Database

Next step is to create a new database in SQL Server and populate it with some sample data. The name of the database will be EMP. You can create it by launching SQL Server Management Studio, right-clicking on **Databases**, and selecting **New Database**.



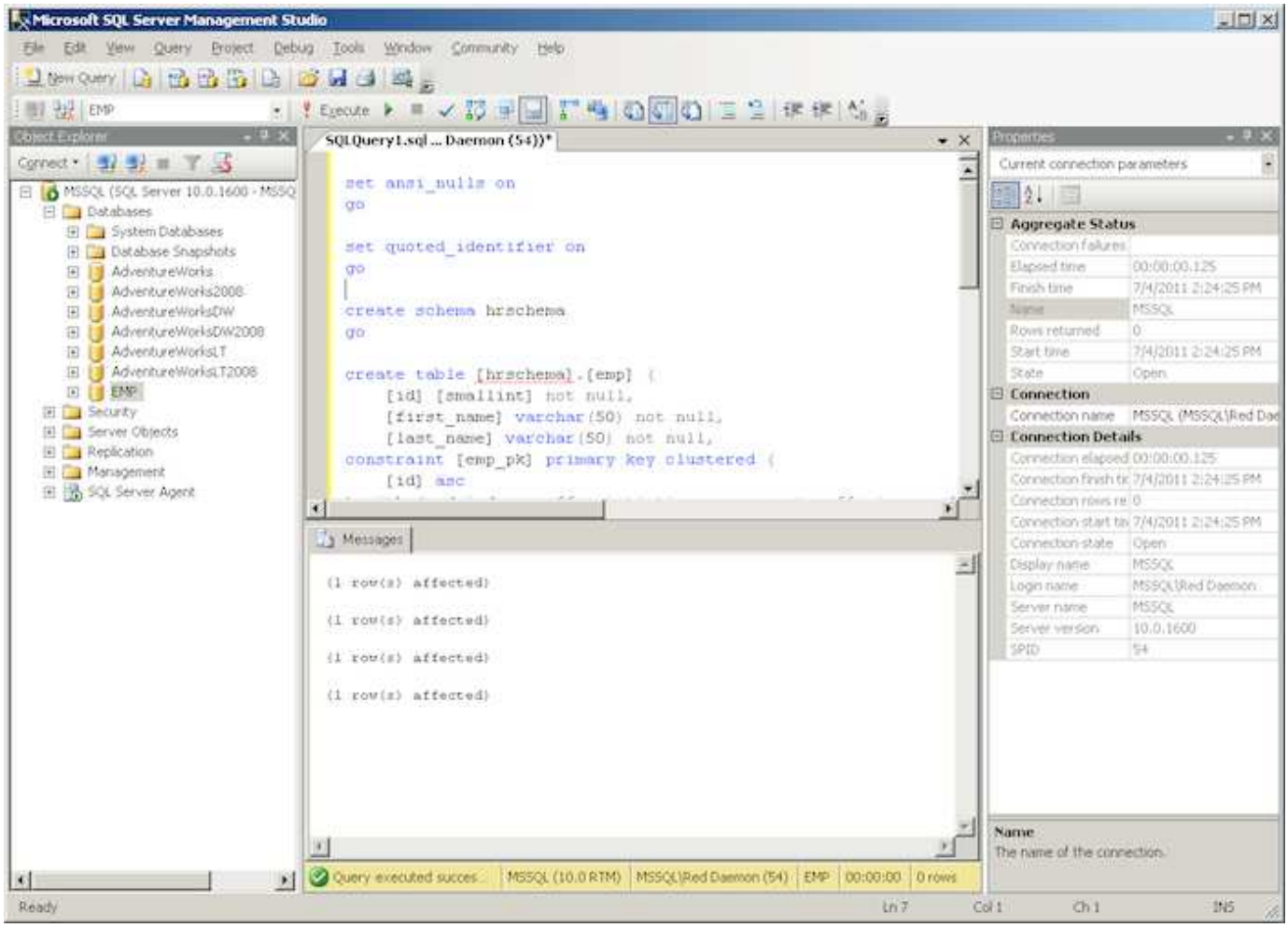
Type EMP in the database name field and click **OK**, leaving all other options by default.

Let's add a new database schema (HRSCHEMA), a table (EMP) and a few test records in the newly created database. This will be accomplished by running the following SQL:

