Firebird 1.0 Quick Start Guide

IBPhoenix Editors

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About this guide

This guide is an introduction for the complete newcomer to a few essentials for getting off to a quick start with a Firebird binary kit. For the fine details of configuring and running your server and tuning your installation, please refer to Chapters 4-6 of the *Using Firebird* manual, distributed on the IBPhoenix CD.

The *Firebird Quick Start Guide* started life as Chapter 1 of the *Using Firebird* manual, sold on CD by IBPhoenix. Later it was published separately on the Internet. In June 2004, IBPhoenix donated the guide to the Firebird Project.

> **Important**
>
> Before you read on, verify that your Firebird version matches this guide. This guide covers versions 1.0, 1.0.2 and 1. 0.3. If you run Firebird 1.5 or higher, get the appropriate version of the Quick Start Guide at http://www.firebirdsql.org/manual/ (HTML) or http://www.firebirdsql.org/pdfmanual/ (PDF).

What is in the kit?

All of the kits contain all of the components needed to install the Firebird server:

- The Firebird server executable.
- A client library located on the server machine.
- The command-line tools.
- The standard user-defined function libraries.
- A sample database.
- The C header files (not needed by beginners!)
- Release notes – ESSENTIAL READING!

Classic or Superserver?

Firebird comes in two flavors, called *architectures*: Classic Server and Superserver. On Windows, only Superserver is available (at least for 1.0 versions) so you can skip this section, but if you're installing on Linux you're faced with the choice. Which one is better? Well, that depends on your situation. A short overview of the most important differences follows.

Table 1. Firebird 1.0 Classic Server vs. Superserver

Classic Server	Superserver
Only available on Linux.	Available on both Windows and Linux.
Creates a process for each client connection, each with its own cache. Less resource use if the number of connections is low.	Single server process with a separate thread for each connection. Shared cache space. More efficient if the number of simultaneous connections grows.
Permits fast, direct I/O to database files for Linux local connections.	On Linux, local connections are made network-style, via `localhost` (often implicitly). On Windows, this is optional; you can also make direct local connections, but these are not as fast as the “Classic” ones on Linux and also less safe.
Server must run as `root`. This poses a risk if the server were to be hacked or contained a severe bug. (Note: in Firebird 1.5 this is no longer the case.)	Server can run as non-root user, e.g. `firebird`. This limits the damage in case of malfunctioning (by hack or otherwise).
No Services Manager. Tasks like backup/restore, user management, stats etc. have to be performed locally using the client tools (small separate executables) that come with Firebird.	Features a *Services Manager* enabling you to perform certain tasks (backup/restore, user management, stats, etc.) programmatically. You can connect to the Services Manager over the network and thus perform these tasks remotely.
SMP (symmetrical multi-processor) support. Better performance in case of a small number of multiple connections that do not influence each other.	No SMP support. On multi-processor Windows machines, performance can even drop dramatically as the OS switches the process between CPUs. To prevent this, set the *`CPU_AFFINITY`* parameter in the configuration file `ibconfig`.

As you can see, neither of the architectures is better in all respects. This is hardly surprising: we wouldn't maintain two architectures if one of them was an all-fronts loser.

If you're still not sure what to choose (maybe you find all this tech talk a little overwhelming), just pick one or the other. In most circumstances, chances are that you won't notice a performance difference. Besides, you can always switch to the other architecture later; your applications and databases will keep functioning (except if they call the Services Manager and you switch to Classic).

Superserver download packages start with `FirebirdSS`, Classic packages with `FirebirdCS`. As said, this only goes for Linux.

Default disk locations

The following table describes the default disk locations for the components on Windows and Linux.

> **Warning**
>
> Firebird 1.0 still uses many of the same locations, component names and resource links as InterBase 6.x and prior versions of InterBase. Hence, it is not possible to run both a Firebird server and an InterBase server on the same machine with these versions - at least not at the same time. This restriction has been removed in Firebird 1.5.

Table 2. Components of the Firebird 1.0 installation

Platform	Component	File Name	Default Location
32-bit and 64-bit Windows (Windows 95, 98, ME, NT, 2000, XP, ...)	Installation directory (referred to hereafter as `<InstallDir>`)		`C:\Program Files\Firebird`
	Firebird server	`ibserver.exe` (SS only)	`<InstallDir>\bin`
	Command-line tools	`gbak.exe`, `gfix.exe`, `gstat.exe`, etc.	`<InstallDir>\bin`
	Sample database	`employee.gdb`	`<InstallDir>\examples`
	User-defined function (UDF) libraries	`ib_udf.dll` & `fbudf.dll`	`<InstallDir>\UDF`
	Firebird client	`gds32.dll`	Windows System directory (see note below table)

Platform	Component	File Name	Default Location
Linux and possibly other UNIX distros	Installation directory (referred to hereafter as `<InstallDir>`)		`/opt/interbase`
	Firebird server	`ibserver` (SS) or `gds_inet_server` (CS)	`<InstallDir>/bin`
	Command-line tools	`gbak`, `gfix`, `gstat`, etc.	`<InstallDir>/bin`
	Sample database	`employee.gdb`	`<InstallDir>/examples`
	UDF libraries	`ib_udf.so`	`<InstallDir>/UDF`
	Firebird client	`libgds.so.0` (binary), `libgds.so` (symlink)	`/usr/lib` (actually, the real stuff is in `<InstallDir>/lib`, but you should use the links in `/usr/lib`)

