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# Using Delphi 2009 with Firebird

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# What is Firebird?

- Firebird is a full-featured SQL database engine.
- It is powerful, yet lightweight, with minimal configuration and administration needs.
- It's easily scalable from single-user, single-database usage up to company-wide enterprise purposes.
- A single Firebird server can handle multiple independent databases, each with multiple client connections.
- And best of all: it's true open source, thus free of any license fees even for commercial use.

# Benefits of using Firebird

- Why would you want to use Firebird? There are five key reasons:
  - capable
  - compact
  - easy
  - free
  - community

# Capable

- Unlike most other open source database systems, Firebird is full featured.
- It is fast.
- It is reliable.
- It scales.
- What more could you wish for?

# Compact

- A minimal install of Firebird only takes up about 3MB of disk space and can run in as little as 32MB of memory.
- This makes Firebird the smallest of the full featured database engines by far
- The "Express" editions of Oracle, DB2 and SQLServer typically take up more than 100MB and offer only restricted functionality.

# Easy

- Firebird is easy. It is easy to develop with, it is easy to deploy, it is easy to manage and administrate.
- A demo install at an OSDC conference took 53 seconds from hitting Enter to start the installer to opening a database using a command-line utility, stopping en route to change the SYSDBA password.

# Free

- Firebird is free.
- You can download it at no cost and use it.
- You can redistribute it with your application, without having to pay license fees or having to open source the entire application.
- You get the full source code, so you can change it should you want to.

# Community

- The strength of Open Source software lies in the community.
- Firebird has a large and vibrant community, ensuring that the code base will continue to be developed.
- The Firebird lists are renowned for their fast and helpful responses.
- Commercial support is available from multiple sources for those users that need it.

# Fact

- There is no other database system on earth that shares all the above five qualities with Firebird.

# Connectivity

- A database system is no use unless applications can connect with it.
- Firebird connects with clients through all popular technologies and through quite a few less well known technologies as well.

# Delphi 2009

- Tested with Delphi 2009
  - IBDAC
  - IBExpertDBX4Firebird
- untested or only for older versions
  - FIBPlus
  - IBObjects
  - Zeos

# C/C++

- The Firebird native client library offers C/C++ programmers full access to the database server and to the security features.
- It is a easy to deploy library: you can simply pack it with your applications and it will work (on Windows no changes to the Registry are needed).
- For C++ development, the IBPP wrapper offers an object-oriented interface to Firebird.

# ODBC

- Like it or not, ODBC is still a workhorse of database system connectivity.
- Many clients written in Visual Basic or MS Access use it to connect.
- The Firebird ODBC driver has full support for the ODBC 3.0 specification and is available for both Windows and Linux.
- The driver works flawlessly with all releases of Microsoft Office, including Access.

# Java

- Java clients use the JDBC standard to connect to database servers.
- The Firebird JDBC driver – more commonly known as 'JayBird' – has full support for the JDBC3 standard and plans support for the recently announced JDBC4 specification.
- Jaybird can operate both as a type 4 and as a type 2 driver and works with all popular makes of virtual machine (Sun, IBM, BEA, etc.).
- JayBird is fully compatible with all major J2EE frameworks, such as JBoss, WebLogic and WebSphere.

# dotNet

- Microsoft's dotNet uses the ADO.Net standard for connecting to database servers.
- Firebird was among the first non-Microsoft databases to support dotNet and as a result the driver is mature and full featured.
- The Firebird ADO.Net driver has support for both dotNet 1.1 and dotNet 2.0, and also supports the Linux equivalent of dotNet, Mono 1.1 and Mono 2.0.

# PHP

- With some 1 million developers using it and driving about 20 million websites, PHP has taken on a prominent role in connecting data to the web
- Firebird has native drivers for both PHP4 and PHP5.
- Firebird also supports the new DAO data access layer.

# Other

- Next to the above technologies, Firebird supports connectivity to a host of other languages and systems, such as Perl, Python and Ruby.
- The driver for Python is called Kinterbasdb.

# Downloading Firebird

- Starting with Firebird is easy, you just have to download it from <http://www.firebirdsql.org/>
- Don't forget to read the Firebird Quick Start Guide to help you through your first steps.

# Releases

- At the time of writing (May 2009), Firebird 2.1.2 is the current version
- Firebird 2.5 is in beta state.
- Firebird 2.X removed many limits
- Version 2.5 should be available this year
- The roadmap continues with Firebird 3

# SQL

- Firebird implements most of the core ANSI SQL-99 standard with several extensions from the SQL200x standard.
- On top of this, Firebird has several unique additional features which are not covered by the standard.

# BLOB's

- Firebird implements typed binary large objects ('blobs').
- Text blobs, a.k.a. "clobs", can be used directly as character data in many cases.
- The engine supports "blob filters" for converting between compatible typed blobs and includes several of its own.
- Blob filters can be user-defined so that, for example, the database programmer can make an XML-to-RTF filter available to applications.

# Internationalization

- Firebird is fully internationalized
- In fact, most of its user base is outside of the English speaking world, with Brazil, Europe, Russia and Japan being important markets / having important communities.

# Transaction processing

- ACID.
  - Firebird is fully ACID compliant.
  - All ANSI isolation levels except Dirty Read are supported.
  - Dirty Read isolation violates ACID principles and is not supported by Firebird.

# Embedded use

- Embedded server.
  - Because the Firebird server is only a few MB in size, offers a Services API and has low maintenance, it is an ideal system to include with an application.
  - Starting the server involves nothing more than spawning a Firebird server process from the main application.

# Administration

- Firebird has a "Services API", which makes it easy for the hosting application to access administration functionality, such as managing users, access rights and performing backup and restore.
- Firebird was designed to be self-managing and self-tuning.
- Other than backup and restore it does not need any DBA intervention to keep running smoothly.
- This quality has been a major driver behind the success of Firebird.

