



Bacula Catalog Database Guide

It comes in the night and sucks the essence from your computers.

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Chapter 1

Catalog Maintenance

Without proper setup and maintenance, your Catalog may continue to grow indefinitely as you run Jobs and backup Files, and/or it may become very inefficient and slow. How fast the size of your Catalog grows depends on the number of Jobs you run and how many files they backup. By deleting records within the database, you can make space available for the new records that will be added during the next Job. By constantly deleting old expired records (dates older than the Retention period), your database size will remain constant.

If you started with the default configuration files, they already contain reasonable defaults for a small number of machines (less than 5), so if you fall into that case, catalog maintenance will not be urgent if you have a few hundred megabytes of disk space free. Whatever the case may be, some knowledge of retention periods will be useful.

1.1 Setting Retention Periods

Bacula uses three Retention periods: the **File Retention** period, the **Job Retention** period, and the **Volume Retention** period. Of these three, the File Retention period is by far the most important in determining how large your database will become.

The **File Retention** and the **Job Retention** are specified in each Client resource as is shown below. The **Volume Retention** period is specified in the Pool resource, and the details are given in the next chapter of this manual.

File Retention = <time-period-specification> The File Retention record defines the length of time that Bacula will keep File records in the Catalog database. When this time period expires, and if **AutoPrune** is set to **yes**, Bacula will prune (remove) File records that are older than the specified File Retention period. The pruning will occur at the end of a backup Job for the given Client. Note that the Client database record contains a copy of the File and Job retention periods, but Bacula uses the current values found in the Director's Client resource to do the pruning.

Since File records in the database account for probably 80 percent of the size of the database, you should carefully determine exactly what File Retention period you need. Once the File records have been removed from the database, you will no longer be able to restore individual files in a Job. However, with Bacula version 1.37 and later, as long as the Job record still exists, you will be able to restore all files in the job.

Retention periods are specified in seconds, but as a convenience, there are a number of modifiers that permit easy specification in terms of minutes, hours, days, weeks, months, quarters, or years on the record. See the Configuration chapter of this manual for additional details of modifier specification.

The default File retention period is 60 days.

Job Retention = <time-period-specification> The Job Retention record defines the length of time that **Bacula** will keep Job records in the Catalog database. When this time period expires, and if

AutoPrune is set to **yes** Bacula will prune (remove) Job records that are older than the specified Job Retention period. Note, if a Job record is selected for pruning, all associated File and JobMedia records will also be pruned regardless of the File Retention period set. As a consequence, you normally will set the File retention period to be less than the Job retention period.

As mentioned above, once the File records are removed from the database, you will no longer be able to restore individual files from the Job. However, as long as the Job record remains in the database, you will be able to restore all the files backed up for the Job (on version 1.37 and later). As a consequence, it is generally a good idea to retain the Job records much longer than the File records.

The retention period is specified in seconds, but as a convenience, there are a number of modifiers that permit easy specification in terms of minutes, hours, days, weeks, months, quarters, or years. See the Configuration chapter of this manual for additional details of modifier specification.

The default Job Retention period is 180 days.

AutoPrune = <yes/no> If **AutoPrune** is set to **yes** (default), Bacula will automatically apply the File retention period and the Job retention period for the Client at the end of the Job.

If you turn this off by setting it to **no**, your Catalog will grow each time you run a Job.

1.2 Compacting Your MySQL Database

Over time, as noted above, your database will tend to grow. I've noticed that even though Bacula regularly prunes files, **MySQL** does not effectively use the space, and instead continues growing. To avoid this, from time to time, you must compact your database. Normally, large commercial database such as Oracle have commands that will compact a database to reclaim wasted file space. MySQL has the **OPTIMIZE TABLE** command that you can use, and SQLite version 2.8.4 and greater has the **VACUUM** command. We leave it to you to explore the utility of the **OPTIMIZE TABLE** command in MySQL.

All database programs have some means of writing the database out in ASCII format and then reloading it. Doing so will re-create the database from scratch producing a compacted result, so below, we show you how you can do this for MySQL, PostgreSQL and SQLite.

For a **MySQL** database, you could write the Bacula database as an ASCII file (bacula.sql) then reload it by doing the following:

```
mysqldump -f --opt bacula > bacula.sql
mysql bacula < bacula.sql
rm -f bacula.sql
```

Depending on the size of your database, this will take more or less time and a fair amount of disk space. For example, if I cd to the location of the MySQL Bacula database (typically /opt/mysql/var or something similar) and enter:

```
du bacula
```

I get **620,644** which means there are that many blocks containing 1024 bytes each or approximately 635 MB of data. After doing the **mysqldump**, I had a bacula.sql file that had **174,356** blocks, and after doing the **mysql** command to recreate the database, I ended up with a total of **210,464** blocks rather than the original **629,644**. In other words, the compressed version of the database took approximately one third of the space of the database that had been in use for about a year.

As a consequence, I suggest you monitor the size of your database and from time to time (once every six months or year), compress it.

1.3 Repairing Your MySQL Database

If you find that you are getting errors writing to your MySQL database, or Bacula hangs each time it tries to access the database, you should consider running MySQL's database check and repair routines. The program you need to run depends on the type of database indexing you are using. If you are using the default, you will probably want to use **myisamchk**. For more details on how to do this, please consult the MySQL document at: <http://www.mysql.com/doc/en/Repair.html>.

If the errors you are getting are simply SQL warnings, then you might try running `dbcheck` before (or possibly after) using the MySQL database repair program. It can clean up many of the orphaned record problems, and certain other inconsistencies in the Bacula database.

