



LISTSERV Maestro Admin Tech Doc 3

Database Configuration

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This document is a LISTSERV Maestro Admin Tech Doc. Each admin tech doc documents a certain facet of the LISTSERV Maestro administration on a technical level. This document is number 3 of the collection of admin tech docs and explains the topic "Database Configuration".

Last updated for LISTSERV Maestro 10.0-1 on September 29, 2021. The information in this document also applies to later LISTSERV Maestro versions, unless a newer version of the document supersedes it.

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1 Introduction

The Maestro User Interface component of LISTSERV Maestro comes ready to use with an instance of MySQL 8.0.25 as the internal system database (MySQL 5.5.16 for the Solaris versions).

Using this internal system database is optional. You may decide during setup not to install the internal system database at all, in which case you have to install a separate external system database. Alternatively, you may choose to install it during setup, but then switch to a different external system database of your own at a later time.

Please see <http://www.mysql.com> for details about MySQL 8.0.25 and its features to determine if it meets your requirements and expectations for a production database. Reviewing the features will help you decide if you want to use the internal database or if you prefer to install a different external system database.

The internal MySQL database is installed on the same server as the Maestro User Interface component (if installation of MySQL was not deselected during setup). You can find the database binaries, including some of the server and client tools, in the folder

```
[maestro_install_folder]/lui/database/bin
```

on that server.

LISTSERV Maestro is also compatible with various other databases, of various versions. The following databases are supported:

- Oracle 9i or later.
- Microsoft SQL Server 2000 or later.
- MySQL 4.1 or later.
- IBM DB2 Universal Database V8.2 or later.

You can install any of these databases on the server where you have installed the Maestro User Interface component (or on any other server that is reachable over the network) and configure the Maestro User Interface to use this database instead of the internal database.

Please refer to the documentation of the database in question for details about how to install and configure the database.

Note: While LISTSERV Maestro supports relatively old database versions, as listed above, it is **recommended** to use a more recent version of the selected database.

2 Preparing the System Database

Before you can use the Maestro User Interface together with a freshly installed system database, you need to prepare the database in some ways. The following sub-sections explain the required preparation steps for each of the supported databases.

2.1 Preparing SQL Server as the System Database

In your SQL Server management console, you can either create a new database for use with the Maestro User Interface or you can configure one of your existing databases so that the Maestro User Interface can share it.

However, it is recommended that you create a new database for sole use by the Maestro User Interface. Please see your SQL Server documentation for details about how to create a database and how to configure and optimize it.

No matter if you create a new database or use an existing one, make sure that the database uses a **case-insensitive** collation. L-Soft recommends using the `Latin1_General_CI_AS` collation. (This of course also means, that if you want to use an existing database you can only do so if this existing database already uses an case-insensitive collation.)

Once you have created a new database (or selected an existing one), you need to create a user account that Maestro User Interface can use to connect to the database:

Create a new user with any name you like and give it the “`db_owner`” role for the database you have created/selected.

2.2 Preparing Oracle as the System Database

Only Oracle 9i or later is supported as the system database.

If you plan to create a new Oracle database for sole use by the Maestro User Interface, start with creating a new database that uses `UTF-8` as its database character set. Note that the database character set `UTF-8` is required and that the Maestro User Interface will not work with a database that has a different character set. (See the Oracle documentation for details.)

To configure an existing database for use with the Maestro User Interface, use your favorite Oracle administration tool to create a new user. This new user must have the `CREATE SESSION` and the `CREATE TABLE` privilege and a sufficiently large tablespace quota in the user's default tablespace. Again, remember that you can only use an existing Oracle database with Maestro User Interface if the database uses the `UTF-8` character set.

Note that the Maestro User Interface does not require unusually large rollback segments. However, for large mail jobs with large numbers of recipients, the Maestro User's tablespace needs to support this, either by its initial size or by allowing it to grow dynamically. Additionally, if duplicate elimination is performed for large mail jobs, larger temporary segments are needed since duplicate elimination is performed via a database sorting operation.

It is recommended to set the tablespace for the database to `autoextend`, so that it can automatically grow if LISTSERV Maestro requires more space. If you do not set it to `autoextend`, then you must monitor the tablespace usage closely and extend it manually well in time before it runs full.

See your Oracle documentation for more details about how to configure and optimize your database.

Special Oracle Issue: Maximum Key Length.

The “maximum key length” value is a feature specific to Oracle. This value is an internal value inherent to each Oracle installation. It is determined mainly by the block size used by the database but may also be influenced by other factors, like the operating system.

