



# Data Replication

## Setup Notes for MS SQL Server Using Triggers

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# Syniti Data Replication

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# Syniti Data Replication

These notes provide essential information for setting up replications using **Microsoft SQL Server** as a source database for one-way mirroring and synchronization. The setup process for a refresh replication can usually be completed using the Syniti Data Replication wizards without additional documentation because it does not involve access to the SQL Server logs.

**This guide describes the setup process using the Triggers options for one-way mirroring and synchronization when replicating data from a SQL Server database.** For mirroring and synchronization replications using SQL Server as a source, Syniti Data Replication offers several approaches:

- **Log Reader:** Queries the SQL Server Log directly. This is the default option and is described in the document *Setup Notes for SQL Server Transactional Replications* available in the [Help Center](#).
- **Log Server Agent:** Uses a Windows service and a Log Server component to query the SQL Server Log for increased performance when dealing with large amounts of data. This approach is described in the document *Setup Notes for SQL Server Transactional Replications* available in the [Help Center](#).
- **Triggers:** Uses triggers installed on the SQL Server database to log changes. This approach may be preferred in your application.

For complete details on the setup process, check the *Syniti Data Replication User Guide* available from the Management Center **Help** menu or the *Syniti Data Replication Setup Guide*, available for download in the [Help Center](#).

## Connection Type

Microsoft SQL Server .NET Data Provider (included with .NET Framework)

**Assembly:** System.Data (file name: System.Data.dll)

## Trigger-Based Replication Overview

A database trigger is code that is automatically executed in response to certain events on a database table. To define a trigger-based replication (mirroring or synchronization), you need to provide information in the Source and/or Target Connection wizards so that triggers can be created to log table changes for replication.

For each table involved in the replication, Syniti DR creates 3 triggers in the source table that fire when a specific event occurs on a record:

- INSERT trigger which fires when a new record is being inserted in the table
- UPDATE trigger which fires when a record is modified
- DELETE trigger which fires when a record is deleted

If the replication is later deleted, the triggers are removed by Syniti Data Replication. However, note that if you change a replication from mirroring to refresh, the triggers on the source table are not deleted. All transactions will continue to be recorded in the log tables. If you are not planning to reset the replication to mirroring, it is better to delete the replication, so that the triggers are removed, and create a new refresh replication.

Data retrieved using the triggers is stored in log tables that are specified in your Source/Target connection. The master log table can be an existing table or one created specifically to hold Syniti DR information. It contains general information about the transactions, like user name, timestamp, table name. A log table (`_DBM__LOG_x`) is also created for each source table in the replication, and contains the data changes identified by the triggers, as well as trigger objects `_DBM__TRG_OBJS`.

Note that Syniti DR does not create a tablespace. If you want to have a table space named SYNITIDR, you must create it beforehand using a SQL tool. Run the appropriate SQL statement for your environment. For example:

```
CREATE TABLESPACE SYNITIDR
```

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When creating a connection, it is important to set the retention time to keep the log table size under control. The higher the value, the more data is kept in the log tables. Try to estimate the number of transactions occurring in all the source tables during a retention period and be sure that the database and table space have enough storage capacity for all those transactions. The Replication Agent cleans up the log tables periodically, based on the retention setting in the connection dialog. If the engine is not running, the log tables are not cleaned up. This might create space problems in the database as the logs grow in size. If you stop the engine and you are not planning to run it again, be sure to remove all the mirroring synchronization replications.

In addition, if you have many table replications in a single group, using a single connection, all the replications share a master log table. Access to the log table for each source table can become a bottleneck if there are many transactions using the same master log and log tables. Syniti DR may report errors about locked tables during replication. Although Syniti DR is able to recover from these errors and continue replicating, a better approach is to prevent the errors by splitting the replications into multiple groups with multiple connections and multiple master log tables. First, create multiple source connections to the database. Use the Transaction Log Type field in the Connection Properties of each connection to open the Setup Info dialog and create a new master log table for each connection.

