FIREBIRD

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What is Firebird?

- Firebird is relational database management software, similar in purpose to products such as DB2 by IBM, Oracle, SQL Server by Microsoft and the open source PostGreSQL.

- The software has two main components:
    1. The database server, which lives on the same host machine as the databases, and the application interface, commonly referred to as "the client library".
    2. The client library is a runtime component—a DLL on Windows or a shared object (.so) on other platforms—that two-tier deployments need on each client workstation.

For multi-tier deployments, where users access databases through middleware from a web browser or other "thin" interface, the Firebird client library is not deployed to end-users at all but is incorporated into the middleware.

Firebird's History?

- Firebird is derived from Borland InterBase 6.0 source code.

- It is open source and has no dual license. Whether you need it for commercial or open source applications, it is totally FREE!

- Firebird technology has been in use for 20 years, which makes it a very mature and stable product.

Firebird's Complete History?

- Firebird (FirebirdSQL) is Open Source
- Developt base Interbase v6.0 in 2000 by Borland
- In earlier development, it started with the trans-Porting the code from C to C++
- Firebird 1.5 was the first release
- 2003 there was a conflict w/ Mozilla Firebird
- 2004 Mozilla changed their browser name
- Firebird was directed and maintain by FirebirdSQL Foundation and it is derived from Interbase

Main Features

The open source Firebird® RDBMS performs excellently and scales impressively, from an embedded, single-user model to enterprise-wide deployments with multiple 500+Gb databases running with hundreds of simultaneous clients.

❑ **Support of all major platforms and operation systems**

Firebird supports a number of hardware and software platforms: Windows, Linux, MacOS, HP-UX, AIX, Solaris and more. It runs on at x386, x64 and PowerPC, Sparc and other hardware platforms, and supports an easy migration mechanism between these platforms. Firebird is included into the following Linux repositories: Fedora, OpenSuse, CentOS, Mandriva, Ubuntu.

Main Features

❑ **Multi-generation architecture**

One of the key Firebird features is its multi-generational architecture, which enables the development and support of hybrid OLTP and OLAP applications. This makes a Firebird database capable of serving simultaneously as both an analytical and an operational data store, because readers do not block writers when accessing the same data under most conditions.
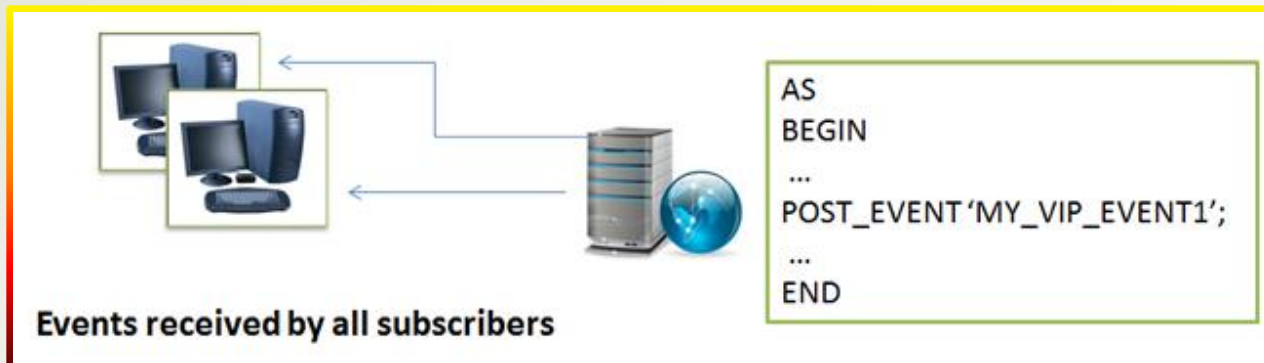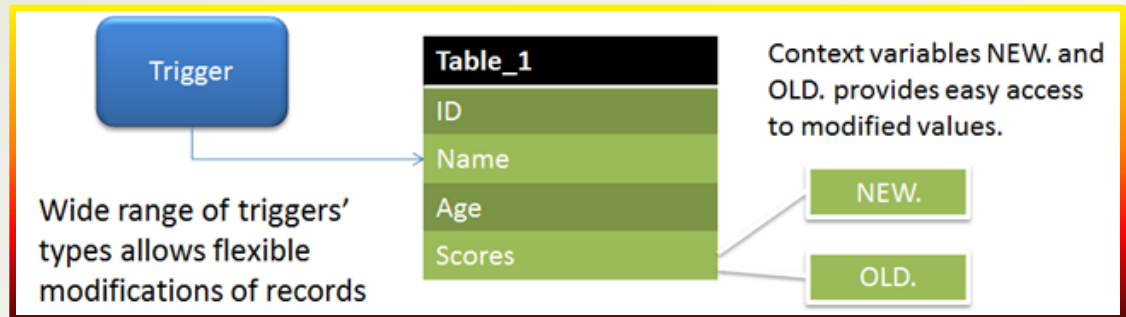
Main Features

❑ **Powerful and developer-friendly SQL language**

Firebird supports stored procedures and triggers, and has comprehensive SQL92 support.

➢ High compatibility with ANSI SQL
➢ Common Table Expressions (CTE)
➢ Flexible transactions management
➢ Full-blown stored procedures (selectable SP enables joins w/tables)
➢ Cross-database queries
➢ Active tables concept and events
➢ User Defined Functions

Trigger

Table_1
ID
Name
Age
Scores

Context variables NEW. and OLD. provides easy access to modified values.

NEW.

OLD.