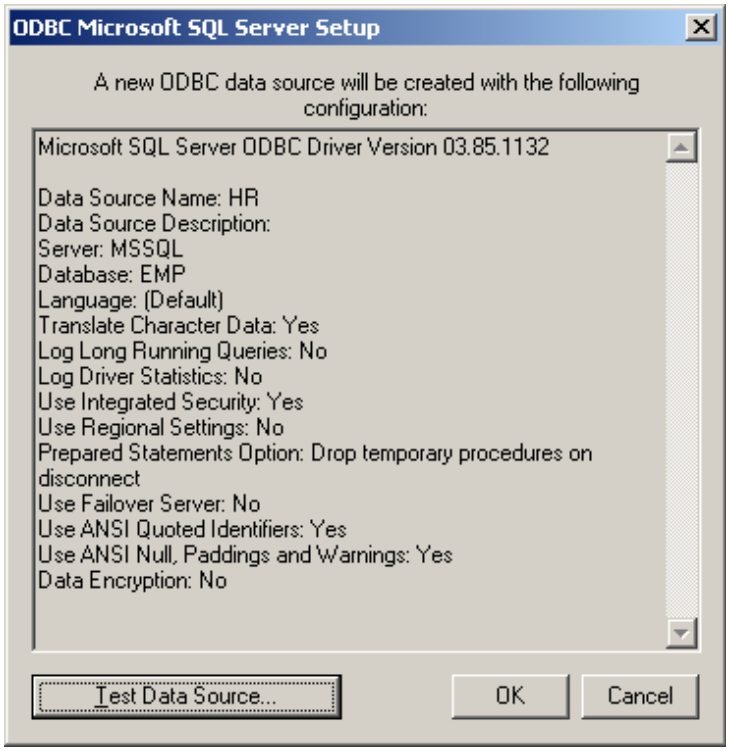
```
set ansi_nulls on
go

set quoted_identifier on
go

create schema hrschema
go

create table [hrschema].[emp] (
     [id] [smallint] not null,
     [first_name] varchar(50) not null,
     [last_name] varchar(50) not null,
constraint [emp_pk] primary key clustered (
     [id] asc
) with (pad_index = off, statistics_norecompute=off, ignore_dup_key=off,
allow_row_locks=on, allow_page_locks=on) on [primary]
) on [primary]

go



-- TEST DATA
```

```
INSERT INTO [hrschema].[emp] ([id], [first_name], [last_name]) VALUES
(1,'Dave','Mustaine')
INSERT INTO [hrschema].[emp] ([id], [first_name], [last_name]) VALUES
(2,'Chris','Broderick')
INSERT INTO [hrschema].[emp] ([id], [first_name], [last_name]) VALUES
(3,'David','Ellefson')
INSERT INTO [hrschema].[emp] ([id], [first_name], [last_name]) VALUES
(4,'Shawn','Drover')
GO
```

First create a new query (by right-clicking on the database name and selecting **New Query**). Then paste-in the SQL text above and hit F5 to execute it.



Now, in order for Oracle GoldenGate to be able to access the EMP database, you have to create an ODBC data source for it. Let's go to **Control Panel -> Administrative Tools -> Data Sources (ODBC)** and add a new System DSN. Select **SQL Server** as the database driver and name the data source HR. You point the source to the local SQL Server (MSSQL) and fill in the login credentials. The data source summary should be similar to this:



Now it's time to enable Oracle GoldenGate to acquire the transaction information for the EMP table from the transaction logs. Again you will be using GGSCI:

```
C:\GG>ggsci.exe

Oracle GoldenGate Command Interpreter for ODBC
Version 11.1.1.0.0 Build 078
Windows (optimized), Microsoft SQL Server on Jul 28 2010 18:55:52

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reserved.


GGSCI (MSSQL) 1> DBLOGIN SOURCEDB HR
Successfully logged into database.

GGSCI (MSSQL) 2> ADD TRANDATA HRSCHEMA.EMP

Logging of supplemental log data is enabled for table hrschema.emp

GGSCI (MSSQL) 3>
```

Because the data types in Oracle and SQL Server are different you have to establish a data type conversion. GoldenGate provides a dedicated tool called DEFGEN that generates data definitions and is referenced by Oracle GoldenGate processes when source and target tables have dissimilar definitions. Before running DEFGEN you have to create a parameter file for it, specifying which tables should the tool inspect and where to place the type definitions file after the tables are inspected. You can create such a parameter file using the EDIT PARAMS command within GGSCI.

```
GGSCI (MSSQL) 3> EDIT PARAMS DEFGEN

GGSCI (MSSQL) 4>
```

This creates an empty parameter file named DEFGEN.PRM and located in the DIRPRM folder of your GoldenGate installation. Put the following contents inside the file:

```
defsfile c:\gg\dirdef\emp.def
sourcedb hr
table hrschema.emp;
```

The parameters are pretty self explanatory. We want DEFGEN to inspect the EMP table inside the HRSCHEMA and to place a definitions file named EMP.DEF in the DIRDEF sub-directory. Let's invoke DEFGEN and examine its output.

```
C:\GG>defgen paramfile c:\gg\dirprm\defgen.prm

***********************************************************************
         Oracle GoldenGate Table Definition Generator for ODBC
                     Version 11.1.1.0.0 Build 078
   Windows (optimized), Microsoft SQL Server on Jul 28 2010 19:16:56

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reserved.


                    Starting at 2011-04-08 14:41:06
***********************************************************************

Operating System Version:
Microsoft Windows XP Professional, on x86
Version 5.1 (Build 2600: Service Pack 3)

Process id: 2948

***********************************************************************
**            Running with the following parameters                  **
***********************************************************************
defsfile c:\gg\dirdef\emp.def
sourcedb hr
table hrschema.emp;
Retrieving definition for HRSCHEMA.EMP

Definitions generated for 1 tables in c:\gg\dirdef\emp.def

C:\GG>
```