A typical cause of MySQL database problems is if your partition fills. In such a case, you will need to create additional space on the partition or free up some space then repair the database probably using **myisamchk**. Recently my root partition filled and the MySQL database was corrupted. Simply running **myisamchk -r** did not fix the problem. However, the following script did the trick for me:

```
#!/bin/sh
for i in *.MYD ; do
    mv $i x${i}
    t='echo $i | cut -f 1 -d \. ' -'
    mysql bacula <<END_OF_DATA
set autocommit=1;
truncate table $t;
quit
END_OF_DATA
    cp x${i} ${i}
    chown mysql:mysql ${i}
    myisamchk -r ${i}
done
```

I invoked it with the following commands:

```
cd /var/lib/mysql/bacula
./repair
```

Then after ensuring that the database was correctly fixed, I did:

```
cd /var/lib/mysql/bacula
rm -f x*.MYD
```

1.4 MySQL Table is Full

If you are running into the error **The table 'File' is full ...**, it is probably because on version 4.x MySQL, the table is limited by default to a maximum size of 4 GB and you have probably run into the limit. The solution can be found at: <http://dev.mysql.com/doc/refman/5.0/en/full-table.html>

You can display the maximum length of your table with:

```
mysql bacula
SHOW TABLE STATUS FROM bacula like "File";
```

If the column labeled "Max_data.length" is around 4Gb, this is likely to be the source of your problem, and you can modify it with:

```
mysql bacula
ALTER TABLE File MAX_ROWS=281474976710656;
```

Alternatively you can modify your `/etc/my.conf` file before creating the Bacula tables, and in the `[mysqld]` section set:

```
set-variable = myisam_data_pointer_size=6
```

The above myisam data pointer size must be made before you create your Bacula tables or it will have no effect.

The row and pointer size changes should already be the default on MySQL version 5.x, so making these changes should only be necessary on MySQL 4.x depending on the size of your catalog database.

1.5 MySQL Server Has Gone Away

If you are having problems with the MySQL server disconnecting or with messages saying that your MySQL server has gone away, then please read the MySQL documentation, which can be found at:

<http://dev.mysql.com/doc/refman/5.0/en/gone-away.html>

1.6 MySQL Temporary Tables

When doing backups with large numbers of files, MySQL creates some temporary tables. When these tables are small they can be held in system memory, but as they approach some size, they spool off to disk. The default location for these temp tables is `/tmp`. Once that space fills up, Bacula daemons such as the Storage daemon doing spooling can get strange errors. E.g.

```
Fatal error: spool.c:402 Spool data read error.  
Fatal error: backup.c:892 Network send error to SD. ERR=Connection reset by  
peer
```

What you need to do is setup MySQL to use a different (larger) temp directory, which can be set in the `/etc/my.cnf` with these variables set:

```
tmpdir=/path/to/larger/tmpdir  
bdb_tmpdir=/path/to/larger/tmpdir
```

1.7 Repairing Your PostgreSQL Database

The same considerations apply that are indicated above for MySQL. That is, consult the PostgreSQL documents for how to repair the database, and also consider using Bacula's `dbcheck` program if the conditions are reasonable for using (see above).

1.8 Database Performance Issues

There are a considerable number of ways each of the databases can be tuned to improve the performance. Going from an untuned database to one that is properly tuned can make a difference of a factor of 100 or more in the time to insert or search for records.

For each of the databases, you may get significant improvements by adding additional indexes. The comments in the Bacula `make_XXX_tables` give some indications as to what indexes may be appropriate. Please see below for specific instructions on checking indexes.

For MySQL, what is very important is to use the examine the my.cnf file (usually in /etc/my.cnf). You may obtain significant performances by switching to the my-large.cnf or my-huge.cnf files that come with the MySQL source code.

For SQLite3, one significant factor in improving the performance is to ensure that there is a "PRAGMA synchronous = NORMAL;" statement. This reduces the number of times that the database flushes the in memory cache to disk. There are other settings for this PRAGMA that can give even further performance improvements at the risk of a database corruption if your system crashes.

For PostgreSQL, you might want to consider turning fsync off. Of course doing so can cause corrupted databases in the event of a machine crash. There are many different ways that you can tune PostgreSQL, the following document discusses a few of them: <http://www.varlena.com/varlena/GeneralBits/Tidbits/perf.html>.

There is also a PostgreSQL FAQ question number 3.3 that may answer some of your questions about how to improve performance of the PostgreSQL engine: <http://www.postgresql.org/docs/faqs.FAQ.html#3.3>.

Also for PostgreSQL, look at what "effective_cache_size". For a 2GB memory machine, you probably want to set it at 131072, but don't set it too high. In addition, for a 2GB system, work_mem = 256000 and maintenance_work_mem = 256000 seem to be reasonable values. Make sure your checkpoint_segments is set to at least 8.

1.9 Performance Issues Indexes

One of the most important considerations for improving performance on the Bacula database is to ensure that it has all the appropriate indexes. Several users have reported finding that their database did not have all the indexes in the default configuration. In addition, you may find that because of your own usage patterns, you need additional indexes.

The most important indexes for performance are the two indexes on the **File** table. The first index is on **FileId** and is automatically made because it is the unique key used to access the table. The other one is the (JobId, PathId, Filename) index. If these Indexes are not present, your performance may suffer a lot.

1.9.1 PostgreSQL Indexes

On PostgreSQL, you can check to see if you have the proper indexes using the following commands:

```
psql bacula
select * from pg_indexes where tablename='file';
```

If you do not see output that indicates that all three indexes are created, you can create the two additional indexes using:

```
psql bacula
CREATE INDEX file_jobid_idx on file (jobid);
CREATE INDEX file_fp_idx on file (jobid, pathid, filenameid);
```

1.9.2 MySQL Indexes

On MySQL, you can check if you have the proper indexes by:

```
mysql bacula
show index from File;
```

If the indexes are not present, especially the JobId index, you can create them with the following commands:

```
mysql bacula
CREATE INDEX file_jobid_idx on File (JobId);
CREATE INDEX file_jpf_idx on File (JobId, FilenameId, PathId);
```

Though normally not a problem, you should ensure that the indexes defined for Filename and Path are both set to 255 characters. Some users reported performance problems when their indexes were set to 50 characters. To check, do:

```
mysql bacula
show index from Filename;
show index from Path;
```

and what is important is that for Filename, you have an index with Key_name "Name" and Sub_part "255". For Path, you should have a Key_name "Path" and Sub_part "255". If one or the other does not exist or the Sub_part is less than 255, you can drop and recreate the appropriate index with:

```
mysql bacula
DROP INDEX Path on Path;
CREATE INDEX Path on Path (Path(255));

DROP INDEX Name on Filename;
CREATE INDEX Name on Filename (Name(255));
```

1.9.3 SQLite Indexes

On SQLite, you can check if you have the proper indexes by:

```
sqlite <path>/bacula.db
select * from sqlite_master where type='index' and tbl_name='File';
```

If the indexes are not present, especially the JobId index, you can create them with the following commands:

```
sqlite <path>/bacula.db
CREATE INDEX file_jobid_idx on File (JobId);
CREATE INDEX file_jfp_idx on File (JobId, PathId, FilenameId);
```

1.10 Compacting Your PostgreSQL Database

Over time, as noted above, your database will tend to grow. I've noticed that even though Bacula regularly prunes files, PostgreSQL has a **VACUUM** command that will compact your database for you. Alternatively you may want to use the **vacuumdb** command, which can be run from a cron job.