During replication:

- When a record is inserted in the source table, the INSERT trigger fires and inserts one record in the master table and one record in the log table associated with the source table. The record inserted in the log table contains all the original values of the INSERT statement.
- When a record is deleted from a table, the DELETE trigger fires and inserts one record in the master table and one record in the log table associated with the source table. The record inserted in the log table contains the key values of the deleted record.
- When a record is updated, the UPDATE trigger fires and inserts one record in the master table and two records in the log table associated with the source table. The two records inserted in the log table contain all the record values before and all the records after the update.

A transaction ID is saved both on the master records and log record to maintain a link between the transaction and the data changes for that transaction. See “Syniti DR Log Tables” for more details on the structure of the Master and Log tables.

Your system administrator needs to create and define appropriate table spaces and databases to hold the log tables. They should be large enough to handle the expected amount of replication data.

## Syniti DR Log Tables

Log tables are used to record all data changes made to the source tables. They are populated by triggers that are fired when source tables are modified. Currently, log tables must reside in the replication source database. Note that log tables are created only if they do not already exist in the database.

There are two log tables associated with each replication: a master table, common to all replications using that connection, and a log table, one for each replication. The master table keeps track of all the transactions affecting the source tables and it records general transactional information.

### Master table structure

- `TID DECIMAL(31,0) GENERATED BY DEFAULT AS IDENTITY:`  
Transaction ID number associated with each record data change (transaction)
- `SNAME VARCHAR(128):`  
Name of the schema the transaction was applied to.

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- `TNAME VARCHAR(128)`:  
Name of the table the transaction was applied to.
- `TTS TIMESTAMP`:  
Transaction timestamp indicating when the transaction was submitted to the system
- `TUSER VARCHAR(128)`:  
Name of the user who executed the transaction

## Log Table Structure

The Log table contains the actual data changes for a specific source table. Its structure depends on the structure of the source table.

- `__TID DECIMAL(31,0)`:  
Transaction ID, link to the corresponding record in the master table
- `__OP CHAR`:  
Indicates the type of operation:  
  
‘I’ INSERT  
‘D’ DELETE  
‘B’ UPDATE: values before the update  
‘A’ UPDATE: values after the update
- `<Field list>`:

All the columns of the source table with their original data type. For example if the source table was created as:

```
CREATE TABLE SOURCET  
(ID INTEGER,  
  FNAME VARCHAR(30),  
  LNAME VARCHAR(50))
```

The log table will have the following structure:

```
CREATE TABLE __DBM__SOURCET  
(__TID DECIMAL(31,0),  
  __OP CHAR,  
  ID INTEGER,  
  FNAME VARCHAR(30),  
  LNAME VARCHAR(50))
```

## Reading From/Managing Log Table

Syniti DR reads the log tables using the SELECT SQL statement. First, it queries the master table to see if new transactions came in since the last processed `__TID`. If transactions are found, Syniti DR queries the corresponding log table to collect the data changes and apply them to the target table.

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The SELECTs on the master and log tables are sorted by the unique column \_\_TID which ensures that all records will be read in the order that they were written. Syniti DR also uses the unique \_\_TID column to keep track of the point where the last record was read and processed from the log tables.

Syniti DR provides options to manage log records that have been read and replicated. They can be deleted from the log table as soon as they are processed or a retention time can be set to leave this record in the log tables for the specified number of hours.

## Limitations for Trigger-based Replications with SQL Server

Data types "image", "text" and "ntext" are not supported. If you create a transactional replication on a table with fields where these data types defined, the Management Center warns you that the fields will not be replicated. In SQL Server 2005 and SQL Server Express, these types have been replaced by "varbinary(max)", "varchar(max)", and "nvarchar(max)". Microsoft recommends replacing the old data types with the new ones. The new data types are supported when using the Triggers option.

The source table does not need a primary key set in SQL Server but it must have a primary key defined in Syniti DR. See the User's Guide Topic *Primary Key Settings for Mirroring and Synchronization* for an explanation on how to create a primary key in Syniti DR.