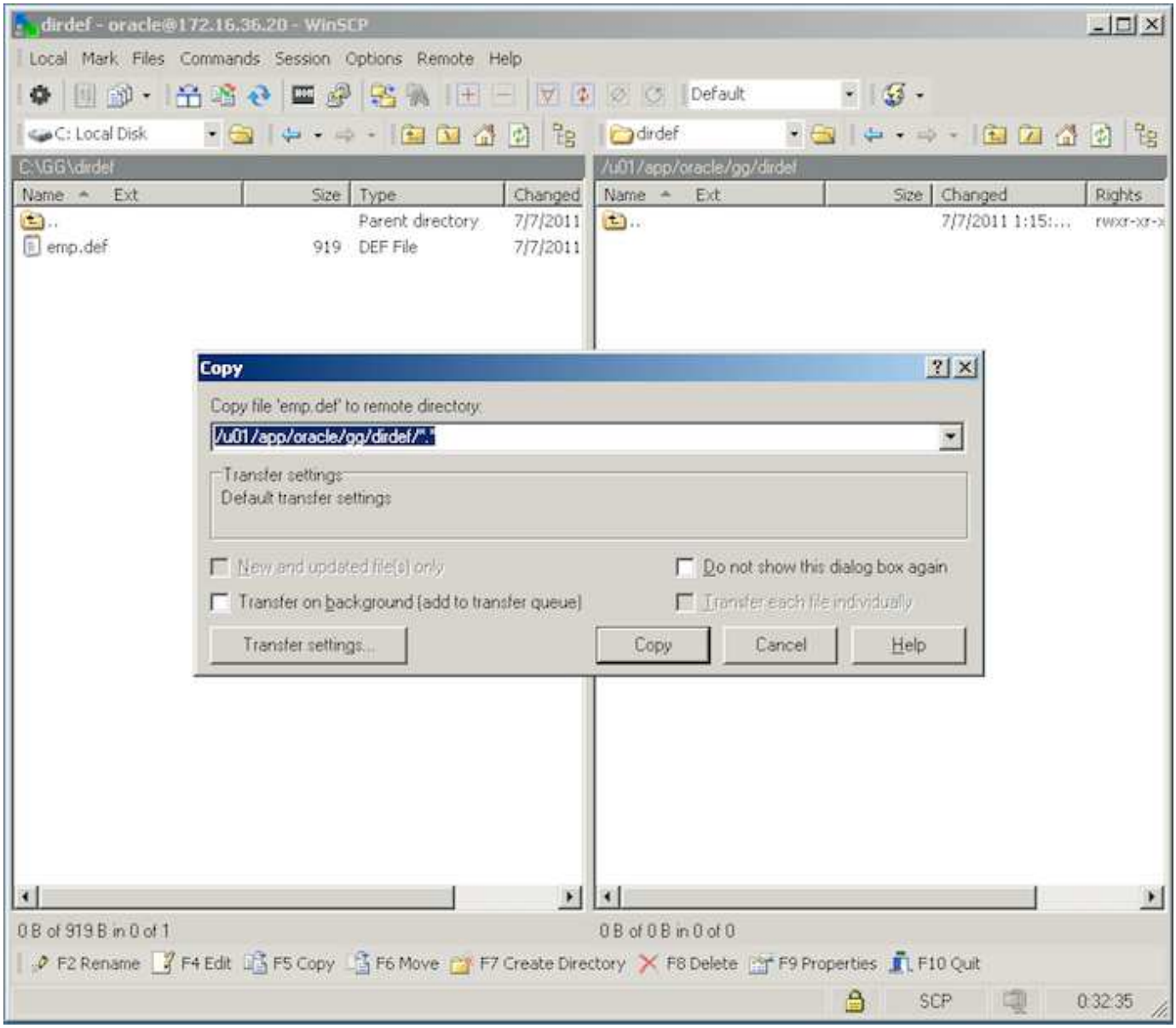
If you bother to check the contents of EMP.DEF it will be something similar to this:

```
*
* Definitions created/modified  2011-07-07 10:27
*
*  Field descriptions for each column entry:
*
*     1    Name
*     2    Data Type
*     3    External Length
*     4    Fetch Offset
*     5    Scale
*     6    Level
*     7    Null
*     8    Bump if Odd
*     9    Internal Length
*    10    Binary Length
*    11    Table Length
```

```
*    12    Most Significant DT
*    13    Least Significant DT
*    14    High Precision
*    15    Low Precision
*    16    Elementary Item
*    17    Occurs
*    18    Key Column
*    19    Sub Data Type
*
*
Definition for table HRSCHEMA.EMP
Record length: 121
Syskey: 0
Columns: 3
id          134     23        0  0  0 1 0      8      8      8 0 0 0 0
1    0 1 0
first_name   64     50       11  0  0 1 0     50     50      0 0 0 0 0
1    0 0 0
last_name    64     50       66  0  0 1 0     50     50      0 0 0 0 0
1    0 0 0
End of definition
```

It basically lists all tables/columns and describes the native database types using a more general definitions.

Now you have to copy the EMP.DEF file to the target machine as it should be available to the Replicat process. The Replicat will have to do another conversion. It will map the more general types back to database specific types (but this time the types will correspond to the ones used by the target database). For copying the file you can use FTP/SFTP or SCP transfer. (Personally I am using a free FTP/SFTP/SCP client called WinSCP to copy EMP.DEF from the Windows box to the /u01/app/oracle/gg/dirdef folder on the Linux machine.)



Preparing the Target Database

After the source preparations are finalized it's time to move to the target machine. Let's create a schema (GG_USER) and a table where the Replicat process can apply the transactions coming from the source.

```
[oracle@oradb ~]$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.1.0 Production on Fri Apr 8 14:11:49 2011

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Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
With the Partitioning, OLAP, Data Mining and Real Application Testing
options

SQL> create user gg_user identified by welcome1;

User created.

SQL> grant connect, resource,select any dictionary to gg_user;
```

```
Grant succeeded.

SQL>
```

The EMP table should reside in GG_USER's schema:

```
SQL> create table gg_user.emp (id number not null, first_name
varchar2(50), last_name varchar2(50));

Table created.

SQL>
```

You have to keep in mind that should the Replicat process apply data to tables residing in different schemas, GG_USER will need additional privileges (like SELECT ANY TABLE, LOCK ANY TABLE etc.). A detailed list of the required privileges is listed in the official documentation.