All database programs have some means of writing the database out in ASCII format and then reloading it. Doing so will re-create the database from scratch producing a compacted result, so below, we show you how you can do this for PostgreSQL.

For a **PostgreSQL** database, you could write the Bacula database as an ASCII file (bacula.sql) then reload it by doing the following:

```
pg_dump -c bacula > bacula.sql
cat bacula.sql | psql bacula
rm -f bacula.sql
```

Depending on the size of your database, this will take more or less time and a fair amount of disk space. For example, you can **cd** to the location of the Bacula database (typically /usr/local/pgsql/data or possibly /var/lib/pgsql/data) and check the size.

There are certain PostgreSQL users who do not recommend the above procedure. They have the following to say: PostgreSQL does not need to be dumped/restored to keep the database efficient. A normal process of vacuuming will prevent the database from ever getting too large. If you want to fine-tweak the database storage, commands such as `VACUUM FULL`, `REINDEX`, and `CLUSTER` exist specifically to keep you from having to do a dump/restore.

Finally, you might want to look at the PostgreSQL documentation on this subject at <http://www.postgresql.org/docs/8.1/interactive/maintenance.html>.

1.11 Compacting Your SQLite Database

First please read the previous section that explains why it is necessary to compress a database. SQLite version 2.8.4 and greater have the **Vacuum** command for compacting the database.

```
cd {\bf working-directory}
echo 'vacuum;' | sqlite bacula.db
```

As an alternative, you can use the following commands, adapted to your system:

```
cd {\bf working-directory}
echo '.dump' | sqlite bacula.db > bacula.sql
rm -f bacula.db
sqlite bacula.db < bacula.sql
rm -f bacula.sql
```

Where **working-directory** is the directory that you specified in the Director's configuration file. Note, in the case of SQLite, it is necessary to completely delete (`rm`) the old database before creating a new compressed version.

1.12 Migrating from SQLite to MySQL or PostgreSQL

You may begin using Bacula with SQLite then later find that you want to switch to MySQL or Postgres for any of a number of reasons: SQLite tends to use more disk than MySQL; when the database is corrupted it is often more catastrophic than with MySQL or PostgreSQL. Several users have succeeded in converting by exporting the SQLite data and then processing it with Perl scripts prior to putting it into MySQL or PostgreSQL. This is, however, not a simple process. Scripts are available on bacula source distribution under `examples/database`.

1.13 Backing Up Your Bacula Database

If ever the machine on which your Bacula database crashes, and you need to restore from backup tapes, one of your first priorities will probably be to recover the database. Although Bacula will happily backup your catalog database if it is specified in the FileSet, this is not a very good way to do it, because the database will be saved while Bacula is modifying it. Thus the database may be in an instable state. Worse yet, you will backup the database before all the Bacula updates have been applied.

To resolve these problems, you need to backup the database after all the backup jobs have been run. In addition, you will want to make a copy while Bacula is not modifying it. To do so, you can use two scripts provided in the release **make_catalog_backup** and **delete_catalog_backup**. These files will be automatically generated along with all the other Bacula scripts. The first script will make an ASCII copy of your Bacula database into **bacula.sql** in the working directory you specified in your configuration, and the second will delete the **bacula.sql** file.

The basic sequence of events to make this work correctly is as follows:

- Run all your nightly backups
- After running your nightly backups, run a Catalog backup Job
- The Catalog backup job must be scheduled after your last nightly backup
- You use **RunBeforeJob** to create the ASCII backup file and **RunAfterJob** to clean up

Assuming that you start all your nightly backup jobs at 1:05 am (and that they run one after another), you can do the catalog backup with the following additional Director configuration statements:

```
# Backup the catalog database (after the nightly save)
Job {
    Name = "BackupCatalog"
    Type = Backup
    Client=rufus-fd
    FileSet="Catalog"
    Schedule = "WeeklyCycleAfterBackup"
    Storage = DLTDrive
    Messages = Standard
    Pool = Default
    # WARNING!!! Passing the password via the command line is insecure.
    # see comments in make_catalog_backup for details.
    RunBeforeJob = "/home/kern/bacula/bin/make_catalog_backup"
    RunAfterJob = "/home/kern/bacula/bin/delete_catalog_backup"
    Write Bootstrap = "/home/kern/bacula/working/BackupCatalog.bsr"
}
# This schedule does the catalog. It starts after the WeeklyCycle
Schedule {
    Name = "WeeklyCycleAfterBackup"
    Run = Level=Full sun-sat at 1:10
}
# This is the backup of the catalog
FileSet {
    Name = "Catalog"
    Include {
        Options {
            signature=MD5
        }
        File = \lt{}working_directory\gt{}/bacula.sql
    }
}
```

Be sure to write a bootstrap file as in the above example. However, it is preferable to write or copy the bootstrap file to another computer. It will allow you to quickly recover the database backup should that be necessary. If you do not have a bootstrap file, it is still possible to recover your database backup, but it will be more work and take longer.

1.14 Security considerations

We provide `make_catalog_backup` as an example of what can be used to backup your Bacula database. We expect you to take security precautions relevant to your situation. `make_catalog_backup` is designed to take a password on the command line. This is fine on machines with only trusted users. It is not acceptable on machines without trusted users. Most database systems provide a alternative method, which does not place the password on the command line.

The `make_catalog_backup` script contains some warnings about how to use it. Please read those tips.