For LISTSERV Maestro to be able to create its database table in an optimal manner, it needs to know the maximum key length value used by the Oracle database that is used as the system database. Unfortunately, there is no method by which Maestro can query this value from the database itself. Therefore, it must rely on the administrator to input the correct value. This happens in the Administration Hub, on the page LUI Settings → System Database Status. On this page, click the “Change Connection Settings” link to supply the necessary adjusted value.

The administrator must determine the maximum key length value used internally by his Oracle database installation and must take care to enter the correct value in the Oracle database settings on the Administration Hub page described above.

If the value entered exceeds the actual maximum key length used by the database, this may result in runtime errors and LISTSERV Maestro will most probably not work correctly.

If on the other hand a value which is smaller than the actual value is entered, LISTSERV Maestro will assume that this smaller value is the value which is used by the database and will tailor its database tables accordingly, to meet this smaller value. As a result, the database tables will be created with a sub-optimal structure and the user may run into database column size limitations which would be avoidable if the correct maximum key length value had been supplied.

Unfortunately, Oracle documentation about which maximum key length value is used under which circumstances is very sparse. A commonly used rule-of-thumb value is that with a block size of **4K**, the maximum key length is **1578**. With a block size of **8K**, the maximum key length is double the value of 4K, i.e. **3156**. Generally, the maximum key length seems to be about 38% - 40% of the block size. If in doubt, please consult the Oracle documentation or contact your Oracle support.

2.3 Preparing DB2 as the System Database

To use a DB2 database for the Maestro User Interface, verify that your selected database supports the code set UTF-8. If this code set is not supported by your chosen database, you need to use the DB2 Control Center application to create a new database and define UTF-8 as the database code set.

To configure an existing database that already has the code set UTF-8, verify that at least one user regular tablespace and one system temporary tablespace with a page size of 32K each exist. You may also need to create a buffer pool with a page size of 32K before you can create tablespaces with 32K page size.

Then you will need to create a new database user for sole use by the Maestro User Interface. This user must be configured to use a regular tablespace with 32K page size, otherwise the Maestro User Interface will not work. The new user needs the **Database Administration** authority for the new database. Then, adjust the database performance parameter **Application Heap Size** to the highest possible value.

2.4 Preparing MySQL as the System Database

If you want to use MySQL as the system database for the Maestro User Interface, you need to set up MySQL to use the so called “InnoDB storage engine” (see the MySQL manual for more details).

The more recent versions of MySQL come with a comfortable “MySQL Server Instance Config Wizard”, which let you specify settings for your database server. These settings will then be written

to the MySQL configuration file. If you use this configuration wizard, specify a database usage type which enables the transactional InnoDB storage engine.

If you do not use this wizard, you need to enable usage of the InnoDB storage engine manually, in the configuration file. Please see the MySQL documentation for details.

It is recommended to configure the InnoDB table space files to be “auto-extending” so that they will grow automatically as needed (this is the default when using the configuration wizard, otherwise, you should specify the `autoextend` option manually).

Once your MySQL database server is set up to use the InnoDB table type, you have the choice between creating a new database specifically for use with the Maestro User Interface (recommended), or to use an already existing database, into which the Maestro User Interface will create its own tables.

In both cases, you need to create a user and grant certain privileges to it. This user will then be used by the Maestro User Interface to connect to the database.

You do so by starting the MySQL client program (“`mysql.exe`”, from the “bin” folder of the MySQL binary installation).

To create a new database, enter the following command in the MySQL client:

```
create database NAME;
```

where you replace “NAME” with the name of the database you want to create (it is recommended that you use an all-lowercase spelling for the database name).

To create a user and grant the necessary access rights to it, enter the following grant command for your username:

```
grant all on DBNAME.* to 'NAME'@'HOST' identified by 'PASSWORD';
```

where you replace the uppercase values as follows:

- **DBNAME:** The name of the database you want to use with the Maestro User Interface (usually the same name as you used in the “`create database`” command, see above – again, it is recommended that you use an all-lowercase spelling of the database name in the grant command too.).
- **NAME:** The user name of the user you want to create (and grant the privileges to).
- **HOST:** The host name of the server where the Maestro User Interface that will access this database is running.
- **PASSWORD:** The password you want to associate with the user name.

2.5 General Optimization Hints for the System Database

If you want to optimize your database installation for use with the Maestro User Interface, you can use the following general information about Maestro User Interface’s usage of the database as a guideline:

- The Maestro User Interface does not use large transactions. I.e., any transactions that are opened are closed after a few hundred inserts or updates (at the most).
- During normal usage, Maestro User Interface behaves with OLTP (online transaction processing) characteristics, e.g. there is a constant switch between read and write on the database. However, if you are running a lot of reports on the collected tracking data, the characteristic of Maestro User Interface’s behavior shifts more and more into OLAP (online

analytical processing), where the amount of (complex) reads outnumbers the amount of writes.