Setting Up the Extract & Replicat for Initial Data Load
Let's start by setting up the Extract process on the source machine. Name the process INEXT (for INitial EXTract). Next create a parameters file in the same manner as the parameter file that you created for the DEFGEN utility. The filename will be INEXT.PRM.

```
C:\GG>ggsci.exe

Oracle GoldenGate Command Interpreter for ODBC
Version 11.1.1.0.0 Build 078
Windows (optimized), Microsoft SQL Server on Jul 28 2010 18:55:52

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GGSCI (MSSQL) 1> EDIT PARAMS INEXT
```

Paste the following contents to INEXT.PRM:

```
SOURCEISTABLE
SOURCEDB HR
RMTHOST ORADB, MGRPORT 7809
RMTFILE /u01/app/oracle/gg/dirdat/ex
TABLE hrschema.emp;
```

The SOURCEISTABLE parameter instructs the Extract process to get the data directly from the table instead of the transaction logs. This is the behavior that we want in order to do a full extraction. SOURCEDB points to the database that contains the data. RMTHOST and MGRPORT specify the remote machine and Manager's port. RMTFILE specifies the file to which the extracted data will be written.

That's all the configuration you need for the initial data extraction. Let's move to the Linux machine and configure the initial data loading.

You have to deal with the Manager process first: Start GGSCI and create a parameter file called MGR.PRM.

```
[oracle@oradb gg]$ ./ggsci

Oracle GoldenGate Command Interpreter for Oracle
Version 11.1.1.0.0 Build 078
Linux, x86, 32bit (optimized), Oracle 11 on Jul 28 2010 13:22:25
```

```
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reserved.


GGSCI (oradb) 1> EDIT PARAM MGR
```

There is only one line that you have to put in MGR.PRM:

```
PORT 7809
```

After saving the file execute the START MANAGER command within GGSCI and see if the manager starts correctly.

```
GGSCI (oradb) 2> START MANAGER

Manager started.


GGSCI (oradb) 3>
```

Next you have to set the parameters for the Replicat process. So create a new parameters file and name it INLOAD (for INitial LOADing).

```
GGSCI (oradb) 3> EDIT PARAMS INLOAD
```

Put the following contents inside INLOAD.PRM:

```
SPECIALRUN
END RUNTIME
USERID gg_user, PASSWORD welcome1
EXTFILE /u01/app/oracle/gg/dirdat/ex
SOURCEDEFS /u01/app/oracle/gg/dirdef/emp.def
MAP hrschema.emp, TARGET gg_user.emp;
```

The SPECIALRUN parameter defines an initial-loading process (it is a one-time loading that doesn't use checkpoints). The next line of the file instructs the Replicat process to terminate after the loading is finished.

Next you provide the database user and password, the extract file, and the table definition. The final parameter, MAP, instructs the Replicat to remap the table HRSCHEMA.EMP to GG_USER.EMP.

Running the Initial Extract and Loading

The databases and processes are finally configured. Now you can start the initial loading and see the data replication in action.

First you have to run the Extract process; it will fetch all data residing at the SQL Server's EMP table and write it to the RMTFILE (/u01/app/oracle/gg/dirdat/ex) at the Linux host.

Start the Extract by running the EXTRACT command and providing parameters and log file as command line arguments.

```
C:\GG>extract paramfile dirprm\inext.prm reportfile dirrpt\inext.rpt

***********************************************************************
                 Oracle GoldenGate Capture for ODBC
                    Version 11.1.1.0.0 Build 078
   Windows (optimized), Microsoft SQL Server on Jul 28 2010 19:22:00
```

```
                    Starting at 2011-04-08 15:57:48
***********************************************************************

Operating System Version:
Microsoft Windows XP Professional, on x86
Version 5.1 (Build 2600: Service Pack 3)

Process id: 556

Description:

***********************************************************************
**            Running with the following parameters                  **
***********************************************************************

2011-04-08 15:57:48  INFO    OGG-01017  Wildcard resolution set to
IMMEDIATE bec
ause SOURCEISTABLE is used.

Using the following key columns for source table HRSCHEMA.EMP: id.

CACHEMGR virtual memory values (may have been adjusted)
CACHEBUFFERSIZE:                              64K
CACHESIZE:                                     1G
CACHEBUFFERSIZE (soft max):                    4M
CACHEPAGEOUTSIZE (normal):                     4M
PROCESS VM AVAIL FROM OS (min):             1.85G
CACHESIZEMAX (strict force to disk):        1.62G

Database Version:
Microsoft SQL Server
Version 10.00.1600
ODBC Version 03.52.0000

Driver Information:
SQLSRV32.DLL
Version 03.85.1132
ODBC Version 03.52

Database Language and Character Set:

Warning: Unable to determine the application and database codepage
settings.
Please refer to user manual for more information.


2011-04-08 15:57:49  INFO    OGG-01478  Output file /u01/app/oracle
/gg/dirdat/ex
 is using format RELEASE 10.4/11.1.

2011-04-08 15:57:55  INFO    OGG-01226  Socket buffer size set to 27985
(flush s
ize 27985).
```

```
Processing table HRSCHEMA.EMP

***********************************************************************
*                   ** Run Time Statistics **                         *
***********************************************************************

Report at 2011-04-08 15:57:55 (activity since 2011-04-08 15:57:49)

Output to /u01/app/oracle/gg/dirdat/ex:

From Table HRSCHEMA.EMP:
       #                   inserts:         4
       #                   updates:         0
       #                   deletes:         0
       #                  discards:         0


C:\GG>
```

The run time statistics shows that 4 rows were successfully extracted. Let's move to the Linux machine and start the Replicat.