To help you get started, we know PostgreSQL has a password file, `.pgpass`, and we know MySQL has `.my.cnf`.

Only you can decide what is appropriate for your situation. We have provided you with a starting point. We hope it helps.

1.15 Backing Up Third Party Databases

If you are running a database in production mode on your machine, Bacula will happily backup the files, but if the database is in use while Bacula is reading it, you may back it up in an unstable state.

The best solution is to shutdown your database before backing it up, or use some tool specific to your database to make a valid live copy perhaps by dumping the database in ASCII format. I am not a database expert, so I cannot provide you advice on how to do this, but if you are unsure about how to backup your database, you might try visiting the Backup Central site, which has been renamed Storage Mountain (www.backupcentral.com). In particular, their Free Backup and Recovery Software page has links to scripts that show you how to shutdown and backup most major databases.

1.16 Database Size

As mentioned above, if you do not do automatic pruning, your Catalog will grow each time you run a Job. Normally, you should decide how long you want File records to be maintained in the Catalog and set the **File Retention** period to that time. Then you can either wait and see how big your Catalog gets or make a calculation assuming approximately 154 bytes for each File saved and knowing the number of Files that are saved during each backup and the number of Clients you backup.

For example, suppose you do a backup of two systems, each with 100,000 files. Suppose further that you do a Full backup weekly and an Incremental every day, and that the Incremental backup typically saves 4,000 files. The size of your database after a month can roughly be calculated as:

$$\text{Size} = 154 * \text{No. Systems} * (100,000 * 4 + 10,000 * 26)$$

where we have assumed four weeks in a month and 26 incremental backups per month. This would give the following:

$$\begin{aligned} \text{Size} &= 154 * 2 * (100,000 * 4 + 10,000 * 26) \\ \text{or} \\ \text{Size} &= 308 * (400,000 + 260,000) \\ \text{or} \\ \text{Size} &= 203,280,000 \text{ bytes} \end{aligned}$$

So for the above two systems, we should expect to have a database size of approximately 200 Megabytes. Of course, this will vary according to how many files are actually backed up.

Below are some statistics for a MySQL database containing Job records for five Clients beginning September 2001 through May 2002 (8.5 months) and File records for the last 80 days. (Older File records have been pruned). For these systems, only the user files and system files that change are backed up. The core part of the system is assumed to be easily reloaded from the Red Hat rpms.

In the list below, the files (corresponding to Bacula Tables) with the extension .MYD contain the data records whereas files with the extension .MYI contain indexes.

You will note that the File records (containing the file attributes) make up the large bulk of the number of records as well as the space used (459 Mega Bytes including the indexes). As a consequence, the most important Retention period will be the **File Retention** period. A quick calculation shows that for each File that is saved, the database grows by approximately 150 bytes.

Size in Bytes	Records	File
=====	=====	=====
168	5	Client.MYD
3,072		Client.MYI
344,394,684	3,080,191	File.MYD
115,280,896		File.MYI

2,590,316	106,902	Filename.MYD
3,026,944		Filename.MYI
184	4	FileSet.MYD
2,048		FileSet.MYI
49,062	1,326	JobMedia.MYD
30,720		JobMedia.MYI
141,752	1,378	Job.MYD
13,312		Job.MYI
1,004	11	Media.MYD
3,072		Media.MYI
1,299,512	22,233	Path.MYD
581,632		Path.MYI
36	1	Pool.MYD
3,072		Pool.MYI
5	1	Version.MYD
1,024		Version.MYI

This database has a total size of approximately 450 Megabytes.

If we were using SQLite, the determination of the total database size would be much easier since it is a single file, but we would have less insight to the size of the individual tables as we have in this case.

Note, SQLite databases may be as much as 50% larger than MySQL databases due to the fact that all data is stored as ASCII strings. That is even binary integers are stored as ASCII strings, and this seems to increase the space needed.

Chapter 2

Installing and Configuring MySQL

2.1 Installing and Configuring MySQL – Phase I

If you use the `./configure --with-mysql=mysql-directory` statement for configuring **Bacula**, you will need MySQL version 4.1 or later installed in the **mysql-directory**. If you are using one of the new modes such as ANSI/ISO compatibility, you may experience problems.

If MySQL is installed in the standard system location, you need only enter **--with-mysql** since the configure program will search all the standard locations. If you install MySQL in your home directory or some other non-standard directory, you will need to provide the full path to it.

Installing and Configuring MySQL is not difficult but can be confusing the first time. As a consequence, below, we list the steps that we used to install it on our machines. Please note that our configuration leaves MySQL without any user passwords. This may be an undesirable situation if you have other users on your system.

The notes below describe how to build MySQL from the source tar files. If you have a pre-installed MySQL, you can return to complete the installation of Bacula, then come back to Phase II of the MySQL installation. If you wish to install MySQL from rpms, you will probably need to install the following:

```
mysql-<version>.rpm  
mysql-server-<version>.rpm  
mysql-devel-<version>.rpm
```

The names of the packages may vary from distribution to distribution. It is important to have the devel package loaded as it contains the libraries and header files necessary to build Bacula. There may be additional packages that are required to install the above, for example, zlib and openssl.

Once these packages are installed, you will be able to build Bacula (using the files installed with the mysql package, then run MySQL using the files installed with mysql-server. If you have installed MySQL by rpms, please skip Phase I below, and return to complete the installation of Bacula, then come back to Phase II of the MySQL installation when indicated to do so.

Beginning with Bacula version 1.31, the thread safe version of the MySQL client library is used, and hence you should add the **--enable-thread-safe-client** option to the `./configure` as shown below:

1. Download MySQL source code from www.mysql.com/downloads
2. Detar it with something like:

```
tar xvfz mysql-filename
```

Note, the above command requires GNU tar. If you do not have GNU tar, a command such as:

```
zcat mysql-filename — tar xvf -
```

will probably accomplish the same thing.

3. cd **mysql-source-directory**

where you replace **mysql-source-directory** with the directory name where you put the MySQL source code.

4. ./configure --enable-thread-safe-client --prefix=mysql-directory

where you replace **mysql-directory** with the directory name where you want to install mysql. Normally for system wide use this is /usr/local/mysql. In my case, I use ~kern/mysql.