Note

The exact path to the Windows System directory depends on your Windows version. Typical locations are:

- for Windows 95/98/ME: `C:\Windows\System`
- for Windows NT/2000: `C:\WINNT\System32`
- for Windows XP: `C:\Windows\System32`

Installing Firebird

Installation drives

Firebird server – and any databases you create or connect to – must reside on a hard drive that is physically connected to the host machine. You cannot locate components of the server, or any database, on a mapped drive, a filesystem share or a network filesystem.

Note

You can mount a read-only database on a CD-ROM drive but you cannot run Firebird server from one.

Installation script or program

Although it is possible to install Firebird by a filesystem copying method – such as “untarring” a snapshot build file or decompressing a structured WinZip `.zip` file – it is strongly recommended that you use the distributed release kit the first time you install Firebird. The Windows executable installation script, the Linux rpm (*RPM Package Manager*, originally *RedHat Package Manager*) program and the official `.tar.gz` for other Posix platforms perform some essential setup tasks. Provided you follow the instructions correctly, there should be nothing for you to do upon completion but log in and go!

Windows platforms

If you install Firebird 1.03 or higher under Windows 95/98/ME, **un**check the option to install the Control Panel applet. It doesn't work on these platforms. We'll give you a link to a usable applet later on in this guide.

On server platforms – Windows NT, 2000 and XP – the Firebird service will be running when the installation completes. Next time you boot up your server machine, it will be started automatically.

The non-server Windows platforms – Windows 95, 98 and ME – do not support services. The installation will start Firebird server as an application, protected by another application known as the Guardian. If the server application should terminate abnormally for some reason, the Guardian will attempt to restart it.

Posix platforms

In all cases, read the release notes that pertain to the version of Firebird that you are going to install. There may be significant variations from release to release of any Posix operating system, especially the open source ones. Where possible, the build engineers for each Firebird version have attempted to document any known issues.

Tip

If you do not find a copy of the release notes in your kit, go back to the Downloads page of the Firebird website at http://firebird.sourceforge.net and download a copy from there.

If you have a Linux distribution that supports rpm installs, consult the appropriate platform documentation for instructions about using RPM Package Manager. In most distributions you will have the choice of performing the install from a command shell or through a GUI interface.

For Linux distributions that cannot process rpm programs, and for the various UNIX flavors, use the `.tar.gz` kit. You will find detailed instructions in the release notes.

Shell scripts have been provided. In some cases, the release notes may instruct you to modify the scripts and make some manual adjustments.

Testing your installation

If everything works as designed, the Firebird server process will be running on your server upon completion of the installation. It will start up automatically whenever you restart your server.

At this point, it is assumed that you will use the recommended TCP/IP protocol for your Firebird client/server network.

Note

For information about using NetBEUI protocol in an all-Windows environment, refer to Chapter 6, *Network Configuration* in the *Using Firebird* manual.

Warning

IPX/SPX networks are not supported by Firebird.

Pinging the server

Usually, the first thing you will want to do once installation is complete is ping the server. This just gives you a reality check to ensure that your client machine is able to see the host machine in your network. For example, if your server's IP address in the domain that is visible to your client is 192.13.14.1, go to a command shell and type the command

ping 192.13.14.1

substituting this example IP address for the IP address that your server is broadcasting.

Warning

If you get a timeout message, study the *Using Firebird* manual – Chapter 6: *Network Configuration*, and Chapter 7: *Troubleshooting Connections* – for further instructions.

Note that if you are connecting to the server from a local client – that is, a client running on the same machine as the server – you can ping the virtual TCP/IP loopback server:

ping localhost –or– **ping 127.0.0.1**

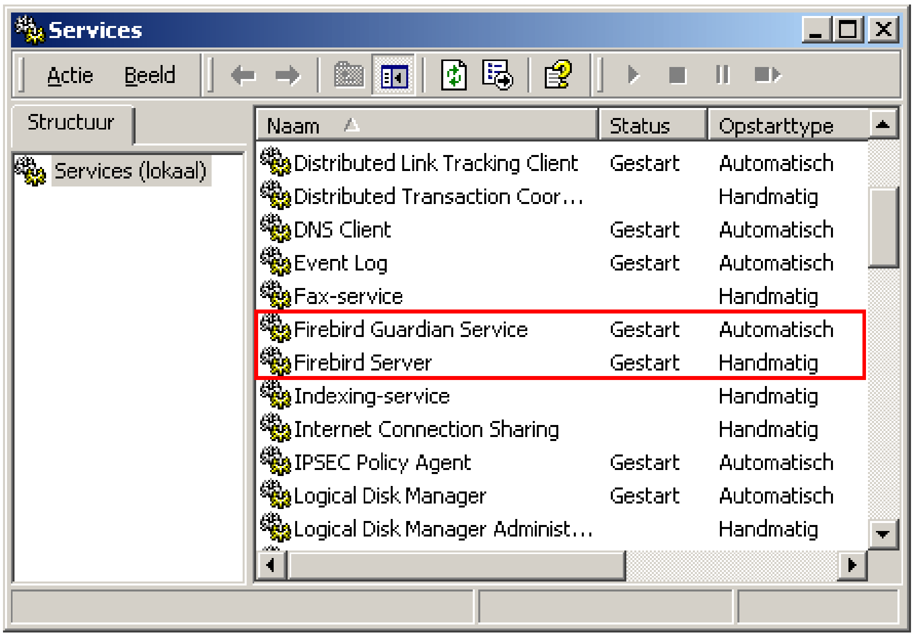
Checking that the Firebird server is running