To apply the extracted data to the target database, run the replicat command and provide the prepared parameters file. Here is an excerpt from the replicat run:

```
[oracle@oradb gg]$ ./replicat paramfile dirprm/inload.prm

***********************************************************************
                 Oracle GoldenGate Delivery for Oracle
                     Version 11.1.1.0.0 Build 078
   Linux, x86, 32bit (optimized), Oracle 11 on Jul 28 2010 15:42:30

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reserved.


                    Starting at 2011-04-11 12:52:52
***********************************************************************

Operating System Version:
Linux
Version #1 SMP Mon Mar 29 20:06:41 EDT 2010, Release 2.6.18-194.el5
Node: oradb
Machine: i686
                         soft limit   hard limit
Address Space Size   :    unlimited    unlimited
Heap Size            :    unlimited    unlimited
File Size            :    unlimited    unlimited
CPU Time             :    unlimited    unlimited

Process id: 23383

Description:

***********************************************************************
**            Running with the following parameters                  **
***********************************************************************
SPECIALRUN
```

```
END RUNTIME
USERID gg_user, PASSWORD ********
EXTFILE /u01/app/oracle/gg/dirdat/ex
SOURCEDEFS /u01/app/oracle/gg/dirdef/emp.def
MAP hrschema.emp, TARGET gg_user.emp;

CACHEMGR virtual memory values (may have been adjusted)
CACHEBUFFERSIZE:                          64K
CACHESIZE:                               512M
CACHEBUFFERSIZE (soft max):                4M
CACHEPAGEOUTSIZE (normal):                 4M
PROCESS VM AVAIL FROM OS (min):            1G
CACHESIZEMAX (strict force to disk):     881M

Database Version:
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
PL/SQL Release 11.2.0.1.0 - Production
CORE 11.2.0.1.0 Production
TNS for Linux: Version 11.2.0.1.0 - Production
NLSRTL Version 11.2.0.1.0 - Production

...

Reading /u01/app/oracle/gg/dirdat/ex, current RBA 1210, 4 records

Report at 2011-04-11 12:53:15 (activity since 2011-04-11 12:53:14)

From Table HRSCHEMA.EMP to GG_USER.EMP:
       #                   inserts:         4
       #                   updates:         0
       #                   deletes:         0
       #                  discards:         0


Last log location read:
     FILE:      /u01/app/oracle/gg/dirdat/ex
     RBA:       1210
     TIMESTAMP: 2011-04-08 16:57:55.433993
     EOF:       NO
     READERR:   400

...

[oracle@oradb gg]$
```

You can login to the Oracle Database as GG_USER and check the contents of the EMP table.

```
SQL> select id, first_name from emp;

     ID FIRST_NAME
---------- --------------------------------------------------
      1 Dave
      2 Chris
      3 David
      4 Shawn

SQL>
```

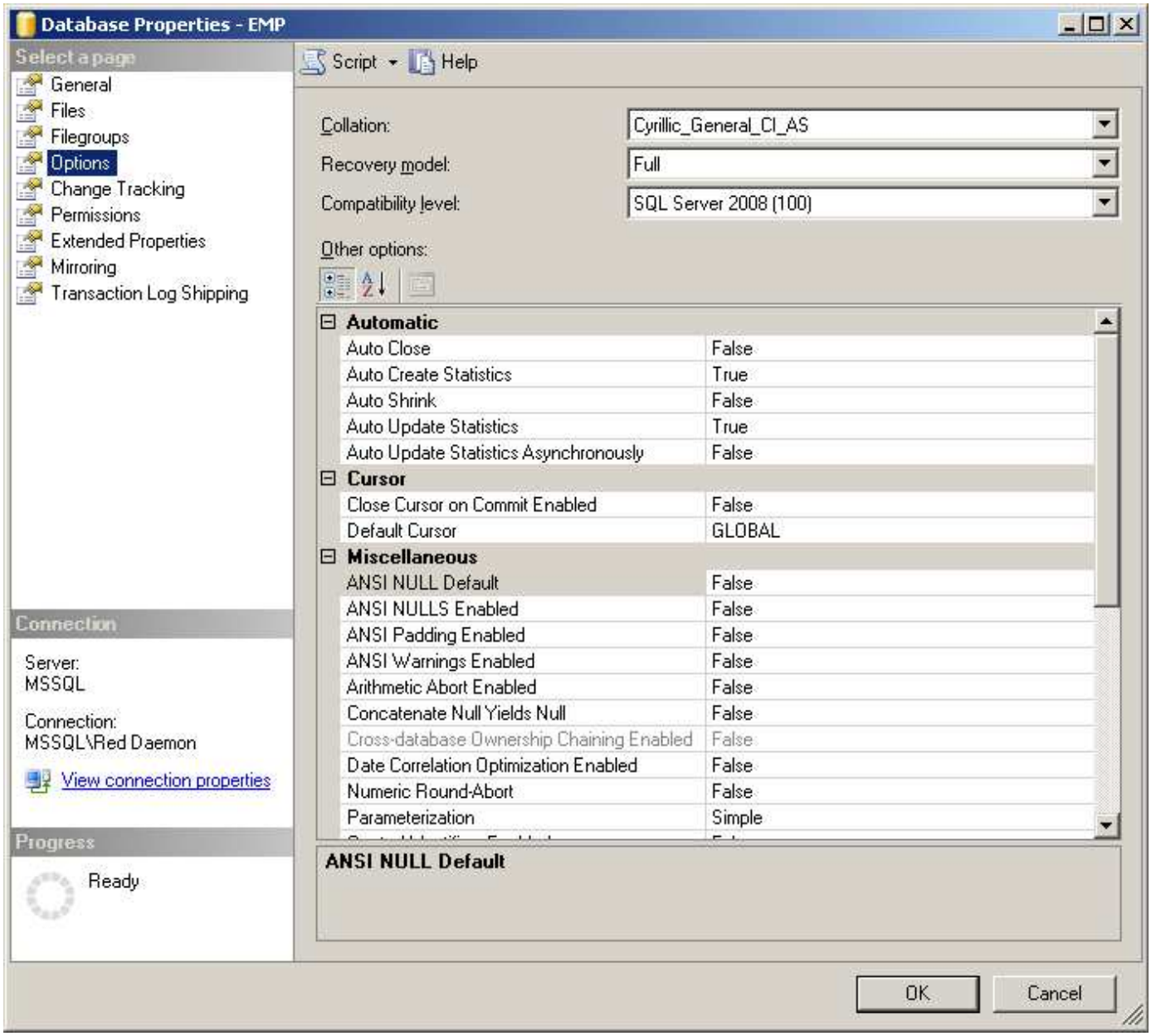
The EMP table now contains a copy of all records that were originally inserted at the SQL Server.