5. make

This takes a bit of time.

6. make install

This will put all the necessary binaries, libraries and support files into the **mysql-directory** that you specified above.

7. ./scripts/mysql_install_db

This will create the necessary MySQL databases for controlling user access. Note, this script can also be found in the **bin** directory in the installation directory

The MySQL client library **mysqlclient** requires the gzip compression library **libz.a** or **libz.so**. If you are using rpm packages, these libraries are in the **libz-devel** package. On Debian systems, you will need to load the **zlib1g-dev** package. If you are not using rpms or debs, you will need to find the appropriate package for your system.

At this point, you should return to completing the installation of **Bacula**. Later after Bacula is installed, come back to this chapter to complete the installation. Please note, the installation files used in the second phase of the MySQL installation are created during the Bacula Installation.

2.2 Installing and Configuring MySQL – Phase II

At this point, you should have built and installed MySQL, or already have a running MySQL, and you should have configured, built and installed **Bacula**. If not, please complete these items before proceeding.

Please note that the **./configure** used to build **Bacula** will need to include **--with-mysql=mysql-directory**, where **mysql-directory** is the directory name that you specified on the **./configure** command for configuring MySQL. This is needed so that Bacula can find the necessary include headers and library files for interfacing to MySQL.

Bacula will install scripts for manipulating the database (create, delete, make tables etc) into the main installation directory. These files will be of the form ***_bacula_*** (e.g. **create_bacula_database**). These files are also available in the **<bacula-src>/src/cats** directory after running **./configure**. If you inspect **create_bacula_database**, you will see that it calls **create_mysql_database**. The ***_bacula_*** files are provided for convenience. It doesn't matter what database you have chosen; **create_bacula_database** will always create your database.

Now you will create the Bacula MySQL database and the tables that Bacula uses.

1. Start **mysql**. You might want to use the **startmysql** script provided in the Bacula release.

2. cd **<install-directory>** This directory contains the Bacula catalog interface routines.

3. **./grant_mysql_privileges** This script creates unrestricted access rights for the user **bacula**. You may want to modify it to suit your situation. Please note that none of the userids, including root, are password protected. If you need more security, please assign a password to the root user and to bacula. The program **mysqladmin** can be used for this.

4. `./create_mysql_database` This script creates the MySQL **bacula** database. The databases you create as well as the access databases will be located in `<install-dir>/var/` in a subdirectory with the name of the database, where `<install-dir>` is the directory name that you specified on the `--prefix` option. This can be important to know if you want to make a special backup of the Bacula database or to check its size.
5. `./make_mysql_tables` This script creates the MySQL tables used by **Bacula**.

Each of the three scripts (`grant_mysql_privileges`, `create_mysql_database` and `make_mysql_tables`) allows the addition of a command line argument. This can be useful for specifying the user and or password. For example, you might need to add `-u root` to the command line to have sufficient privilege to create the Bacula tables.

To take a closer look at the access privileges that you have setup with the above, you can do:

```
mysql-directory/bin/mysql -u root mysql
select * from user;
```

2.3 Re-initializing the Catalog Database

After you have done some initial testing with **Bacula**, you will probably want to re-initialize the catalog database and throw away all the test Jobs that you ran. To do so, you can do the following:

```
cd <install-directory>
./drop_mysql_tables
./make_mysql_tables
```

Please note that all information in the database will be lost and you will be starting from scratch. If you have written on any Volumes, you must write an end of file mark on the volume so that Bacula can reuse it. Do so with:

```
(stop Bacula or unmount the drive)
mt -f /dev/nst0 rewind
mt -f /dev/nst0 weof
```

Where you should replace `/dev/nst0` with the appropriate tape drive device name for your machine.

2.4 Linking Bacula with MySQL

After configuring Bacula with

`./configure --enable-thread-safe-client --prefix=<mysql-directory>` where `<mysql-directory>` is in my case `/home/kern/mysql`, you may have to configure the loader so that it can find the MySQL shared libraries. If you have previously followed this procedure and later add the `--enable-thread-safe-client` options, you will need to rerun the `ldconfig` program shown below. If you put MySQL in a standard place such as `/usr/lib` or `/usr/local/lib` this will not be necessary, but in my case it is. The description that follows is Linux specific. For other operating systems, please consult your manuals on how to do the same thing:

First edit: `/etc/ld.so.conf` and add a new line to the end of the file with the name of the mysql-directory. In my case, it is:

`/home/kern/mysql/lib/mysql` then rebuild the loader's cache with:

`/sbin/ldconfig` If you upgrade to a new version of **MySQL**, the shared library names will probably change, and you must re-run the `/sbin/ldconfig` command so that the runtime loader can find them.

Alternatively, your system may have a loader environment variable that can be set. For example, on a Solaris system where I do not have root permission, I use:

```
LD_LIBRARY_PATH=/home/kern/mysql/lib/mysql
```

Finally, if you have encryption enabled in MySQL, you may need to add **-lssl -lcrypto** to the link. In that case, you can either export the appropriate LDFLAGS definition, or alternatively, you can include them directly on the `./configure` line as in:

```
LDFLAGS="-lssl -lcrypto" \  
./configure \  
  <your-options>
```

2.5 Installing MySQL from RPMs

If you are installing MySQL from RPMs, you will need to install both the MySQL binaries and the client libraries. The client libraries are usually found in a devel package, so you must install:

```
mysql  
mysql-devel
```

This will be the same with most other package managers too.

2.6 Upgrading MySQL

If you upgrade MySQL, you must reconfigure, rebuild, and re-install Bacula otherwise you are likely to get bizarre failures. If you install from rpms and you upgrade MySQL, you must also rebuild Bacula. You can do so by rebuilding from the source rpm. To do so, you may need to modify the `bacula.spec` file to account for the new MySQL version.

Chapter 3

Installing and Configuring PostgreSQL

If you are considering using PostgreSQL, you should be aware of their philosophy of upgrades, which could be destabilizing for a production shop. Basically at every major version upgrade, you are required to dump your database in an ASCII format, do the upgrade, and then reload your database (or databases). This is because they frequently update the "data format" from version to version, and they supply no tools to automatically do the conversion. If you forget to do the ASCII dump, your database may become totally useless because none of the new tools can access it due to the format change, and the PostgreSQL server will not be able to start.