After installation, Firebird server should be running as a service on Windows NT, 2000 or XP or on Linux.

Windows NT4, 2000 and XP

Open Control Panel -> Services (NT) or Control Panel -> Administrative Tools -> Services (2000, XP).

This illustration shows the Services applet display on Windows 2000. The appearance may vary from one Windows server edition to another.



Naam	Status	Opstarttype
Distributed Link Tracking Client	Gestart	Automatisch
Distributed Transaction Coor...		Handmatig
DNS Client	Gestart	Automatisch
Event Log	Gestart	Automatisch
Fax-service		Handmatig
Firebird Guardian Service	Gestart	Automatisch
Firebird Server	Gestart	Handmatig
Indexing-service		Handmatig
Internet Connection Sharing		Handmatig
IPSEC Policy Agent	Gestart	Automatisch
Logical Disk Manager	Gestart	Automatisch
Logical Disk Manager Administ...		Handmatig

If the Guardian is running (as shown in the screenshot, over) it may have a different service name because of version changes.

> **Note**
>
> On Windows 2000 and XP, the Guardian is a convenience rather than a necessity, since these two operating systems have the facility to watch and restart services. It is recommended that you keep Guardian active for other platforms if a SYSDBA is not available to restart the server manually in the event that it is stopped for some reason.

Windows 9x or ME

On Windows 9x or ME Firebird server should be running as an application, monitored by the Guardian. The Guardian's icon should appear in the tray with a green graphic. If the icon is flashing or showing as a red graphic, it indicates that Guardian is either attempting to start the server or has failed.

If you used an installation kit that installed but did not automatically start the Guardian and the Firebird server, you can set it up as follows:

1. Locate the executable file for the Guardian program (`ibguard.exe`) and create a shortcut for it in the Startup area of your machine's Start Menu.
2. Open the Properties dialog of the shortcut and go to the field where the command line is.
3. Edit the command line so it reads as follows:

   ```
   ibguard.exe -a
   ```

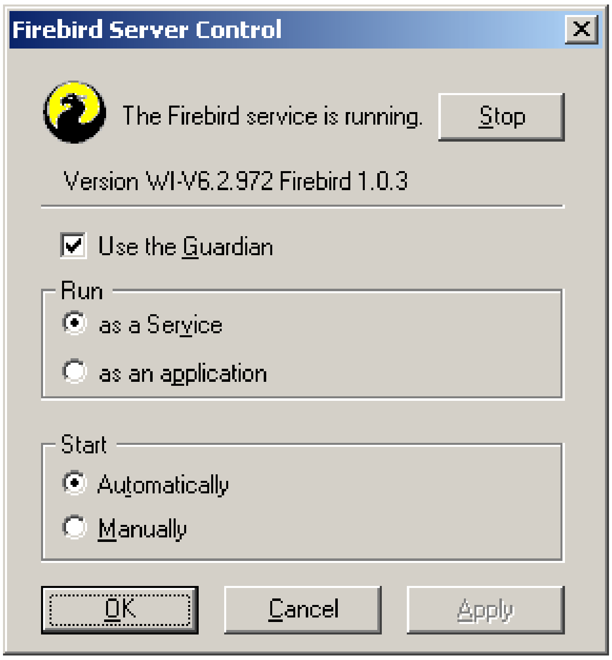
4. Save and close the Properties dialog.
5. Double-click on the shortcut to start the Guardian. The Guardian will proceed to start `ibserver.exe`.

The Guardian should start up automatically next time you boot your Windows 9x or ME machine.

Alternatively, you can use a Control Panel applet to control the starting and stopping of the Firebird server.

Windows Control Panel applets

Pre-1.0 distributions of Firebird for Windows kits installed the InterBase Manager applet into the Control Panel of operating systems that support services. It was omitted from Firebird 1.0 because a number of Firebird-specific “Firebird [Server] Manager” implementations became available through open source channels. From version 1.0.3 onward, a control panel applet is again included in the distribution. Whilst the applet is not essential, it does provide a convenient way to start and stop the server.



The Firebird service is running.