Live Data Capture Configuration

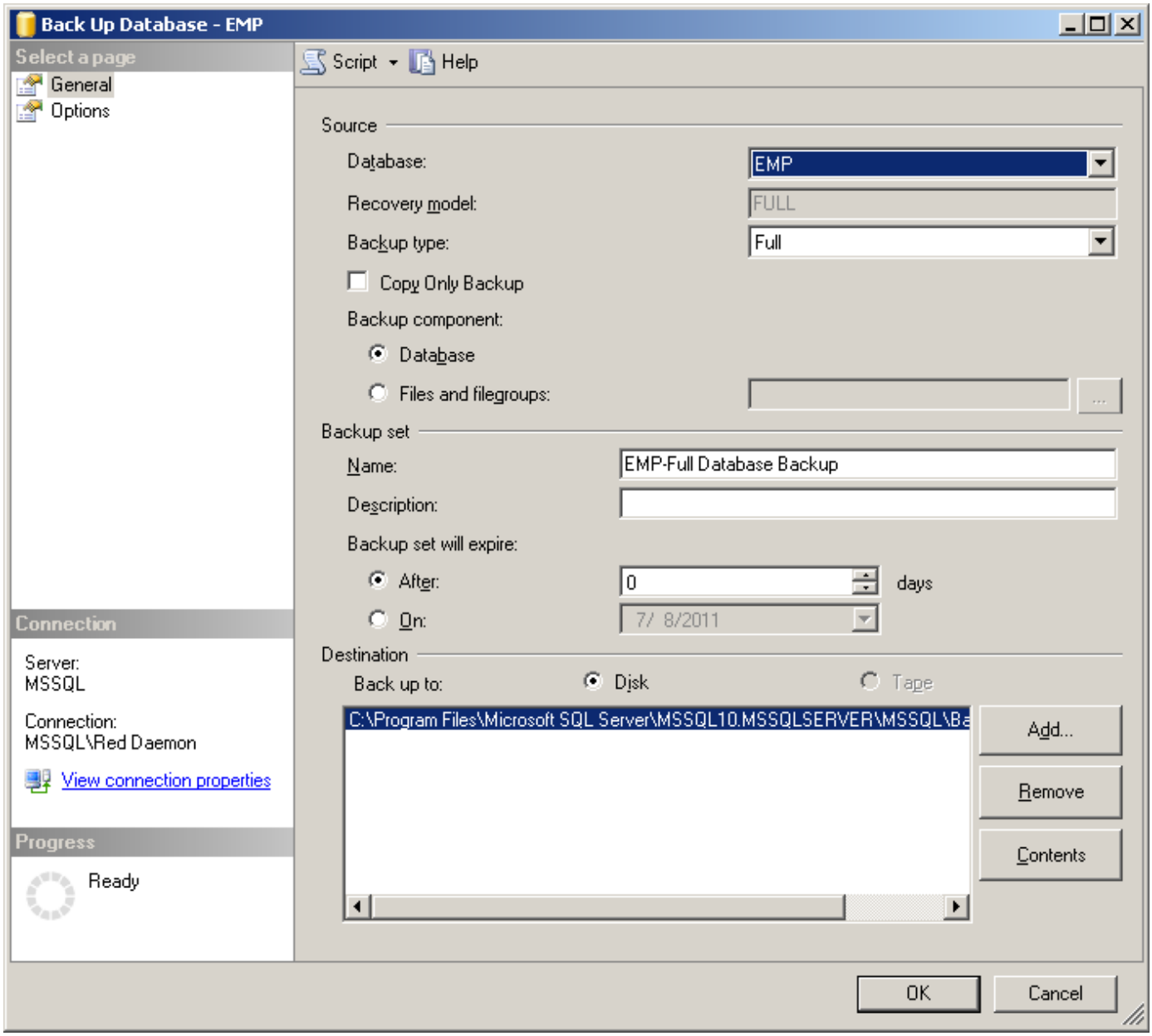
With the Oracle database having an exact copy of the SQL Server's EMP table, it is now time to create a live capture configuration. We will setup the Extract and Replicat processes to run all the time and continuously transmit/apply changes of the EMP table.

In order to implement the new configuration you will have to create new parameter files for extracting and replicating. First however you have to perform two additional steps on SQL Server: Confirm that the database is set to Full Recovery and then take a full database backup of the EMP database. Failure to take a full backup will prevent the Extract process from capturing live data changes.