Wide range of triggers' types allows flexible modifications of records


```
AS
BEGIN
...
POST_EVENT 'MY_VIP_EVENT1';
...
END
```

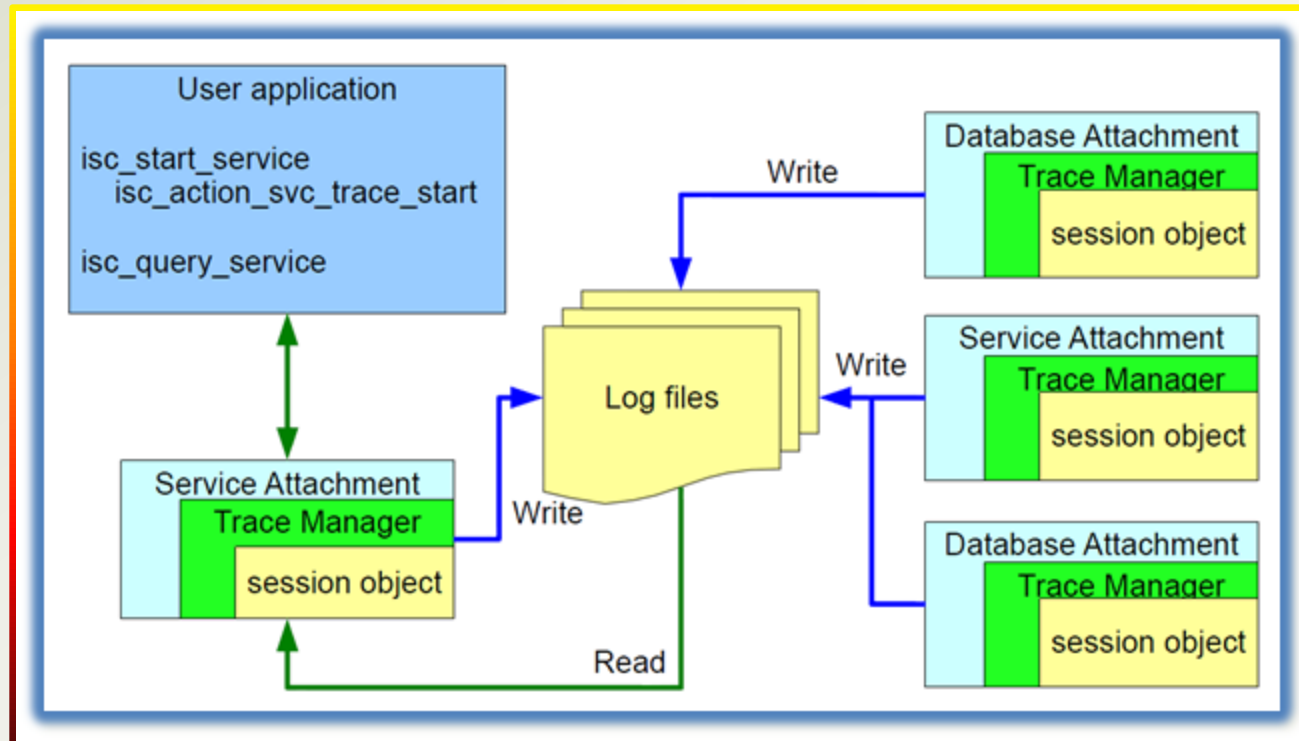**Events received by all subscribers**
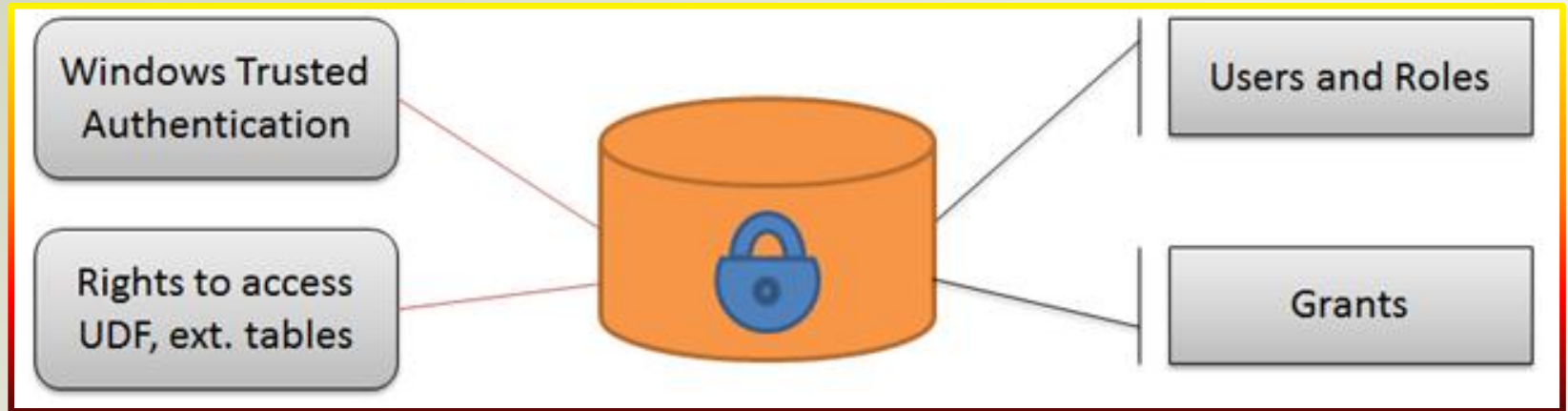
Main Features

❑ **Logging and monitoring**

Firebird offers Trace API and rich set of monitoring tables (MON$)

➢ Real-time monitoring
➢ SQL debugging
➢ Audit
- Events
- Partial or full logging
- Through remote connection

Main Features

❑ **Security**

Standard security
- Users and roles
- GRANT/REVOKE on main operations
- Database owner concept

Windows Trusted Authentication
- Single-sign on for end-users
- Integration with Windows domain/Active Directory security

Network
- The only network port should be open (3050 by default, configurable)
- Aliases (path to the database is not exposed)

Main Features

❑ **Developer Tools**

Firebird is supported by numerous database connectivity options:
- Firebird.NET
- JayBird (Java)
- Delphi/C++ Builder drivers (Embarcadero Delphi/C++ Builder IDEs include dbExpress drivers to work with Firebird.)
- FreePascal & Lazarus
- PHP for Firebird
- FireRuby
- and more!

Main Features

❑ **More Features**

True Open Source
Firebird is free for commercial and educational usage: no license fees, installation or activation restrictions. No double licensing - Firebird license is based on Mozilla Public License.