Version WI-V6.2.972 Firebird 1.0.3

☑ Use the Guardian

Run
● as a Service
○ as an application

Start
● Automatically
○ Manually

Unfortunately, the bundled applet only works on Windows NT, 2000 and XP. On Windows 9x and ME it fires an unstoppable series of error messages. But... there's a free third-party applet that can help you out. So if you're in one of these situations:

- You use Firebird 1.0 or 1.0.2 and don't want to upgrade to at least 1.0.3; or
- You run Firebird under Windows 9x or ME

and you still want a handy applet like this, *don't* use the version that comes with your Firebird installation, but visit this webpage:

http://www.achim-kalwa.de/fbcc.phtml

and download the “old” FirebirdSQL Service Manager fbmgr-setup.exe.

This applet looks different from the above screenshot, but offers the same functionality.

> **Note**
>
> The FirebirdSQL Service Manager screen says it supports 1.0 and 1.5, but that's incorrect. Only use it for 1.0 versions.

Posix servers

Use the **top** command in a command shell to inspect the running processes interactively. If a Firebird Superserver is running, you should see a process named `ibguard`. This is the Guardian process. Further, there will be one main and zero or more child processes named `ibserver`.

For Classic Server versions, the process name is `gds_inet_server`. There will be one instance of this process running for each network connection. Note that if there are no active connections, or if there are only direct local connections, you won't find `gds_inet_server` in the process list.

The following screen shows the output of top, restricted by grep to show only processes with names starting with the characters `ib`:

```
frodo:/inkomend/firebird # top -b -n1 | grep ib
 2587 firebird  24   0  1232 1232 1028 S  0.0  0.3   0:00.00 ibguard
 2588 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.04 ibserver
 2589 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.00 ibserver
 2604 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.00 ibserver
 2605 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.02 ibserver
 2606 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.00 ibserver
 2607 firebird  15   0  4124 4120 2092 S  0.0  0.9   0:00.00 ibserver
```

If you run Classic Server, grep for `gds` instead.

As an alternative to top, you can use **ps -ax** or **ps -aux** and pipe the output to grep.

Other things you need

A network address for the server

- If you are on a managed network, get the server's IP address from your system administrator.

- If you have a simple network of two machines linked by a crossover cable, you can set up your server with any IP address you like except 127.0.0.1 (which is reserved for a local loopback server) and, of course, the IP address which you are using for your client machine. If you know the “native” IP addresses of your network cards, and they are different, you can simply use those.

- If you are intending to try out a single-machine installation of both client and server, you should use the local loopback server address – localhost, with the IP address 127.0.0.1

> **Note**
>
> It is possible to connect directly to a local Windows Superserver, without using the TCP/IP loopback. This is not a TCP/IP connection and it is not a thread-safe way to connect to a local server. For using single instances of the command-line tools (gsec, gbak etc.) it works just fine. By contrast, direct database connections - even multiple - under a Linux Classic server are completely safe.

Default user name and password

The SYSDBA user has all privileges on the server. The installation program will install the SYSDBA user with the password `masterkey` (actually, it's `masterke`: characters after the eighth are ignored).

If your server is exposed to the Internet *at all*, you should change this password immediately using the gsec command-line utility.

How to change the SYSDBA password

Firebird comes with a command-line tool called gsec that is used to manipulate user accounts.

> **Important**
>
> With some Firebird installations, you can only run gsec if you are logged into the operating system as Superuser (`root` on Linux) or as the user the Firebird server process runs under. On Windows server platforms, you typically need to be in the Power User group or higher to run gsec successfully.
>
> If you have enough privileges but invoking gsec results in a message like “`unavailable database - unable to open database`”, the server probably isn't running. In that case, go back to *Testing your installation* and fix the problem.

Let's say you decide to change the SYSDBA password to `icuryy4me`.

1. Go to a command shell on your server and change to the directory where the command-line utilities are located. Refer to the Firebird installation components table to find this location.

2. Type the following:

   gsec -user sysdba -password masterkey

   > **Note**
   >
   > - On Linux, type **./gsec** rather than **gsec**. Otherwise there's a chance that a “wrong” gsec is launched, or that it isn't found at all.
   > - Paths and file names are case-sensitive on all platforms except Windows; passwords are always case-sensitive.

   You should now see the shell prompt for the gsec utility:

   ```
   GSEC>
   ```

3. Type this command:

   ```
   modify sysdba -pw icuryy4me
   ```

4. Press **Enter**. The new password `icuryy4me` is now encrypted and saved and `masterkey` is no longer valid.

5. Now quit the gsec shell:

   ```
   quit
   ```

> **Note**
>
> Because Firebird ignores all characters in a password past the eighth character, `icuryy4m` will work, as will `icuryy4monkeys`.

An Admin tool

The Firebird kit does not come with a GUI admin tool. It does have a set of command-line tools, executable programs which are located in the `bin` subdirectory of your Firebird installation.

The range of excellent GUI tools available for use with a Windows client machine is too numerous to describe here. A few GUI tools written in Borland Kylix, for use on Linux client machines, are also in various stages of completion.

Inspect the Downloads > Contributed > Admin Tools page at http://www.ibphoenix.com for all of the options.

> **Note**
>
> You can use a Windows client to access a Linux server and vice-versa.