You would have to analyze your own usage of the Maestro User Interface to determine if you are working more with OLTP or OLAP characteristics, so that you can use this information to optimize the database.

2.6 General System Database Configuration Remarks

As already mentioned in the previous paragraphs, the database that is used as storage for the Maestro User Interface should be configured in a way that it allows dynamic growth because the data stored by the Maestro User Interface grows over time. The growth rate corresponds to the number and the size of the mail jobs that are delivered. Large mail jobs with large volumes of collected tracking events will use more database storage than smaller mail jobs.

Some examples of upper limits that might need to be adjusted for large volume environments:

- **User space quota.** Most databases limit the amount of space that a given user may store in the database. This limit should be set to "unlimited" or a sufficiently large value.
- **Database or tablespace size.** Many database vendors, especially those supporting larger database environments, support the sub-division of the database server in smaller areas, sometimes called "tablespaces" or a similar term (see your vendor's documentation for details). Normally, each database account that is created is assigned to one of these areas, which is then the so-called "default tablespace" or "standard tablespace". This part of the database should be configured in a way that it allows dynamic growth, if possible. **Note:** It is possible to use Maestro User Interface with a database that does not support this type of dynamic growth. An administrator should make it part of his daily or weekly routine to check the amount of space available for the Maestro User Interface.
- **File system size.** Like other server applications storing persistent data on the file system, the database storing Maestro User Interface data must of course reside on a server whose file system is monitored on a regular basis, either through automated system administration tools or by an administrator who regularly checks the system.

3 Changing the System Database Settings

Running LISTSERV Maestro (or any other database-driven information system) in production for a longer time means that at some point the administrator may face the task of having to change the current system database connection settings. Typical scenarios that require such a change can be:

- The database server must now be accessed via a different host name than before, either because the server has been moved to a different network segment or some other networking component (such as a firewall) has been changed and therefore a new host name is required.
- The password of the database user account has been changed (e.g. due to password policy regulations).
- A new version of the database vendor software has been installed on a new server and the system database data shall be moved over from the old database to the new database on the new server.
- For whatever reasons, it is necessary to move the system database to a different database software from a different database vendor.

This list is certainly not complete, but in each of the situations above, you will need to supply different system database connection settings in the HUB. Viewing the **System Database Status** screen in the HUB immediately also triggers a connection test, so any problem that may arise from a connection attempt (such as the password no longer being accepted or the host name no longer working etc.) is shown on the screen.

If you make any changes to the system database settings, LISTSERV Maestro automatically detects if the changed settings refer to the same database as before (for example if only the password of the database account was changed) or if they refer to a different database (for example if you want to move the system database to a different server or different database software).

In the former case, nothing further needs to be done. LISTSERV Maestro continues to use the same database as before, only now with different connection settings.

In the latter case however, you have actually initiated a transfer into a new system database. This is described in more detail in the following section 3.1.

When you submit the connection settings for such a database transfer to a new system database, as a first step, LISTSERV Maestro verifies that the new system database is actually empty. The new settings are not accepted otherwise. If the desired new system database is not empty, please verify that you have supplied the correct connection settings (and have not inadvertently specified the settings for a database that is already in use otherwise) and if verified, use the appropriate database tools to cleanup any remaining data in the database. Then try again.

Note: It is not possible to simply supply a new system database when the original system database is no longer available (for example after a serious failure), because in that case, LISTSERV Maestro cannot access the old database to transfer the data. If the original database is no longer available, you need to perform a full backup restore instead, as described in “Admin Tech Doc 2 – Backups”. During such a restore, it is however possible to restore the backup data into a different system database than before. The steps for this are also described in Admin Tech Doc 2.

3.1 Connecting to a Different System Database

If you want to use a different database as the system database, LISTSERV Maestro needs to transfer all data from the old database to the new database, therefore, while you execute the following steps, **both databases must be running** and a connection from LISTSERV Maestro to both databases must be possible.

1. Install and prepare the new database you want to use as described earlier.
2. Log into the Administration Hub. Select **Main Menu → LUI Settings → System Database Status**. Click the **Change Connection Settings** link.
3. Select the database plugin that matches your database and JDBC driver configuration (if you do not see the required plugin in this list, you first have to provide the JDBC driver jar file provided by your database vendor – please see below).
4. Fill out the connection parameters as required by the plugin. The type and semantics of these parameters depend on the database you want to use. Usually, this are parameters like the host name where the database server is running, the database name, the user name and password, and the connection port.
5. Submit your settings with “OK”. Usually, at this point, LISTSERV Maestro recognizes that you indeed did supply settings that point to a different database than before and, as described above, that this database is in fact empty and thus eligible as target for a database transfer. LISTSERV Maestro informs you that the database transfer is pending and will be performed during the next restart.