Deployment
- Embedded version (in dll) with multi-user support
- Native Windows installer available, localized in most popular languages
- Run as service or as application
- RPM or tar.gz distributions available
- Ability to create custom "100% silent" installers
- Read-only deployments (database and server can be on CD, DVD, Blu-Ray, etc)
- Small footprint (minimal installation is 4Mb, standard is 33Mb)

Performance
- Choice of architectures to fit all needs – Embedded, SuperServer, SuperClassic and Classic
- Multi-CPU and multi-core SMP scalability for SuperClassic and Classic architecures
- Database up to 20 Terabytes supported
- Thread-Safe Client Library

Backup and restore
- Online backup – ability to create backup copy without stopping database
- Online dump – ability to quickly create copy even for very big database
- Incremental backup – partially supported Point-In-Time Recovery

Full Text Search
Integration with Sphinx, Full Text Search Engine

Abilities

- Full support for stored procedures, view and triggers
- Full ACID compliant transactions
- Referential integrity
- Multi Generational Architecture (sometimes called MVCC)
- Support for External Functions (UDFs)
- SQL activity can send asynchronous notification events to clients
- Third party tools, including GUI administrative tools and replication tools
- Careful writes - fast recovery, no need for transaction logs
- Many access methods: native/API, dbExpress drivers, ODBC, OLEDB, .Net provider, JDBC native type 4 driver, Python module, PHP, Perl
- Incremental backups
- Full cursor implementation in PSQL

Variant

- Firebird SuperServer has a single daemon/server for all client connections, multithreaded with shared cache

- Firebird SuperClassic also has a single daemon/server for all client connections, multithreaded with separate caches

- Firebird Classic uses inetd to run one copy of the server per client connection, recommended for SMP systems but might have event-notification issues if access is via a firewall

- Firebird Embedded for creating CD-ROM catalogs, single user or evaluation versions of applications; omits some advanced features such as event notification
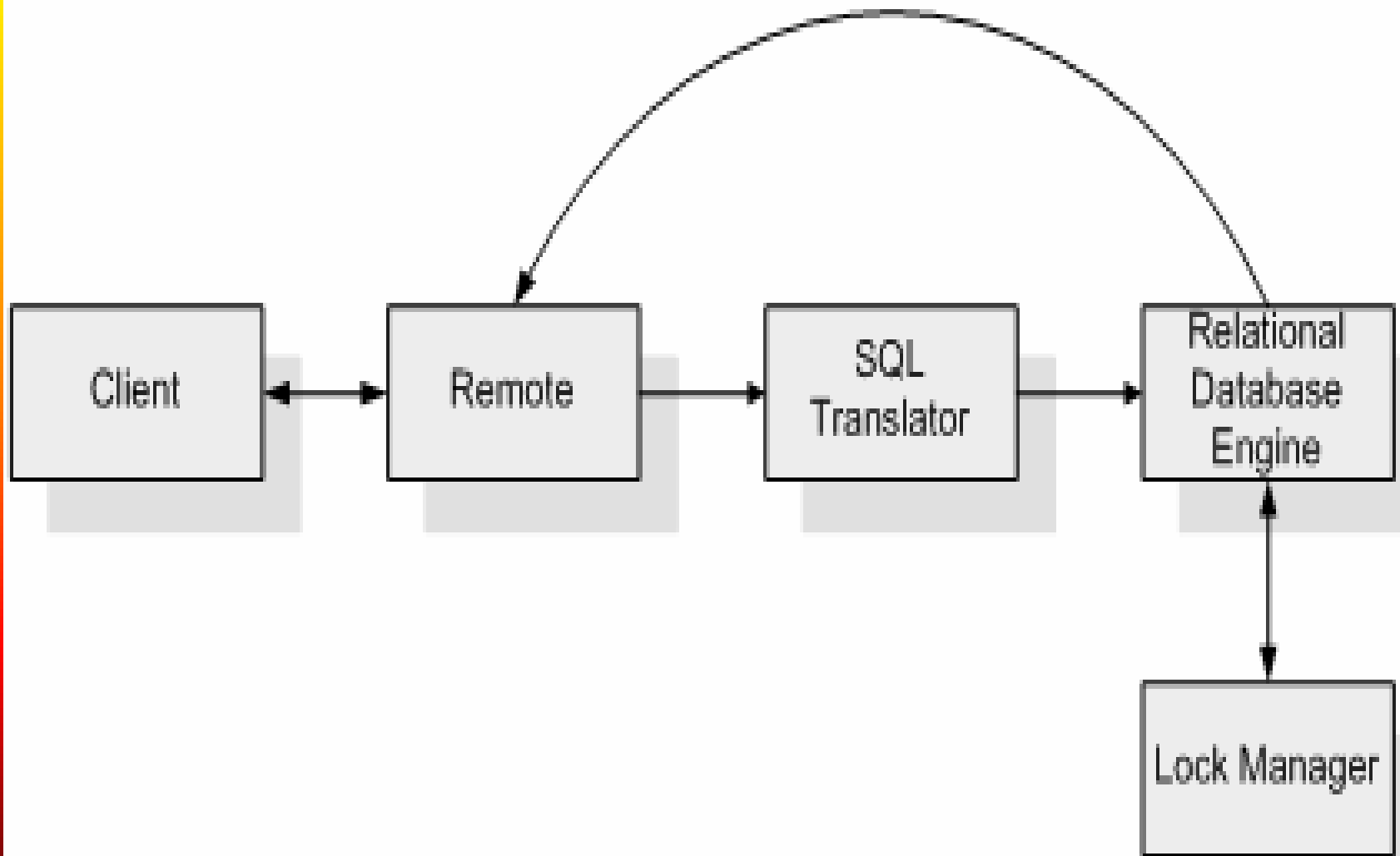
Network Protocol Support

As a Client-Server Database, Firebird supports the general uses of Network Protocol, like NetBEUI, IPX/SPX, or TCP/IP.

So, which protocol use? This is depend on how we specified the connection string to accessed the database.

- NetBEUI: \\hostname\path\to\database.fdb
- IPX/SPX: hostname@path\to\database.fdb
- TCP/IP: hostname:path\to\database.fdb

Firebird Architecture

Firebird Architecture

Chan and Yaskhir (2002): Firebird consist of 4 subsystem components and the configuration drawn like a pipe. The subsystem components are:

- Remote Connection System is the subsystem that connect the Client to the Server.

- SQL Translator is the Subsystem that changed SQL (*structured query language*) became BLR (*binary language representation*)

- Relational Database Engine is the Subsystem which taken every actual data.