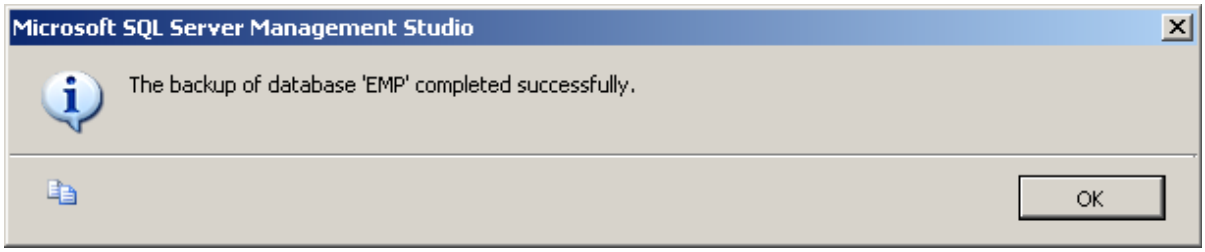
You can easily check if the EMP database is in Full Recovery by right-clicking on it, selecting **Properties**, and inspecting the value of Recovery model.



Taking a full backup is done in a few clicks as well. Right-click on the EMP database, select **Tasks** and then **Back Up**. This brings up the backup database dialog. We confirm that the Backup type is set to **Full** and then click **OK**.



If everything goes well in a couple of seconds we should see a notification that the operation is successful.



Time to set the processes. We will start by configuring a Manager process on the Windows machine. We skipped this step in the initial loading phase, but in the new configuration that you are building the Extract process must be running all the time. This requires an active manager process that will perform resource management functions. You will follow the same steps as with the Linux box configuration.

```
GGSCI (MSSQL) 1> EDIT PARAM MGR

GGSCI (MSSQL) 2>
```

Put a single line in MGR.PRM to set the port of the Manager instance.

```
PORT 7809
```

Then we start the Manager.

```
GGSCI (MSSQL) 2> START MANAGER

Starting Manager as service ('GGSMGR')...
Service started.


GGSCI (MSSQL) 3>
```

Let's create a new extract group for mining the transaction logs and name it MSEXT. Then set a destination where the data changes should be written (/u01/app/oracle/gg/dirdat/ms).

```
GGSCI (MSSQL) 3> ADD EXTRACT MSEXT, TRANLOG, BEGIN NOW
EXTRACT added.

GGSCI (MSSQL) 4> ADD RMTTRAIL /u01/app/oracle/gg/dirdat/ms, EXTRACT MSEXT
RMTTRAIL added.
```

You will also need a new parameters file.

```
GGSCI (MSSQL) 5> EDIT PARAMS MSEXT


GGSCI (MSSQL) 6>
```

Type the following lines in it:

```
EXTRACT MSEXT
SOURCEDB HR
TRANLOGOPTIONS MANAGESECONDARYTRUNCATIONPOINT
RMTHOST ORADB, MGRPORT 7809
RMTTRAIL /u01/app/oracle/gg/dirdat/ms
TABLE HRSCHEMA.EMP;
```

The difference here is that we are omitting the SOURCEISTABLE parameter and introducing a new one: TRANLOGOPTIONS MANAGESECONDARYTRUNCATIONPOINT. This options tells the Extract process to routinely check and delete the CDC capture job, resulting in better performance and less occupied space for captured data.

This is all you need on the source machine. Let's move on and configure the replication at the target.

On the Linux box you have to start by creating a checkpoint table. Checkpoints are used to store the current read/write positions of the Extract and Replicat processes. They prevent loss of data and insure that the processes can recover from faults (for example if the network between the source and target machine goes down for a moment). Create a table that holds checkpoints information by issuing the ADD CHECKPOINT command at the target.

```
GGSCI (oradb) 1> DBLOGIN USERID gg_user, PASSWORD welcome1
Successfully logged into database.

GGSCI (oradb) 2> ADD CHECKPOINTTABLE gg_user.chkpt

Successfully created checkpoint table GG_USER.CHKPT.

GGSCI (oradb) 3>
```

Let's add a Replicat group and setup its parameters.

```
GGSCI (oradb) 3> ADD REPLICAT MSREP, EXTTRAIL /u01/app/oracle
/gg/dirdat/ms, CHECKPOINTTABLE gg_user.chkpt
REPLICAT added.


GGSCI (oradb) 4> EDIT PARAMS MSREP

GGSCI (oradb) 5>
```

As a final step put the following lines in MSREP.PRM.

```
REPLICAT MSREP
SOURCEDEFS /u01/app/oracle/gg/dirdef/emp.def
USERID gg_user, PASSWORD welcome1
MAP hrschema.emp, TARGET gg_user.emp;
```

The configuration is now completed. Let's start the Extract and Replicat and do some testing.