Connecting to the sample database

In the `examples` subdirectory of your Firebird installation is a sample database named `employee.gdb`. You can use this database to “try your wings”.

> **Warning**
>
> If you are running the server on Windows XP or ME, be sure to rename this test database to `employee.`**`fdb`** to get around the System Restore utility, which targets files with a `.gdb` extension. There is more information about this problem in the Release Notes (look in the `doc` subdir of your Firebird installation).

Server name and path

If you move the sample database, be sure you move it to a hard disk that is physically attached to your server machine. Shares, mapped drives or (on Unix) mounted SMB (Samba) filesystems will not work. The same rule applies to any databases that you create.

There are two elements to a TCP/IP connection string: the server name and the disk/filesystem path. Its format is as follows:

- For a Linux server:

  servername:/filesystem-path/database-file

  Example on a Linux or other Posix server named `serverxyz`:

```
serverxyz:/opt/interbase/examples/employee.gdb
```

- For a Windows server:

  servername:DriveLetter:\filesystem-path\database-file

  Windows example:

  ```
  serverxyz:C:\Program Files\Firebird\examples\employee.gdb
  ```

The CONNECT statement

Connecting to a Firebird database requires the user to authenticate using a user name and a valid password. Any user other than SYSDBA, `root` (on Posix systems), or `Administrator` (on Windows systems, if Firebird runs as this user) needs also to have permissions to objects inside a database. For simplicity here, we will look at authenticating as SYSDBA using the password `masterkey`.

Using isql

There are several different ways to connect to a database using isql. One way is to start isql in its interactive shell. Go to the `bin` subdirectory of your Firebird installation and, at that prompt, type the command **isql** (on Linux: **./isql**) [# means “hit **Enter**”]:

```
C:\Program Files\Firebird\bin>isql#
Use CONNECT or CREATE DATABASE to specify a database
SQL>CONNECT "C:\Program Files\Firebird\examples\employee.gdb"#
CON>user 'SYSDBA' password 'masterkey';#
```

Important

- In isql, every SQL statement must end with a semicolon. If you hit **Enter** and the line doesn't end with a semicolon, isql assumes that the statement continues on the next line and the prompt will change from `SQL>` to `CON>`. This enables you to spread long statements over multiple lines. If you hit **Enter** after your statement and you've forgotten the semicolon, just type it on the empty line after the `CON>` prompt and press **Enter** again.

- If you run Classic Server on Linux, a fast, direct local connection is attempted if the database path does not start with a hostname. This may fail if your Linux login doesn't have sufficient access rights to the database file. In that case, connect to `localhost:/`<path>. Then the server process (with Firebird 1.0 usually running as `root`) will open the file. On the other hand, network-style connections may fail if a user created the database in Classic local mode and the server doesn't have enough access rights.

Note

Although single quote symbols are the “norm” for delimiting strings in Firebird, double quote symbols were used with the database path string in the above example. This is sometimes necessary with some of the command-line utilities where the path string contains spaces. Single quotes should work for paths that do not contain spaces.

The quotes around “SYSDBA” and “masterkey” are optional, by the way. Database paths without spaces also don't need to be quoted.

At this point, isql will inform you that you are connected:

```
DATABASE "C:\Program Files\Firebird\examples\employee.gdb", User: sysdba
SQL>
```

You can now continue to play about with the `employee.gdb` database. The characters isql stand for *interactive SQL [utility]*. You can use it for querying data, getting information about the metadata, creating database objects, running data definition scripts and much more.

To get back to the command prompt type

```
SQL>QUIT;#
```

For more information about isql, see *Using Firebird*, Chapter 10: *Interactive SQL Utility (isql)*.

Using a GUI client

GUI client tools usually take charge of composing the CONNECT string for you, using server, path, user name and password information that you type into prompting fields. Use the elements as described in the preceding topic.

Note

- It is quite common for such tools to expect the entire server + path as a single string
- Remember that file names and commands on Linux and other Posix command shells are case-sensitive

Creating a database using isql

There is more than one way to create a database using isql. Here, we will look at one simple way to create a database interactively – although, for your serious database definition work, you should create and maintain your metadata objects using data definition scripts. There is a complete chapter in the *Using Firebird* manual discussing this topic.

Starting isql

To create a database interactively using the isql command shell, get to a command prompt in Firebird's `bin` subdirectory and type **isql** (Windows) or **./isql** (Linux):

```
C:\Program Files\Firebird\bin>isql#
Use CONNECT or CREATE DATABASE to specify a database
```

The CREATE DATABASE statement

Now, you can create your new database interactively. Let's suppose that you want to create a database named `test.fdb` and store it in a directory named `data` on your `D` drive:

```
SQL>CREATE DATABASE 'D:\data\test.fdb' page_size 8192#
CON>user 'SYSDBA' password 'masterkey';#
```

> **Important**
>
> - In the CREATE DATABASE statement the quotes around path string, username, and password are *mandatory*. This is different from the CONNECT statement.
> - If you run Classic Server on Linux and you don't start the database path with a hostname, creation of the database file is attempted with your Linux login as the owner. This may or may not be what you want (think of access rights if you want others to be able to connect). If you prepend `localhost:` to the path, the server process (with Firebird 1.0 usually running as `root`) will create and own the file.