- Lock Manager is Subsystem that functionality became a tool for concruency tool control

Remote Connection System
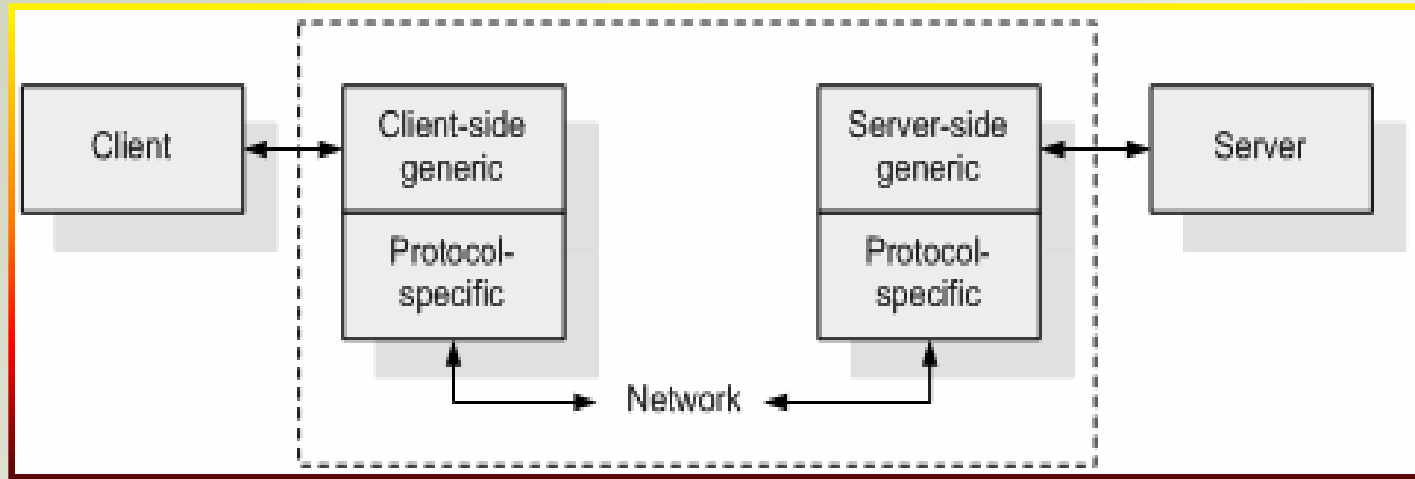
Clients communicate with the server over a network or local. Communication from client to server through a variety of network protocols. TCP / IP, MS LanManager, and the SPX network protocols to connect clients with servers.

This subsystem consists of two parts: the client side and server side. The client side and server side is composed of some generic code and code-specific protocol to communicate
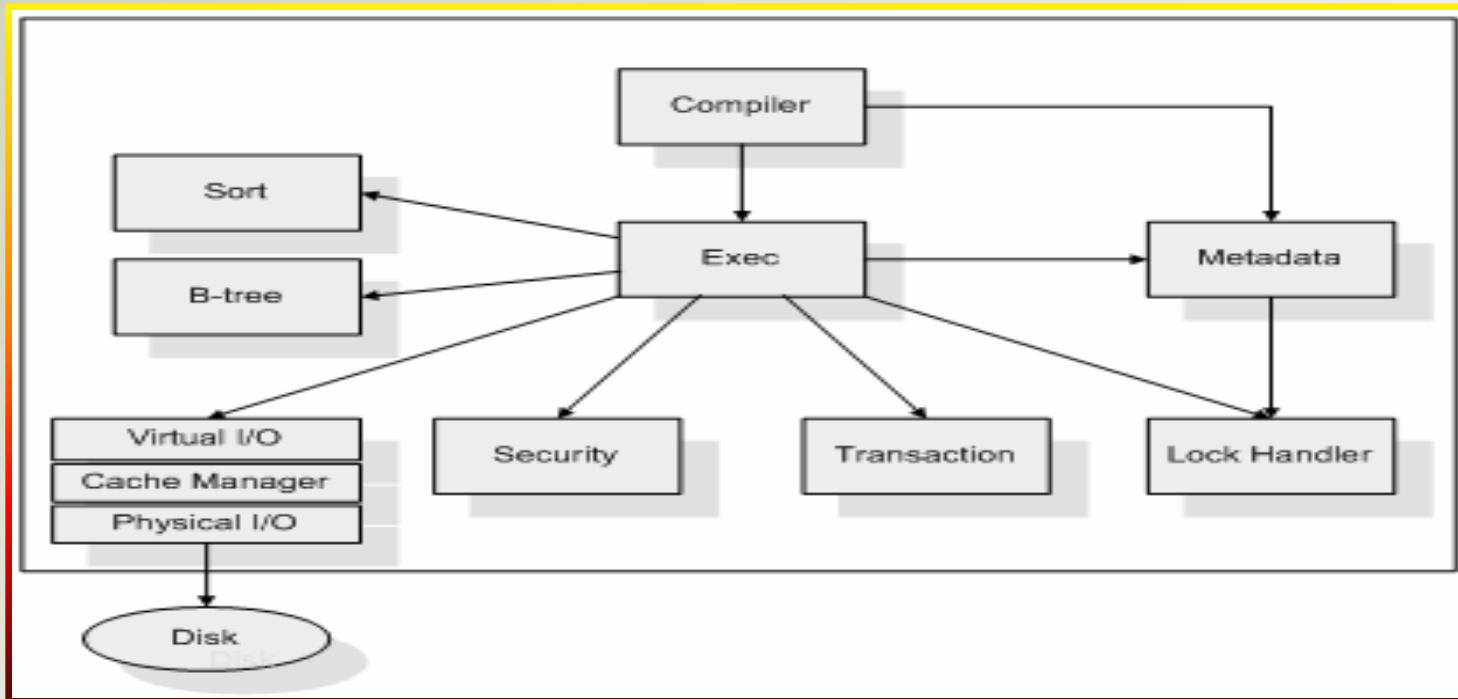
SQL Translator
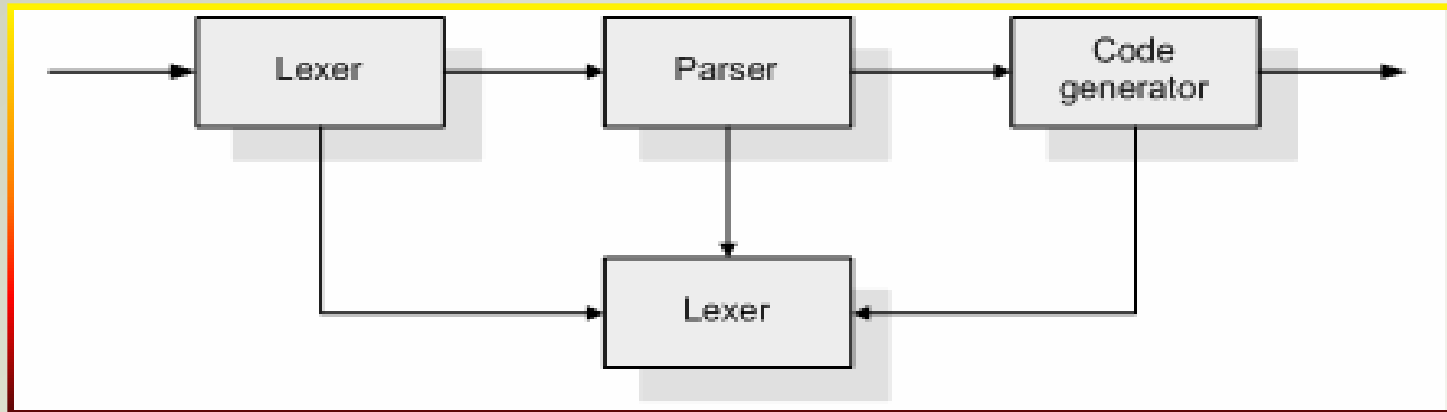
DSQL subsystem translates requests from SQL to the BLR.