If you are building PostgreSQL from source, please be sure to add the **--enable-thread-safety** option when doing the `./configure` for PostgreSQL.

3.1 Installing PostgreSQL

If you use the `./configure --with-postgresql=PostgreSQL-Directory` statement for configuring **Bacula**, you will need PostgreSQL version 7.4 or later installed. NOTE! PostgreSQL versions earlier than 7.4 do not work with Bacula. If PostgreSQL is installed in the standard system location, you need only enter **--with-postgresql** since the configure program will search all the standard locations. If you install PostgreSQL in your home directory or some other non-standard directory, you will need to provide the full path with the **--with-postgresql** option.

Installing and configuring PostgreSQL is not difficult but can be confusing the first time. If you prefer, you may want to use a package provided by your chosen operating system. Binary packages are available on most PostgreSQL mirrors.

If you prefer to install from source, we recommend following the instructions found in the PostgreSQL documentation.

If you are using FreeBSD, this FreeBSD Diary article will be useful. Even if you are not using FreeBSD, the article will contain useful configuration and setup information.

If you configure the Batch Insert code in Bacula (attribute inserts are 10 times faster), you **must** be using a PostgreSQL that was built with the **--enable-thread-safety** option, otherwise you will get data corruption. Most major Linux distros have thread safety turned on, but it is better to check. One way is to see if the PostgreSQL library that Bacula will be linked against references pthreads. This can be done with a command such as:

```
nm /usr/lib/libpq.a | grep pthread_mutex_lock
```

The above command should print a line that looks like:

```
U pthread_mutex_lock
```

if does, then everything is OK. If it prints nothing, do not enable batch inserts when building Bacula.

After installing PostgreSQL, you should return to completing the installation of **Bacula**. Later, after Bacula is installed, come back to this chapter to complete the installation. Please note, the installation files used in the second phase of the PostgreSQL installation are created during the Bacula Installation. You must still come back to complete the second phase of the PostgreSQL installation even if you installed binaries (e.g. rpm, deb, ...).

3.2 Configuring PostgreSQL

At this point, you should have built and installed PostgreSQL, or already have a running PostgreSQL, and you should have configured, built and installed **Bacula**. If not, please complete these items before proceeding.

Please note that the `./configure` used to build **Bacula** will need to include `--with-postgresql=PostgreSQL-directory`, where **PostgreSQL-directory** is the directory name that you specified on the `./configure` command for configuring PostgreSQL (if you didn't specify a directory or PostgreSQL is installed in a default location, you do not need to specify the directory). This is needed so that Bacula can find the necessary include headers and library files for interfacing to PostgreSQL.

Bacula will install scripts for manipulating the database (create, delete, make tables etc) into the main installation directory. These files will be of the form `*_bacula_*` (e.g. `create_bacula_database`). These files are also available in the `<bacula-src>/src/cats` directory after running `./configure`. If you inspect `create_bacula_database`, you will see that it calls `create_postgresql_database`. The `*_bacula_*` files are provided for convenience. It doesn't matter what database you have chosen; `create_bacula_database` will always create your database.

Now you will create the Bacula PostgreSQL database and the tables that Bacula uses. These instructions assume that you already have PostgreSQL running. You will need to perform these steps as a user that is able to create new databases. This can be the PostgreSQL user (on most systems, this is the `pgsql` user).

1. `cd <install-directory>`

This directory contains the Bacula catalog interface routines.

2. `./create_bacula_database`

This script creates the PostgreSQL **bacula** database. Before running this command, you should carefully think about what encoding sequence you want for the text fields (paths, files, ...). Ideally, the encoding should be set to UTF8. However, many Unix systems have filenames that are not encoded in UTF8, either because you have not set UTF8 as your default character set or because you have imported files from elsewhere (e.g. MacOS X). For this reason, Bacula uses `SQL_ASCII` as the default encoding. If you want to change this, please modify the script before running it, but be forewarned that Bacula backups will fail if PostgreSQL finds any non-UTF8 sequences.

If running the script fails, it is probably because the database is owned by a user other than yourself. On many systems, the database owner is **pgsql** and on others such as Red Hat and Fedora it is **postgres**. You can find out which it is by examining your `/etc/passwd` file. To create a new user under either your name or with say the name **bacula**, you can do the following:

```
su
(enter root password)
su pgsql (or postgres)
createuser kern (or perhaps bacula)
Shall the new user be allowed to create databases? (y/n) y
Shall the new user be allowed to create more new users? (y/n) (choose
    what you want)
exit
```

At this point, you should be able to execute the `./create_bacula_database` command.

3. `./make_bacula_tables`

This script creates the PostgreSQL tables used by **Bacula**.

4. `./grant_bacula_privileges`

This script creates the database user **bacula** with restricted access rights. You may want to modify it to suit your situation. Please note that this database is not password protected.

Each of the three scripts (`create_bacula_database`, `make_bacula_tables`, and `grant_bacula_privileges`) allows the addition of a command line argument. This can be useful for specifying the user name. For example, you might need to add **-h hostname** to the command line to specify a remote database server.

To take a closer look at the access privileges that you have setup with the above, you can do:

```
PostgreSQL-directory/bin/psql --command '\dp bacula
```

Also, I had an authorization problem with the password. In the end, I had to modify my **pg_hba.conf** file (in `/var/lib/pgsql/data` on my machine) from:

```
local  all  all          ident  sameuser
to
local  all  all          trust
```

This solved the problem for me, but it is not always a good thing to do from a security standpoint. However, it allowed me to run my regression scripts without having a password.

A more secure way to perform database authentication is with md5 password hashes. Begin by editing the **pg_hba.conf** file, and just prior the the existing “local” and “host” lines, add the line:

```
local bacula bacula md5
```

and restart the Postgres database server (frequently, this can be done using “`/etc/init.d/postgresql restart`” or “`service postgresql restart`”) to put this new authentication rule into effect.