The database will be created and, after a few moments, the SQL prompt will reappear. You are now connected to the new database and can proceed to create some test objects in it.

To verify that there really is a database there, type in this query:

```
SQL>SELECT * FROM RDB$RELATIONS;#
```

The screen will fill up with a large amount of data! This query selects all of the rows in the system table where Firebird stores the metadata for tables. An “empty” database is not empty – it contains a database which will become populated with metadata as you begin creating objects in your database.

To get back to the command prompt type

```
SQL>QUIT;#
```

For more information about isql, see *Using Firebird*, Chapter 10: *Interactive SQL Utility (isql)*.

Performing a client-only install

Each remote client machine needs to have the client library – `libgds.so` on Posix clients, `gds32.dll` on Windows clients – that matches the release version of the Firebird server.

Some extra pieces are also needed for the client-only install.

Windows

At present, no compact installation program is available to assist with installing the client pieces on a Windows client. If you are in the common situation of running Windows clients to a Linux or other Posix Firebird server (or another Windows machine), you need to download the full Windows installation kit that corresponds to the version of Firebird server you install on your Linux or other server machine.

Fortunately, once you have the kit, the Windows client-only install is easy to do. Run the installation program, just as though you were going to install the server – but select the CLIENT ONLY option from the install menu.

Linux and some other Posix clients

A small-footprint client install program for Linux clients is not available either. Additionally, some Posix flavors – even within the Linux constellation – have somewhat idosyncratic requirements for filesystem locations. For these reasons, not all *x distributions for Firebird even contain a client-only install option.

For most Linux flavors, the following procedure is suggested for a Firebird client-only install. Log in as `root` for this.

1. Look for `libgds.so.0` in `/opt/interbase/lib` on the server where Firebird server is installed. Copy it to `/usr/lib` on the client.

2. Create the symlink `libgds.so` for it, using the following command:

   ln -s /usr/lib/libgds.so.0 /usr/lib/libgds.so

3. Copy the `interbase.msg` file to `/opt/interbase`

4. In the system-wide default shell profile, or using `setenv()` from a shell, create the `INTERBASE` environment variable and point it to `/opt/interbase`, to enable the API routines to locate the messages.

Firebird SQL

Every database management system has its own idiosyncrasies in the ways it implements SQL. Firebird adheres to the SQL standard more rigorously than any other RDBMS except possibly its “cousin”, InterBase®. Developers migrating from products that are less standards-compliant often wrongly suppose that Firebird is quirky, whereas many of its apparent quirks are not quirky at all.

String delimiter symbol

Strings in Firebird are delimited by a pair of single quote symbols – `'I am a string'` – (ASCII code 39, *not* 96). If you used earlier versions of Firebird's relative, InterBase®, you might recall that double and single quotes were interchangeable as string delimiters. Double quotes cannot be used as string delimiters in Firebird SQL statements.

Double-quoted identifiers

Before the SQL-92 standard, it was not legal to have object names (identifiers) in a database that duplicated keywords in the language, were case-sensitive or contained spaces. SQL-92 introduced a single new standard to make any of them legal, provided that the identifiers were defined within pairs of double-quote symbols (ASCII 34) and were always referred to using double-quote delimiters.

The purpose of this “gift” was to make it easier to migrate metadata from non-standard RDBMSs to standards-compliant ones. The down-side is that, if you choose to define an identifier in double quotes, its case-sensitivity and the enforced double-quoting will remain mandatory.

Firebird does permit a slight relaxation under a very limited set of conditions. If the identifier which was defined in double-quotes:

1. was defined as all upper-case,
2. is not a keyword, and
3. does not contain any spaces,

...then it can be used in SQL unquoted and case-insensitively. (But as soon as you put double-quotes around it, you must match the case again!)

> **Warning**
>
> Don't get too smart with this! For instance, if you have tables "TESTTABLE" and "TestTable", both defined within double-quotes, and you issue the command:
>
> ```
> SQL>select * from TestTable;
> ```
>
> ...you will get the records from "TESTTABLE", not "TestTable"!

Unless you have a compelling reason to define quoted identifiers, it is usually recommended that you avoid them. Firebird happily accepts a mix of quoted and unquoted identifiers – so there is no problem including that keyword which you inherited from a legacy database, if you need to.

> **Warning**
>
> Some database admin tools enforce double-quoting of *all* identifiers by default. Try to choose a tool which makes double-quoting optional.

Apostrophes in strings

If you need to use an apostrophe inside a Firebird string, you can “escape” the apostrophe character by preceding it with another apostrophe.

For example, this string will give an error:

```
'Joe's Emporium'
```

because the parser encounters the apostrophe and interprets the string as `'Joe'` followed by some unknown keywords.

To make this a legal string, double the apostrophe character:

```
'Joe''s Emporium'
```

Notice that this is TWO single quotes, not one double-quote.