BLR is the native language of the database. DSQL architecture similar to a simple compiler that consists of a lexer, parser, symbol table, and generating code

Relational DB Engine

JRD (Jim's Relational Database) is a subsystem that performs the actual data collection. JRD subsystem executes the request and returns the result of the execution.

JRD handles access to the storage space via a virtual IO subsystem. JRD verify safety and ensure that transaction data is handled automatically.

JRD has several subsystems that support each function to handle and process requests

Lock Manager
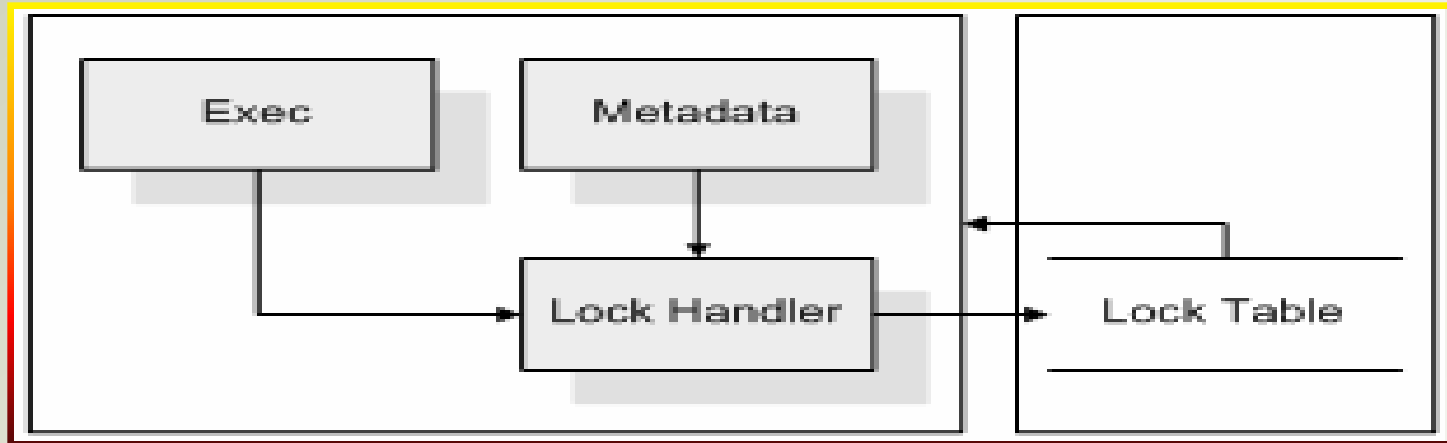
LOCK subsystem handles the synchronization process the transaction.

The main function of the subsystem LOCK is a concurrency control when there are many users accessing the same database file simultaneously.

Concurrency situation is common in the normal operation of any DBMS.

LOCK consists of two main components which are submodules lock and lock handler on the table outside JRD.

Installation

Firebird-2.5.1.26351_1_Win32
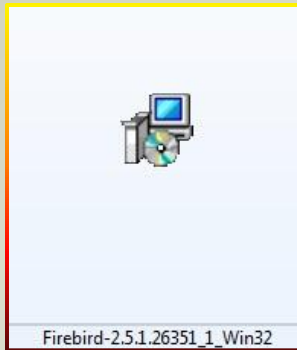
□ To begin, Double click on Firebird.exe Setup application

□ Choose the Installation Language
□ Click OK

□ The Welcome Setup Wizard Display
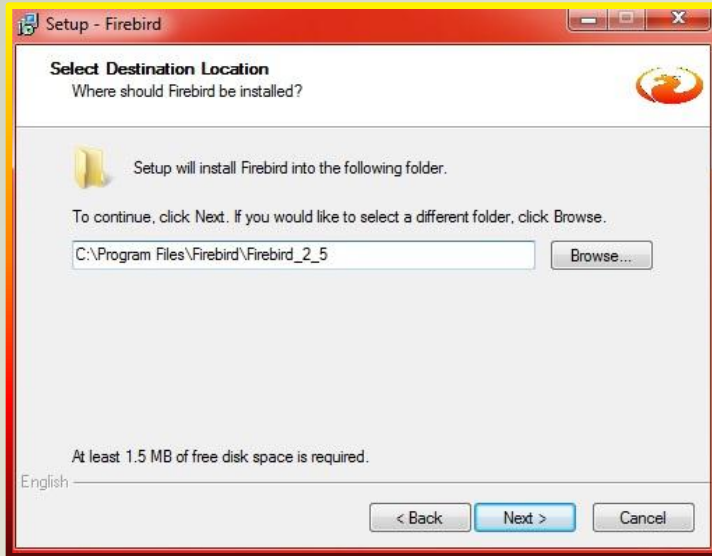□ Click Next