## Add a Source Connection Wizard

### Set Connection String Screen

#### Data Source

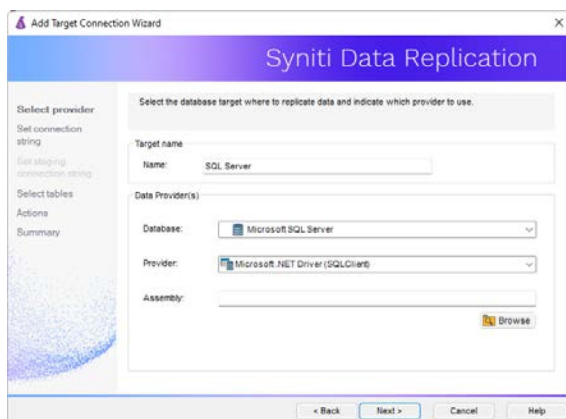
Type the IP address of the server.

#### User ID

Enter a user ID which will be exclusively used by Syniti DR and has the authority to read the database transaction log.

#### For Synchronization Replications:

The login/user ID that you provide must be unique to Syniti DR. It should not be used for any transactions occurring in either database involved in the synchronization. Syniti DR does not replicate transactions by the user you specify in this connection. This user ID is used by Syniti DR during synchronization to read the database logs and perform the synchronization operations. Therefore, any transactions found in the logs with this user ID are not replicated as part of the synchronization data.



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## Enable Transactional Replication Wizard

For transactional replications (mirroring and synchronization), use the Enable Transactional Replication wizard after setting up a source connection.

### Log Type Screen

Select the Triggers option.

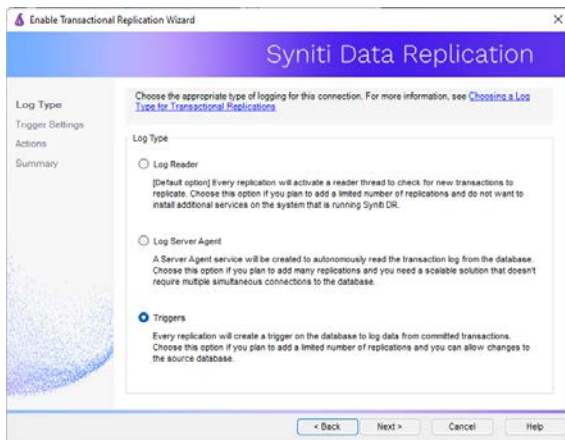
### Trigger Settings Screen

#### Master Table

Either specify an existing qualified table name, or click **Change** to create a new table to hold general information about replication transactions including user name, timestamp, table name for each transaction.

There are two tables associated with each replication: a Master table, common to all replications using that connection, and a Log table for each replication source table. The Master table keeps track of all the transactions affecting the source tables and it records general transactional information.

Master and Log tables are created in the schema specified when you set the Master table name. You can choose a Master table name, or use the default `_DBM__MASTERLOG`. Log tables are automatically generated by Syniti DR and the names are `_DBM__LOG_#`, where # is a number. The selected schema for the Master and Log tables must not contain other non-Syniti tables with names `_DBM__LOG_#`. The recommended approach is to create a new schema to use specifically for the Syniti Master and Log tables.



#### Tablespace

The recommended approach is to assign a tablespace for the Master table and Log Tables so that it is easier to control log table sizes. If you leave this field blank, the default tablespace value for your login ID will be used. Your system administrator should be able to provide you with the appropriate value for this field.



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## Retention Time

The amount of time in hours that a transaction is kept in the log tables. The default value is 72 hours. When the amount of time a transaction resides in the log exceeds the retention time, the transaction is permanently removed from the log tables. Tuning the retention time provides control over the size of the log tables. It is also possible to instruct Syniti DR to remove all the processed transactions at the end of each mirroring interval. Tuning the retention time provides control over the size of the log tables.

## Delete Block Size

Based on the retention time, Syniti DR deletes items from the log. This field specifies the maximum number of records to delete from the Syniti DR log tables with a single SQL statement. The default value is 10,000 records. You do not typically need to edit this value.

## Lower-case Trigger Identifiers

Check this option if your database installation uses lower-case trigger identifiers.

## Trigger Order

Always inactive for SQL Server sources.

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