Concatenation of strings

The concatenation symbol in SQL is two “pipe” symbols (ASCII 124, in a pair with no space between). In SQL, the “+” symbol is an arithmetic operator and it will cause an error if you attempt to use it for concatenating strings. The following expression prefixes a character column value with the characters “`Reported by: `”:

```
'Reported by: ' || LastName
```

Take care with concatenations. Be aware that Firebird will raise an error if your expression attempts to concatenate two or more char or varchar columns whose potential combined lengths would exceed the maximum length limit for a char or a varchar (32 Kb).

See also the note below, Expressions involving NULL, about concatenating in expressions involving

NULL.

Division of an integer by an integer

Firebird accords with the SQL standard by truncating the result (quotient) of an integer/integer calculation to the next lower integer. This can have bizarre results unless you are aware of it.

For example, this calculation is correct in SQL:

```
1 / 3 = 0
```

If you are upgrading from a RDBMS which resolves integer/integer division to a float quotient, you will need to alter any affected expressions to use a float or scaled numeric type for either dividend, divisor, or both.

For example, the calculation above could be modified thus in order to produce a non-zero result:

```
1.000 / 3 = 0.333
```

Expressions involving NULL

In SQL, NULL is not a value. It is a condition, or *state*, of a data item, in which its value is unknown. Because it is unknown, NULL cannot behave like a value. When you try to perform arithmetic on NULL, or involve it with values in other expressions, the result of the operation will always be NULL. It is not zero or blank or an “empty string” and it does not behave like any of these values.

So – here are some examples of the types of surprises you will get if you try to perform calculations and comparisons with NULL:

- `1 + 2 + 3 + NULL = NULL`
- `not (NULL) = NULL`
- `'Home ' || 'sweet ' || NULL = NULL`
-
  ```
  if (a = b) then
    MyVariable = 'Equal';
  else
    MyVariable = 'Not equal';
  ```

  After executing this code, MyVariable will be 'Not equal' if both a and b are NULL. The reason is that the expression 'a = b' yields NULL if at least one of them is NULL. In an “if...then” context, NULL behaves like FALSE. So the 'then' block is skipped, and the 'else' block executed.

-
  ```
  if (a <> b) then
    MyVariable = 'Not equal';
  else
    MyVariable = 'Equal';
  ```

  Here, MyVariable will be 'Equal' if a is NULL and b isn't, or vice versa. The explanation is analogous to that of the previous example.

- `FirstName || ' ' || LastName`

  will return NULL if either FirstName or LastName is NULL.

Tip

Think of NULL as UNKNOWN and all these strange results suddenly start to make sense! If the value of Number is unknown, the outcome of '1 + 2 + 3 + Number' is also unknown (and therefore NULL). If the content of MyString is unknown, then so is 'MyString || YourString' (even if YourString is non-NULL). Etcetera.

Backup

Firebird comes with its own utility for backing up and restoring your databases. Its name is gbak and it can be found in the bin subdirectory of your Firebird installation. Firebird databases can be backed up whilst users are connected to the system and going about their normal work. The backup will be taken from a snapshot of the database state at the time the backup began.

Regular backups and occasional restores using gbak should be a scheduled part of your database management activity.

Warning

Do not use external proprietary backup utilities or file-copying tools such as WinZip, tar, copy, xcopy, etc., on a database which is running. Not only will the backup be unreliable, but the disk-level blocking used by these tools can corrupt a running database.

Important

Study the warnings in the next section about database activity during restores!

How to corrupt a database

1. Modifying metadata tables yourself

Firebird stores and maintains all of the metadata for its own and your user-defined objects in – a Firebird database! More precisely, it stores them in relations (tables) right in the database itself. The identifiers for the system tables, their columns and several other types of system objects begin with the characters RDB$.

Because these are ordinary database objects, they can be queried and manipulated just like your user-defined objects. However, just because you can does not say you should. The Firebird engine implements a high-level subset of SQL (DDL) for the purpose of defining and operating on metadata objects, typically through CREATE, ALTER and DROP statements.

It cannot be recommended too strongly that you use DDL – not direct SQL operations on the system tables – whenever you need to alter or remove metadata. Defer the “hot fix” stuff until your skills in SQL and your knowledge of the Firebird engine become very advanced. A wrecked database is neither pretty to behold nor cheap to repair.

2. Disabling forced writes on Windows

Firebird is installed with forced writes (synchronous writes) enabled by default. Changed and new data are written to disk immediately upon posting.

It is possible to configure a database to use asynchronous data writes – whereby modified or new data are held in the memory cache for periodic flushing to disk by the operating system's I/O subsystem. The common term for this configuration is *forced writes off* (or *disabled*). It is sometimes resorted to in order to improve performance during large batch operations.

The big warning here is: do *not* disable forced writes on a Windows server. It has been observed that the Windows server platforms do not flush the write cache until the Firebird service is shut down. Apart from power interruptions, there is just too much that can go wrong on a Windows server. If it should hang, the I/O system goes out of reach and your users' work will be lost in the process of rebooting.

Note

Windows 9x and ME do not support deferred data writes

Disabling Forced Writes on a Linux server

Linux servers are safer for running an operation with forced writes disabled temporarily. Still, do not leave it disabled once your large batch task is completed, unless you have a very robust fall-back power system.