Installation (2)
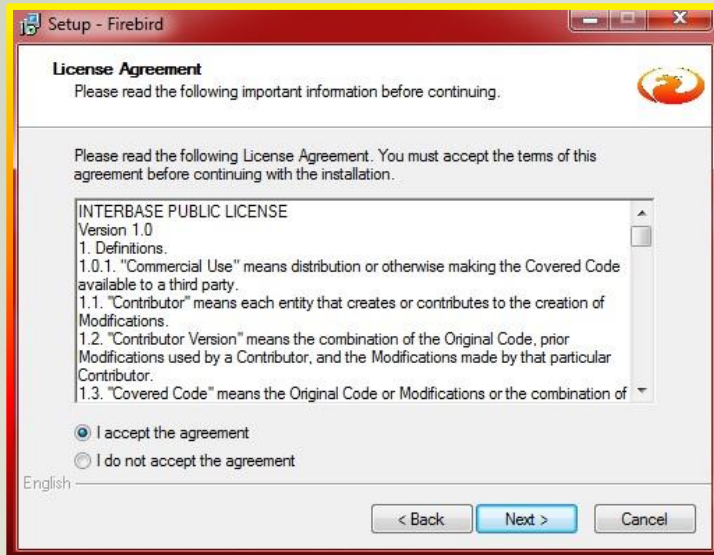
- Read the License Agreement
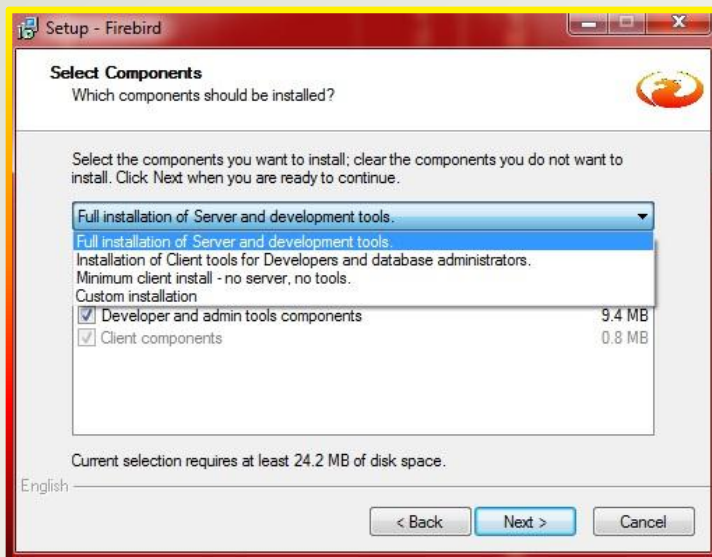- Click "I Accept The Agreement", if you agree with the agreement.
- Click Next
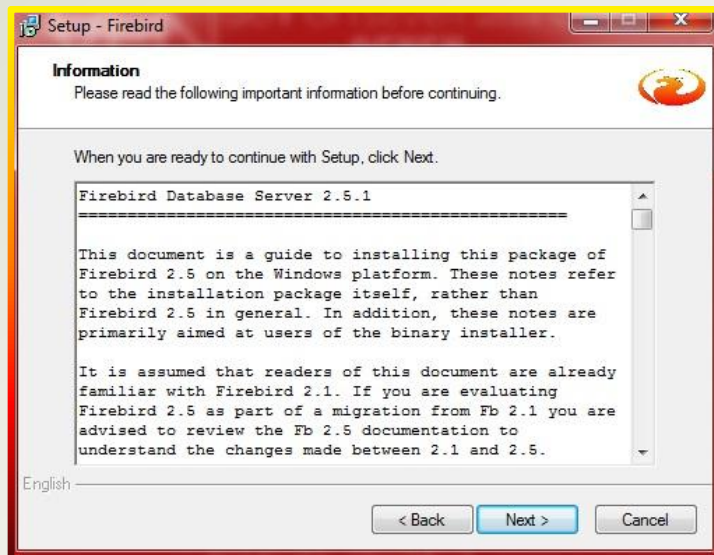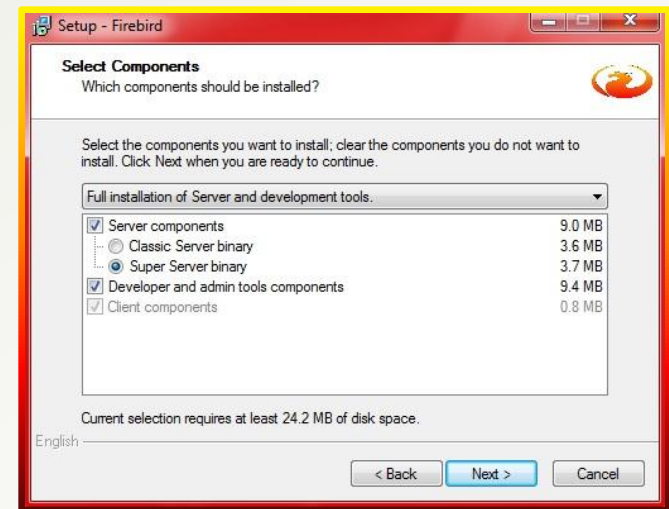

- Information about the installation
- Click Next

Installation (3)

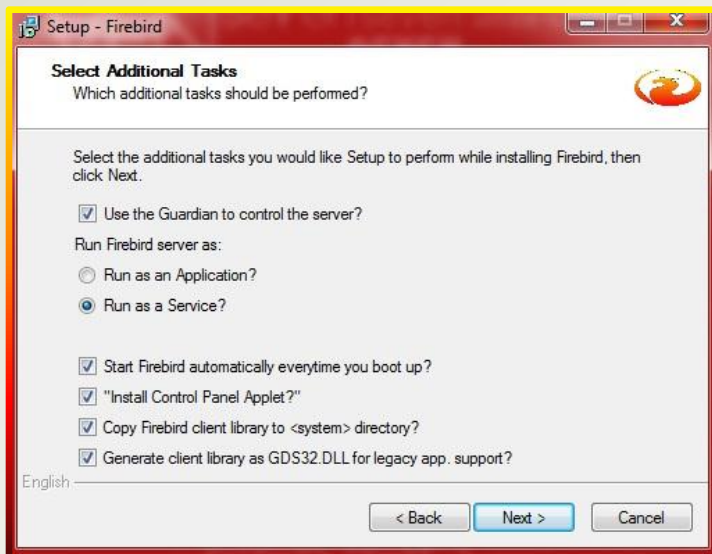□ Select the destination location to the install the program