Starting and Testing Online Transaction Replication

To start the Extract process, use GGSCI and execute the `START EXTRACT` command.

```
GGSCI (MSSQL) 1> START EXTRACT MSEXT

Sending START request to MANAGER ('GGSMGR') ...
EXTRACT MSEXT starting


GGSCI (MSSQL) 2>
```

On the Linux machine use the `START REPLICAT` command respectively.

```
GGSCI (oradb) 1> START REPLICAT MSREP

Sending START request to MANAGER ...
REPLICAT MSREP starting


GGSCI (oradb) 2>
```

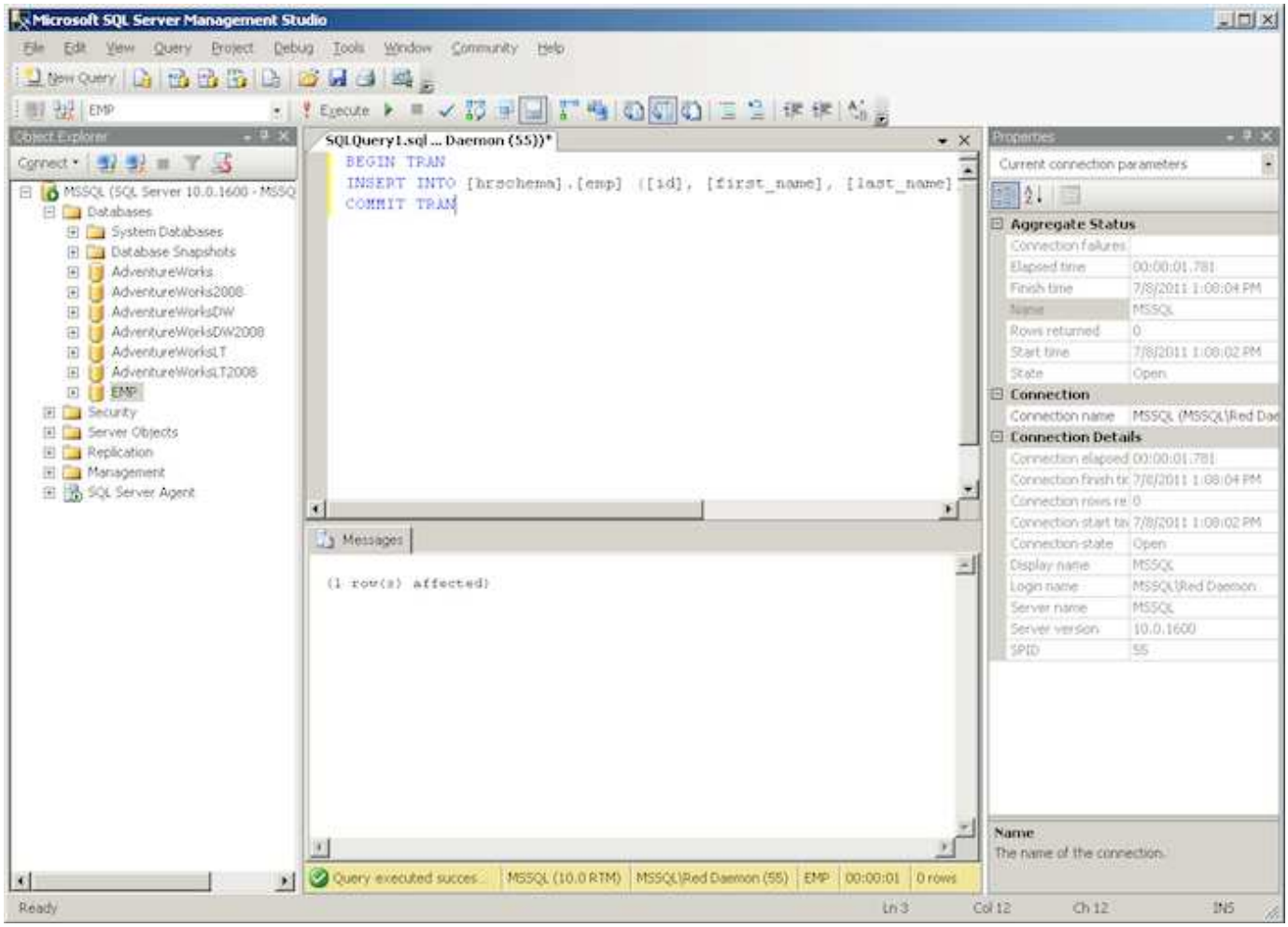
Let's login as GG_USER and see the contents of the EMP table.

```
SQL> select id, first_name from emp;

     ID FIRST_NAME
--------- --------------------------------------------------
      1 Dave
      2 Chris
      3 David
      4 Shawn

SQL>
```

Nothing new here. The data hasn't change since the last time we checked. Let's go back to the SQL Server machine and run the following query, adding one additional row to the EMP table at the source.

```
BEGIN TRAN
INSERT INTO [hrschema].[emp] ([id], [first_name], [last_name]) VALUES
```

```
(9,'Gar','Samuelson')
COMMIT TRAN
```



Let's go back to the Oracle Database and see if anything changed there.

```
SQL> select id, first_name from emp;

     ID FIRST_NAME
---------- --------------------------------------------------
      1 Dave
      2 Chris
      3 David
      4 Shawn
      9 Samuelson

SQL>
```

Congratulations! The data is getting replicated in a sub-second interval, reflecting every single transaction.

Conclusion

In this article we performed a very basic demonstration of some of the Oracle GoldenGate features. You should be aware that there are many different topologies and usage scenarios. For instance, you can configure GoldenGate to perform bidirectional replication (where two different databases simultaneously replicate changes to each other). There are also broadcast (where a single database replicates to multiple targets) and consolidation (many databases replicate to a central database) configurations. One can use GoldenGate to implement query offloading (separating reporting from production, but avoiding the time gap of the traditional data warehouses). It is also a powerful solution for implementing zero downtime upgrades and database migrations.

For detailed information on features, supported databases and platforms and recommended architectures consult the official documentation available at Oracle Technology Network.

Nikolay Manchev, Oracle ACE, is an IT professional with strong background in Oracle Database (OCP - 10*g* & 11*g*), Java (SCJP), virtualization (VCP VI3, vSphere) and information security. He is currently working as an IT Architect and is leading the system integration team at one of Oracle's Gold Partners.