6. Shut down and restart LISTSERV Maestro. Right after restart, LISTSERV Maestro will transfer the data from the old database to the new database. This may take some time, during which users will not be able to log into the Maestro User Interface. You, as the administrator, are however able to log in to the Administration Hub already while the transfer is in progress to monitor some of the transfer details. You must log in to the Administration Hub to see and fix any problems that may arise because LISTSERV Maestro is unable to connect to any of the two databases during the transfer.
7. The transfer between the two databases is completed when LISTSERV Maestro has started up completely. You can see this either by looking at the log files (or console output), to watch for the startup messages, wait until login is allowed, or, as described above, log in to the Administration Hub to monitor the progress. You may now delete the LISTSERV Maestro data from the old database, or shut it down, or similar. For example, if you previously used the standard internal database, and have now switched to an external database, you might want to disable the internal database on the LISTSERV Maestro server, to save resources on that machine. Please see the below for details on how to do this.

4 Removing or Adding the Internal Database

If you connect the Maestro User Interface to an external database, there is no longer any need for the internal MySQL database to be run together with LISTSERV Maestro.

To reduce the resource usage of LISTSERV Maestro, you can uninstall the internal database **after** you have switched the Maestro User Interface to an external database, as described in the previous section.

Do not uninstall the internal database while the Maestro User Interface is still using it as the system database!

To uninstall the internal database, run the LISTSERV Maestro setup wizard on the server where the Maestro User Interface component is installed (see the LISTSERV Maestro installation manual, section “Modifying or Uninstalling an Existing Installation”, for details).

In this case, you will perform a “Modify”, by removing the internal database component: Unselect the “Internal MySQL database” component and leave the other components “Maestro User Interface”, “Administration Hub” and “Maestro Tracker” in the same select/unselect state as before. Setup will then uninstall the internal database only.

Remember, that you can now no longer use the default MySQL connection parameters that point to the locally installed internal MySQL instance.

5 Installing Vendor-Specific JDBC Drivers

The Maestro User Interface is a Java server application that uses JDBC to connect to the configured database.

Therefore, you usually need to install a compatible JDBC driver for the database. Each database plugin is developed to use exactly one JDBC driver. There may be several plugins for the same database, each of which uses a different driver to access that database. Which plugin you use depends on the database you want to use and the JDBC driver for that database that is available to you.

Important Note: On Windows, after installing a new JDBC driver into LISTSERV Maestro (see descriptions below), you need to re-install the LISTSERV Maestro Windows service, to make it aware of the new driver.

To do so, you **must** execute the following command **after** installing the driver:

```
[maestro_install_folder]/commands/InstallService.cmd
```

5.1 The IBM DB2 V8.2 Thin Driver Database Plugin: IBM DB2 V8.2 Thin Driver

For connecting to the DB2 V8.2 database (or later). This plugin uses the IBM DB2 V8.2 thin driver.

- **How to install the driver:** The driver comes in form of a set of four JAR files which are found in the installation folder of the DB2 V8.2 database (license conditions from IBM may apply):

```
[db2_install_folder]/SQLLIB/java/db2jcc.jar  
[db2_install_folder]/SQLLIB/java/db2jcc_javax.jar  
[db2_install_folder]/SQLLIB/java/db2jcc_license_cu.jar  
[db2_install_folder]/SQLLIB/java/db2policy.jar
```

Simply copy these files into the “lib” folder in the LISTSERV Maestro installation:

```
[maestro_install_folder]/lib
```

Later versions of the DB2 database may come with the same, or possibly a similar, set of JAR files. Whatever set of JDBC driver JAR file there is for a given database version, you need to copy it to the described “lib” folder. With the file present, LISTSERV Maestro automatically enables the associated database plugin.

5.2 The MySQL ConnectorJ Driver Database Plugin: MySQL ConnectorJ Driver

For connecting to the MySQL database of version 4.1 and later (tested up to 5.5.16, at the time this was written). This plugin uses the ConnectorJ MySQL driver which is installed together with LISTSERV Maestro.

- **How to install the driver:** The driver is pre-installed together with LISTSERV Maestro.

5.3 The Oracle Thin Driver Database Plugin: Oracle Thin Driver

For connecting to a single Oracle database of version 9i (or later). This plugin uses the Oracle Thin driver.