□ Click Next

□ Select the type of Installation, there is 4 type of installation
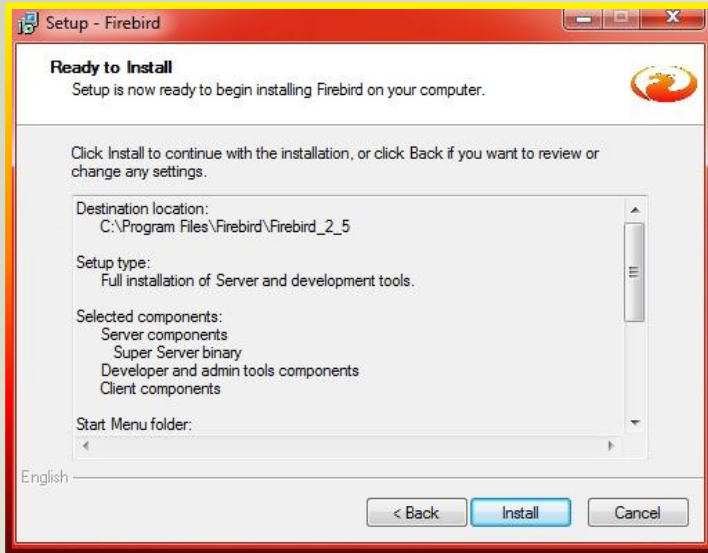
□ Click Next

Installation (4)

- Select the start Menu Folder (optional)
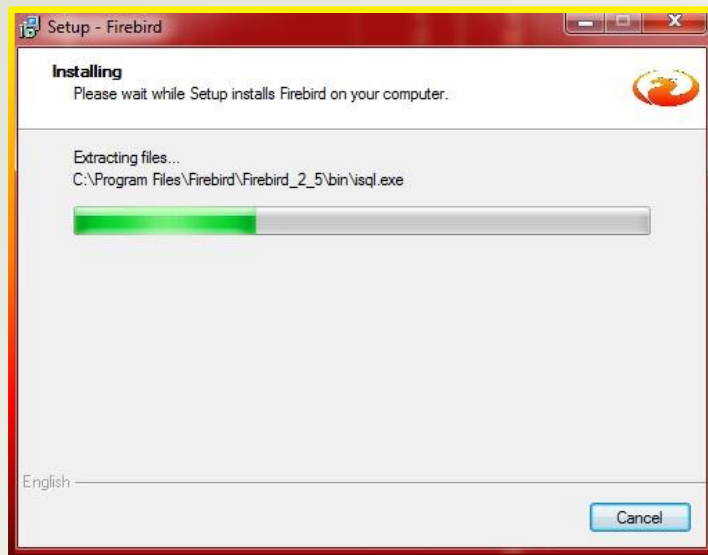- Click Next

- Select additional Tasks that you need
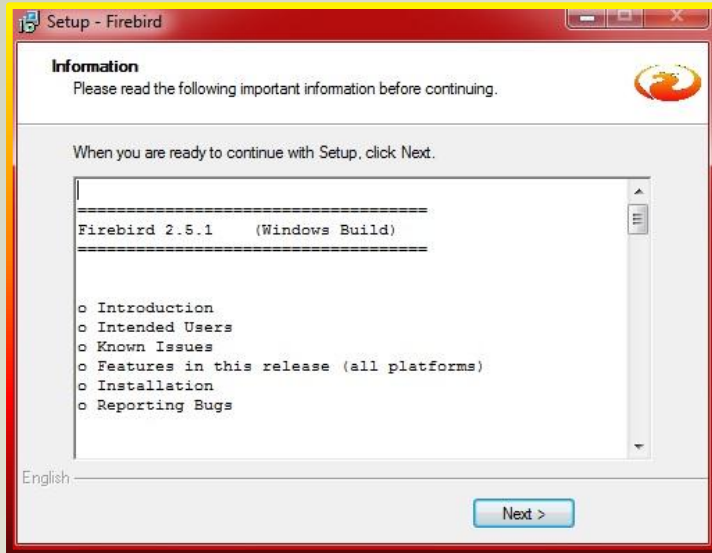- Click Next

Installation (5)

- The permission display for you about Ready to Install
- Click Install

- The installation Progress
- Wait until the progress bar done

Installation (6)

- The installation information Setup
- Click Next

- Installation Complete Wizard Display
- Click Finish

Connectivity (APIs)

- Firebird native API is used directly / indirectly by applications or middleware that connect to a Firebird DB. It is implemented in the client library, fbclient.dll, on Windows systems, & in libfbclient.so on Unix.

- The Services API is a special function set for accessing and controlling service administration tasks such as user management, backup/restore and statistics gathering.

- Standard cross-database APIs:

  a) JCA/JDBC:
     - Jaybird, an Open Source (LGPL) Type 4 JCA/JDBC driver.

  b) .NET/Mono:
     - Firebird NETProvider

  c) ODBC:
     - ODBCFBLib, open source ODBC driver for Windows and Linux.
     - Easysoft ODBC driver (commercial). For Linux, Windows, Mac OS X and Solaris

  d) OLE DB
     - IBProvider, with commercial and Open Source versions.

JDBC

- A JDBC driver is a software component enabling a Java application to interact with a database. JDBC drivers are analogous to ODBC drivers, ADO.NET data providers, and OLE DB providers.