3. Restoring a backup to a running database

One of the restore options in the gbak utility (`gbak -r[eplace]`) allows you to restore a gbak file over the top of an existing database. It is possible for this style of restore to proceed without warning while users are logged in to the database. Database corruption is almost certain to be the result.

Warning

Be aware that you will need to design your Admin tools and procedures to prevent any possibility for any user (including SYSDBA) to restore to your active database if any users are logged in.

Note

For gbak instructions see chapter 21, *Database Backup and Restore*, of *Using Firebird*.

For instructions about blocking access to users, see chapter 14, *Getting exclusive access to a database*, of *Using Firebird*.

If is practicable to do so, it is recommended to restore to spare disk space using the `gbak -c [reate]` option and test the restored database using isql or your preferred admin tool. If the restored database is good, shut down the server. Make a filesystem copy of the old database and then copy the restored database file (or files) over their existing counterparts.

4. Allowing users to log in during a restore

If you do not block access to users while performing a restore using `gbak -r[eplace]` then users may be able to log in and attempt to do operations on data. Corrupted structures will result.

Where to next?

How to get help

The community of willing helpers around Firebird goes a long way back, to many years before the source code for its ancestor, InterBase® 6, was made open source. Collectively, the Firebird community does have all the answers! It even includes some people who have been involved with it since it was a design on a drawing board in a bathroom in Boston.

- Visit the official Firebird Project site at http://firebird.sourceforge.net and join the user support lists.
- Visit the Firebird knowledge site at http://www.ibphoenix.com to look up a vast collection of information about developing with and using Firebird.
- See the growing list of documentation that has been produced within the Firebird project itself at http://firebird.sourceforge.net/manual/.
- Get the *Using Firebird* manual and its companion volume, the *Firebird Reference Guide*. Both books ship on the IBPhoenix CD as e-books in PDF format. They are fully cross-referenced.
- Read the *Firebird Reference Guide*, chapter 10: *Resources and References* – for a collection of useful resources about Firebird, SQL and database application development.
- Order the official Firebird Book at http://www.ibphoenix.com/main.nfs?a=ibphoenix&s=1093098777:149734&page=ibp_firebird_book, for more than 1100 pages jam-packed with Firebird information.

Using the books by IBPhoenix Publications

Using Firebird and the *Firebird Reference Guide* have been designed for easy use and access during your development work. A button at the top right-hand corner of each “content” page will cause Acrobat Reader to switch back and forth between the two volumes. Each content page also has a navigation bar with buttons to take you directly to the index listings for the selected character. All index listings are hyperlinked to their sources.

For greater detail about setting up your server and your network, refer to the early chapters of *Using Firebird*. Chapter 7 is a troubleshooting reference. The ensuing chapters deal in turn with design, language and development issues and provided detailed instructions for using the command-line tools.

The Firebird Project

The developers, designers and testers who gave you Firebird and several of the drivers are members of the Firebird open source project at SourceForge, that amazing virtual community that is home to thousands of open source software teams. The Firebird project's address there is http://sourceforge.net/projects/firebird. At that site are the source code tree, the bug tracker and a number of technical files which can be downloaded for various purposes related to the development and testing of the codebases.

The Firebird Project developers and testers use an email list forum – firebird-devel@lists.sourceforge.net – as their “virtual laboratory” for communicating with one another about their work on enhancements, bug-fixing and producing new versions of Firebird.

Anyone who is interested in watching progress can join this forum. However, user support questions are a distraction which they do not welcome. Please do not try to post your user support questions there! These belong in firebird-support@yahoogroups.com.

Appendix A: Document History

The exact file history is recorded in the `manual` module in our CVS tree; see http://sourceforge.net/cvs/?group_id=9028

Revision History

0.0	2002	IBP	Published as Chapter One of *Using Firebird*.
1.0	2003	IBP	Published separately as a free Quick Start Guide.
1.x	June 2004	IBP	Donated to Firebird Project by IBPhoenix.
2.0	27 Aug 2004	PV	Downgraded to Firebird 1.0 Added Classic vs. Superserver section. Reorganised and corrected Disk Locations Table. Added (new) screenshots. Updated and completed information on Control Panel applets. Added more examples to “Expressions involving `NULL`”. Various other corrections and additions.
2.1	20 Feb 2005	PV	Enhanced GSEC section. Added more info to CONNECT and CREATE DATABASE sections. Added version number and document history.

Appendix B: License notice

The contents of this Documentation are subject to the Public Documentation License Version 1.0 (the “License”); you may only use this Documentation if you comply with the terms of this License. Copies of the License are available at http://www.firebirdsql.org/pdfmanual/pdl.pdf (PDF) and http://www.firebirdsql.org/manual/pdl.html (HTML).

The Original Documentation is titled *Firebird Quick Start Guide*.

The Initial Writer of the Original Documentation is: IBPhoenix Editors.

Copyright (C) 2002-2004. All Rights Reserved. Initial Writer contact: hborrie at ibphoenix dot com.

Contributor: Paul Vinkenoog - see document history.

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