Next, become the Postgres administrator, `postgres`, either by logging on as the `postgres` user, or by using `su` to become root and then using `su - postgres` to become `postgres`. Add a password to the bacula database for the bacula user using:

```
\$ psql bacula
bacula=# alter user bacula with password 'secret';
ALTER USER
bacula=# \q
```

You’ll have to add this password to two locations in the `bacula-dir.conf` file: once to the Catalog resource and once to the `RunBeforeJob` entry in the BackupCatalog Job resource. With the password in place, these two lines should look something like:

```
dbname = bacula; user = bacula; password = "secret"
... and ...
# WARNING!!! Passing the password via the command line is insecure.
# see comments in make_catalog_backup for details.
RunBeforeJob = "/etc/make_catalog_backup bacula bacula secret"
```

Naturally, you should choose your own significantly more random password, and ensure that the `bacula-dir.conf` file containing this password is readable only by the root.

Even with the files containing the database password properly restricted, there is still a security problem with this approach: on some platforms, the environment variable that is used to supply the password to Postgres is available to all users of the local system. To eliminate this problem, the Postgres team have deprecated the use of the environment variable password-passing mechanism and recommend the use of a .pgpass file instead. To use this mechanism, create a file named .pgpass containing the single line:

```
localhost:5432:bacula:bacula:secret
```

This file should be copied into the home directory of all accounts that will need to gain access to the database: typically, root, bacula, and any users who will make use of any of the console programs. The files must then have the owner and group set to match the user (so root:root for the copy in root, and so on), and the mode set to 600, limiting access to the owner of the file.

3.3 Re-initializing the Catalog Database

After you have done some initial testing with **Bacula**, you will probably want to re-initialize the catalog database and throw away all the test Jobs that you ran. To do so, you can do the following:

```
cd <install-directory>
./drop_bacula_tables
./make_bacula_tables
./grant_bacula_privileges
```

Please note that all information in the database will be lost and you will be starting from scratch. If you have written on any Volumes, you must write an end of file mark on the volume so that Bacula can reuse it. Do so with:

```
(stop Bacula or unmount the drive)
mt -f /dev/nst0 rewind
mt -f /dev/nst0 weof
```

Where you should replace `/dev/nst0` with the appropriate tape drive device name for your machine.

3.4 Installing PostgreSQL from RPMs

If you are installing PostgreSQL from RPMs, you will need to install both the PostgreSQL binaries and the client libraries. The client libraries are usually found in a devel package, so you must install:

```
postgresql
postgresql-devel
postgresql-server
postgresql-libs
```

These will be similar with most other package managers too. After installing from rpms, you will still need to run the scripts that set up the database and create the tables as described above.

3.5 Converting from MySQL to PostgreSQL

The conversion procedure presented here was worked out by Norm Dressler <ndressler at dinmar dot com>

This process was tested using the following software versions:

- Linux Mandrake 10/Kernel 2.4.22-10 SMP
- Mysql Ver 12.21 Distrib 4.0.15, for mandrake-linux-gnu (i586)
- PostgreSQL 7.3.4
- Bacula 1.34.5

WARNING: Always as a precaution, take a complete backup of your databases before proceeding with this process!

1. Shutdown bacula (`cd /etc/bacula;./bacula stop`)
2. Run the following command to dump your Mysql database:

```
mysqldump -f -t -n >bacula-backup.dmp
```

3. Make a backup of your `/etc/bacula` directory (but leave the original in place).
4. Go to your Bacula source directory and rebuild it to include PostgreSQL support rather than Mysql support. Check the `config.log` file for your original configure command and replace `enable-mysql` with `enable-postgresql`.
5. Recompile Bacula with a make and if everything compiles completely, perform a make install.
6. Shutdown Mysql.
7. Start PostgreSQL on your system.
8. Create a bacula user in Postgres with the `createuser` command. Depending on your Postgres install, you may have to `SU` to the user who has privileges to create a user.
9. Verify your `pg_hba.conf` file contains sufficient permissions to allow bacula to access the server. Mine has the following since it's on a secure network:

```
local all all trust
host all all 127.0.0.1 255.255.255.255 trust

NOTE: you should restart your postgres server if you
      made changes
```

10. Change into the `/etc/bacula` directory and prepare the database and tables with the following commands:

```
./create_postgresql_database
./make_postgresql_tables
./grant_postgresql_privileges
```

11. Verify you have access to the database:

```
psql -Ubacula bacula
```

You should not get any errors.

12. Load your database from the Mysql database dump with:

```
psql -Ubacula bacula <bacula-backup.dmp>
```

13. Resequence your tables with the following commands:

```
psql -Ubacula bacula

SELECT SETVAL('basefiles_baseid_seq', (SELECT
MAX(baseid) FROM basefiles));
SELECT SETVAL('client_clientid_seq', (SELECT
MAX(clientid) FROM client));
SELECT SETVAL('file_fileid_seq', (SELECT MAX(fileid)
FROM file));
SELECT SETVAL('filename_filenameid_seq', (SELECT
MAX(filenameid) FROM filename));

SELECT SETVAL('fileset_filesetid_seq', (SELECT
MAX(filesetid) FROM fileset));

SELECT SETVAL('job_jobid_seq', (SELECT MAX(jobid) FROM job));
SELECT SETVAL('jobmedia_jobmediaid_seq', (SELECT
MAX(jobmediaid) FROM jobmedia));
SELECT SETVAL('media_mediaid_seq', (SELECT MAX(mediaid) FROM media));
SELECT SETVAL('path_pathid_seq', (SELECT MAX(pathid) FROM path));

SELECT SETVAL('pool_poolid_seq', (SELECT MAX(poolid) FROM pool));
```

14. At this point, start up Bacula, verify your volume library and perform a test backup to make sure everything is working properly.

3.6 Upgrading PostgreSQL

If you upgrade PostgreSQL, you must reconfigure, rebuild, and re-install Bacula otherwise you are likely to get bizarre failures. If you to modify the bacula.spec file to account for the new PostgreSQL version. You can do so by rebuilding from the source rpm. To do so, you may need install from rpms and you upgrade PostgreSQL, you must also rebuild Bacula.