- To connect with individual databases, JDBC (the Java Database Connectivity API) requires drivers for each database. The JDBC driver gives out the connection to the database and implements the protocol for transferring the query and result between client and database
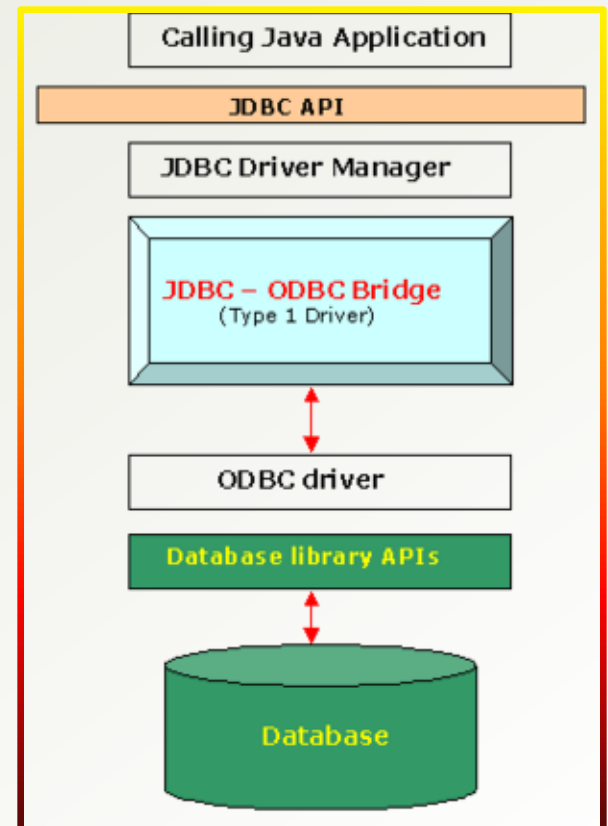
JDBC: JayBird Architecture

- Jaybird is a JCA/JDBC driver suite to connect to Firebird database server
- This driver is based on both the new JCA standard for application server connections to enterprise information systems and the well known JDBC standard.

The JCA standard specifies an architecture in which an application server can cooperate with a driver so that the application server manages transactions, security, and resource pooling, and the driver supplies only the connection functionality.
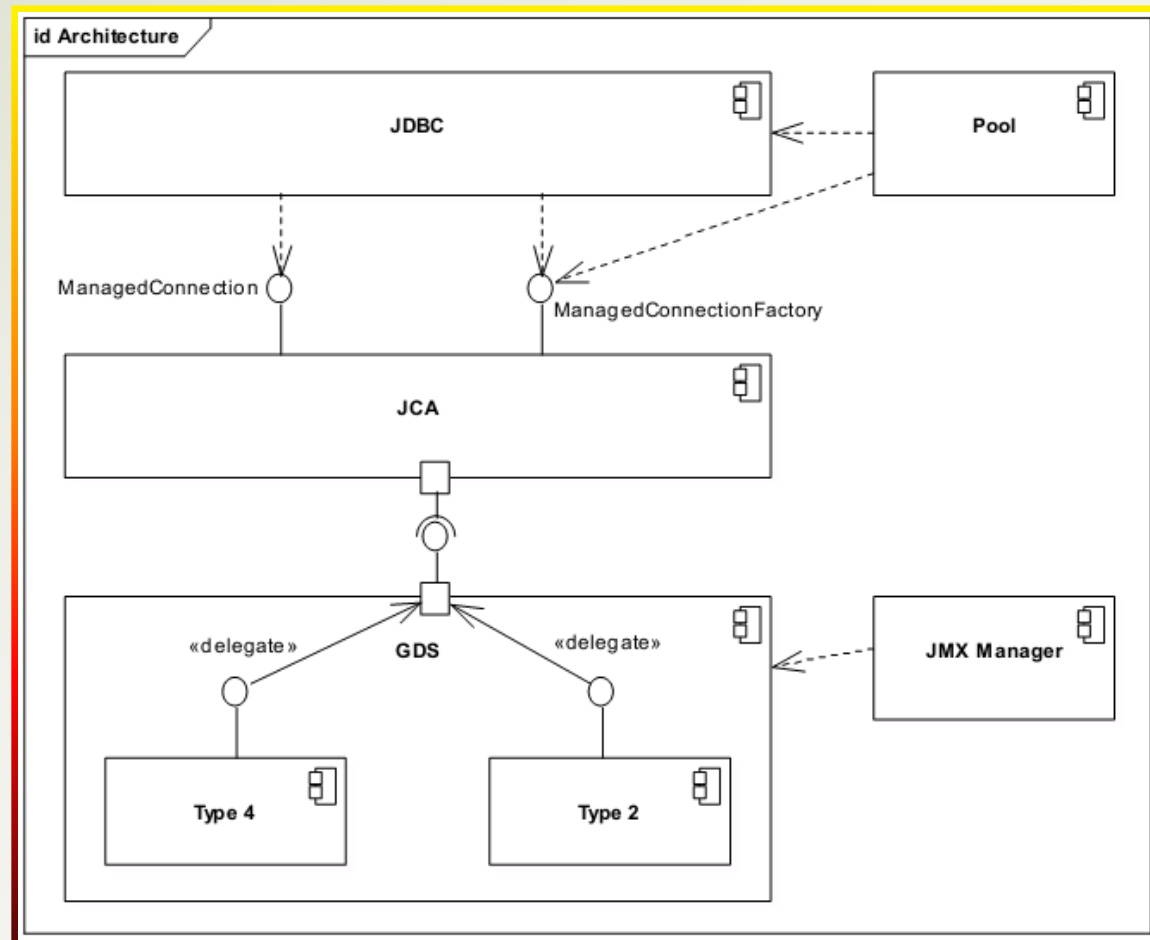
Advantages

- Easy to Install
- Complete Standard Features (Stored Procedure, View, Trigger)
- Database just 1 file or multispan file
- There is a Embeded Server feature
- Multiplatforms (windows, linux, unix)
- Minimum Footprint
- UDF supports
- Have a big community
- driver support easy to get and free

Disadvantages

- Unsupported for derived table (FB 2.0 already supported)
- Query Plan yang kurang optimize (FB2.0 sudah diperbaiki). Disini saya telah melakukan pengujian kecil, yaitu dengan menjalankan suatu query yang melibatkan penggunaan correlated query dan fungsi coalesce, di FB1.5 membutuhkan waktu yang jauh lebih lama dari pada di FB2.0
- Tidak dapat mempergunakan alias kolom dalam *where clause* sehingga cukup menyulitkan jika kita pergunakan corelated query. (FB 2.0 sudah diperbaiki).
- Built in function minimum

Thank You

- Your development and reporting tools
- You choose operation system and architecture
- You choose hardware
- No vendor lock-in

You decide.

Firebird works.