Note: If instead you want to connect to an Oracle RAC cluster, see the “Oracle RAC Thin Driver Database Plugin” below.

- **How to install the driver:**

The driver comes in form of a JAR file. The name of the JAR file differs depending on the Oracle version. The driver can be downloaded from the Oracle Technology Network. Look for the latest JDBC driver that is compatible with your Oracle version. If there are drivers available for different Java versions, then select the driver for Java 8 (JDK 1.8). If no driver for Java 8 is available, select the driver for the highest available Java version that is less than 8 (or the highest JDK version that is less than 1.8).

Copy the driver JAR-file into the “lib” folder in the LISTSERV Maestro installation:

```
[maestro_install_folder]/lib
```

5.4 The Oracle RAC Thin Driver Database Plugin: Oracle Thin Driver

For connecting to an Oracle RAC cluster of version 10g (or later). This plugin uses the Oracle RAC Thin driver.

Note: If instead you want to connect to a single Oracle database, see the “Oracle Thin Driver Database Plugin” above.

- **How to install the driver:**

The driver comes in form of a JAR file. This is actually the same driver JAR file as for the “Oracle Thin Driver”. See above for details on how to obtain this driver JAR file.

Copy the driver JAR-file into the “lib” folder in the LISTSERV Maestro installation:

```
[maestro_install_folder]/lib
```

Note: Since the JDBC driver is the same for the two Oracle plugins (“Thin” and “RAC Thin”), you only need this driver JAR file once, this enables **both** Oracle database plugins.

5.5 The SQL Server jTDS Driver Database Plugin: jTDS Driver (Open Source)

For connecting to the SQL Server database of version SQL Server 2000 (or later). This plugin uses the free open-source jTDS driver.

- **How to install the driver:**

From the binary distribution download, copy the file “jtds-1.3.1.jar” into the “lib” folder in the LISTSERV Maestro installation:

```
[maestro_install_folder]/lib
```

(At the time this document was written, version “1.3.1” was the most current version. When a new version is released, the name of the jar file that needs to be copied into the lib folder will probably change accordingly.)

The driver can be downloaded from the jTDS website: <http://jtds.sourceforge.net>. License conditions may apply.

Note: LISTSERV Maestro 10.0 and later requires a jTDS driver of version 1.2.7 or later. It is not compatible with older versions of the driver. And most older versions of LISTSERV Maestro (9.0-12 and older) are not compatible with the 1.3.x drivers (however, LMA 9.0-13 is compatible even with the 1.3.x drivers).

5.6 The SQL Server Microsoft Driver Database Plugin: MS SQL Server Driver

For connecting to the SQL Server database of version SQL Server 2000 (or later). This plugin uses the SQL Server driver from Microsoft. There are several versions of this driver, which are compatible with different versions of SQL Server. As Microsoft drops support for older SQL Server versions, these versions are then also no longer supported by newer versions of the JDBC driver.

If you have an old (unsupported) version of SQL Server, it can therefore be difficult to obtain the JDBC driver for this version. In this case, either upgrade to a newer version of SQL Server, or use the jTDS driver instead (see above).

The most recent version of the driver at the time of writing was the “Microsoft JDBC Driver 4.0”, which is compatible with MS SQL Server 2005, 2008, 2008 R2 and 2012.

- **How to install the driver:** Download the driver from Microsoft's SQL Server website. License conditions from Microsoft may apply.

Some versions of the driver come in form of a Windows install file, others come in form of a self-extracting *.exe file. What is important for the Maestro User Interface is not that the driver is installed on the same computer, but that you copy the driver JAR file(s) to the installation folder of LISTSERV Maestro. So if the driver comes in form of an install file, you can install it on any computer you like and then you just pick the driver JAR file(s) from the install target folder (and then you can uninstall it again, if you want). If it comes in form of a self-extracting *.exe file, then you can extract it to a temporary folder and pick the driver JAR file(s) from this folder.

Exactly which JAR file(s) constitute the full driver also depends on the version of the driver. For example:

- The driver for SQL Server 2000 came in form of three JAR files: "msbase.jar", "mssqlserver.jar" and "msutil.jar"
- The driver for SQL Server 2005 came in form of a single JAR file: "sqljdbc.jar"
- The newest driver 4.0 (at the time of writing) is for SQL Server 2012 and comes in form of two JAR files, of which however **you only need one**: For LISTSERV Maestro, you must use the JAR file "sqljdbc4.jar" (from the JDBC 4.0 package, do **not** use the other JAR file with the name "sqljdbc.jar").

Copy the relevant driver JAR file(s) into the "lib" folder in the LISTSERV Maestro installation:

```
[maestro_install_folder]/lib
```