3.7 Tuning PostgreSQL

If you despool attributes for many jobs at the same time, you can tune the sequence object for the `FileId` field.

```
psql -Ubacula bacula

ALTER SEQUENCE file_fileid_seq CACHE 1000;
```

3.8 Credits

Many thanks to Dan Langille for writing the PostgreSQL driver. This will surely become the most popular database that Bacula supports.

Chapter 4

Installing and Configuring SQLite

Please note that SQLite both versions 2 and 3 are not network enabled, which means that they must be linked into the Director rather than accessed by the network as MySQL and PostgreSQL are. This has two consequences:

1. SQLite cannot be used in the **bweb** web GUI package.
2. If you use SQLite, and your Storage daemon is not on the same machine as your Director, you will need to transfer your database to the Storage daemon's machine before you can use any of the SD tools such as **bscan**, ...

4.1 Installing and Configuring SQLite – Phase I

If you use the `./configure --with-sqlite` statement for configuring **Bacula**, you will need SQLite version 2.8.16 or later installed. Our standard location (for the moment) for SQLite is in the dependency package **depkgs/sqlite-2.8.16**. Please note that the version will be updated as new versions are available and tested.

Installing and Configuring is quite easy.

1. Download the Bacula dependency packages
2. Detar it with something like:

```
tar xvfz depkgs.tar.gz
```

Note, the above command requires GNU tar. If you do not have GNU tar, a command such as:

```
zcat depkgs.tar.gz — tar xvf -
```

will probably accomplish the same thing.

3. `cd depkgs`
4. `make sqlite`

Please note that the `./configure` used to build **Bacula** will need to include `--with-sqlite` or `--with-sqlite3` depending on which version of SQLite you are using. You should not use the `--enable-batch-insert` configuration parameter for Bacula if you are using SQLite version 2 as it is probably not thread safe. If you are using SQLite version 3, you may use the `--enable-batch-insert` configuration option with Bacula, but when building SQLite3 you MUST configure it with `--enable-threadsafety` and `--enable-cross-thread-connections`.

By default, SQLite3 is now run with `PRAGMA synchronous=OFF` this increases the speed by more than 30 times, but it also increases the possibility of a corrupted database if your server crashes (power failure or kernel bug). If you want more security, you can change the PRAGMA that is used in the file `src/version.h`.

At this point, you should return to completing the installation of **Bacula**.

4.2 Installing and Configuring SQLite – Phase II

This phase is done **after** you have run the `./configure` command to configure **Bacula**.

Bacula will install scripts for manipulating the database (create, delete, make tables etc) into the main installation directory. These files will be of the form `*_bacula_*` (e.g. `create_bacula_database`). These files are also available in the `<bacula-src>/src/cats` directory after running `./configure`. If you inspect `create_bacula_database`, you will see that it calls `create_sqlite_database`. The `*_bacula_*` files are provided for convenience. It doesn't matter what database you have chosen; `create_bacula_database` will always create your database.

At this point, you can create the SQLite database and tables:

1. `cd <install-directory>`

This directory contains the Bacula catalog interface routines.

2. `./make_sqlite_tables`

This script creates the SQLite database as well as the tables used by **Bacula**. This script will be automatically setup by the `./configure` program to create a database named **bacula.db** in **Bacula's** working directory.

4.3 Linking Bacula with SQLite

If you have followed the above steps, this will all happen automatically and the SQLite libraries will be linked into **Bacula**.

4.4 Testing SQLite

We have much less "production" experience using SQLite than using MySQL. SQLite has performed flawlessly for us in all our testing. However, several users have reported corrupted databases while using SQLite. For that reason, we do not recommend it for production use.

If Bacula crashes with the following type of error when it is started:

```
Using default Catalog name=MyCatalog DB=bacula
Could not open database "bacula".
sqlite.c:151 Unable to open Database=/var/lib/bacula/bacula.db.
ERR=malformed database schema - unable to open a temporary database file
for storing temporary tables
```

this is most likely caused by the fact that some versions of SQLite attempt to create a temporary file in the current directory. If that fails, because Bacula does not have write permission on the current directory, then you may get this errr. The solution is to start Bacula in a current directory where it has write permission.

4.5 Re-initializing the Catalog Database

After you have done some initial testing with **Bacula**, you will probably want to re-initialize the catalog database and throw away all the test Jobs that you ran. To do so, you can do the following:

```
cd <install-directory>
./drop_sqlite_tables
./make_sqlite_tables
```

Please note that all information in the database will be lost and you will be starting from scratch. If you have written on any Volumes, you must write an end of file mark on the volume so that Bacula can reuse it. Do so with:

```
(stop Bacula or unmount the drive)
mt -f /dev/nst0 rewind
mt -f /dev/nst0 weof
```

Where you should replace `/dev/nst0` with the appropriate tape drive device name for your machine.

Chapter 5

The internal database is not supported, please do not use it.

5.1 Internal Bacula Database

Previously it was intended to be used primarily by Bacula developers for testing; although SQLite is also a good choice for this. We do not recommend its use in general.

This database is simplistic in that it consists entirely of Bacula's internal structures appended sequentially to a file. Consequently, it is in most cases inappropriate for sites with many clients or systems with large numbers of files, or long-term production environments.

Below, you will find a table comparing the features available with SQLite and MySQL and with the internal Bacula database. At the current time, you cannot dynamically switch from one to the other, but must rebuild the Bacula source code. If you wish to experiment with both, it is possible to build both versions of Bacula and install them into separate directories.

Feature	SQLite or MySQL	Bacula
Job Record	Yes	Yes
Media Record	Yes	Yes
FileName Record	Yes	No
File Record	Yes	No
FileSet Record	Yes	Yes
Pool Record	Yes	Yes
Client Record	Yes	Yes
JobMedia Record	Yes	Yes
List Job Records	Yes	Yes
List Media Records	Yes	Yes
List Pool Records	Yes	Yes
List JobMedia Records	Yes	Yes
Delete Pool Record	Yes	Yes
Delete Media Record	Yes	Yes
Update Pool Record	Yes	Yes
Implement Verify	Yes	No
MD5 Signatures	Yes	No

In addition, since there is no SQL available, the Console commands: **sqlquery**, **query**, **retention**, and any other command that directly uses SQL are not available with the Internal database.

Chapter 6

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