# Programmability

- Constraints.
  - Firebird has full support for constraints, including primary key, foreign key, check constraint, unique, default and not null.
  - Referential integrity is completely implemented, including SQL-standard CASCADE and SET NULL options.

# Triggers

- Firebird supports triggers on tables and views.
- Triggers can act on update, delete and insert with full access to both the "old" and "new" column values for all columns.
- Uniquely, Firebird allows multiple triggers for each combination of phase (BEFORE/AFTER) and event (INSERT/UPDATE/DELETE), for execution in a specified sequence.
- It also supports multi-event triggers, i.e. a single trigger module that can be executed conditionally BEFORE | AFTER INSERT OR UPDATE OR DELETE.

# Stored Procedures

- Firebird supports stored procedures.
- The procedure bodies can be written in Firebird's powerful native procedural SQL language, "PSQL".
- Debugging tools are available for example in IBExpert

# User-defined external functions

- Firebird supports UDF's.
- UDF's can be written in any language that can provide an entry point through the "cdecl" interface, although C/C++ and Delphi are the most common choice.
- The Firebird distributions come with two UDF libraries and many more are available through community channels, with or without open source code.

# Views

- Firebird supports views.
- Views are 'first class citizens', with their own user access control, the possibility for views on views, support for WITH CHECK OPTION, etc.

# Procedural views

- Firebird directly supports another form of virtual table, the selectable stored procedure.
- This is a procedure that returns a result set of individually calculated rows.

# Sub-queries

- Firebird supports sub-queries in many contexts: in the select list, in the from list ('derived tables'), as source for updates or inserts, in where clauses, as (potentially recursive) common table expressions, etc.
- Sub-queries can be nested to any depth within the maximum of 254 sub-queries per main query.

# Database availability

- Online reorganization
- Firebird was designed to be self-managing and self-tuning.
- Incremental reorganisations are part of query execution.
- Larger reorganisations are handled by a background thread and do not stall queries and/or transactions.

# Replication

- Firebird does not support replication in the core engine.
- However, it is supported through a range of third party products, including support for bi-directional replication
- IBExpert offers workshops to set up online/offline replication

# High-availability

- Firebird offers a range of high-availability techniques.
- It can be configured with a guardian process to restart the database server after failure.
- It can be configured as 'one process per client', to isolate failures.
- To deal with failing disk hardware, Firebird can maintain a hot backup, or 'shadow', on a second disk.

# Online backups

- Firebird can take a backup of a database without shutting down.
- Making backups does not halt or delay transactions and/or queries.
- Backups are database level. From version 2.0 onward, incremental hot backup is an option also.

# Disaster recovery

- Firebird has a 'careful write' design, which always leaves the database in a consistent, ACID state.
- As a result, recovery is very fast.
- This quality has led to several design wins for Firebird, including usage by research ships in Antarctic waters and by the US military in field tanks.
- Firebird's architecture does not require WAL or retrospective logging to recover from

# Security

- Authentication and authorization
  - Authentication is through user name and encrypted password.
- Roles are supported

# Encryption

- Firebird does not encrypt the database or network communication.
- For secure communication across a network a companion product, Zebedee, is frequently used.
- Backups are not encrypted
- Firebird Sourcecode can be changed to create individual binary formats unreadable with regular Firebird Server

# Auditing

- Firebird does not offer auditing built into the core engine.
- Auditing is offered through third party companion products, for example IBExpert or IBLogmanager.

# Administration

- Installation.
  - The install requires only a few mouse clicks and typically completes in a few minutes.
  - Even a first time user would complete the default install in under 5 minutes.

# Disk space

- A typical install requires some 25MB of disk space.
- A minimal install would require about 3MB of disk space.
- Firebird is by far the smallest of the full featured SQL database engines.

# Memory

- For a minimal configuration, some 16..32MB would suffice.
- As a rule of thumb, one should allow for 10MB of free memory per concurrent connection/user, using the installation defaults for configurable memory settings.

# On-going administration

- The install leaves the database system up and running.
- Other than backup/restore, DBA attention is not needed.
- All tasks, start/stop, backup/restore, etc. can be handled entirely programmatically.

# Native administration tools

- Firebird's native tools are powerful command line tools, that work identically across all supported platforms.
- Typically, these tools are also scriptable.
- GUI tools are offered by a variety of third party vendors and open source projects.

# Third-party GUI tools

- Many GUI tools are offered for Firebird -- too many to count accurately!
- Two toolsets that are widely used throughout the Firebird world are IBExpert and Database Workbench
- Both are available as free limited and fully functional commercial editions
- The open source FlameRobin toolset is a cross-platform GUI application

# Platforms

- Server platform
  - Firebird is available for Windows, Linux, Solaris (SPARC and Intel), FreeBSD, MacOSX and HPUX.
- Client platform
  - As above. Any supported client platform can access any supported server platform.
- 64-bit support
  - Firebird support 32 and 64-bit Linux and Windows

# Development support cost

- Firebird is free, including for commercial use.
- Firebird is often included with an application, and the vendor or reseller typically supports Firebird as part of the application support

# Community

- Governance.
  - Control is held by the Firebird Project community, specifically centred in the Firebird Admin team, which is convened by consensus as the group of core engine developers and others most closely involved in product architecture, development, production and support.

# History

- The Firebird project has been running for almost 9 years and it has not slowed down.
- Firebird began in 2000 from the InterBase 6 source code that was released as open source.
- The roots of InterBase go back to 1984, and even before that to DEC's "Rdb" product.

# Installed base

- Firebird is distributed through a variety of means, including downloads directly from the project's website and as both source code and binaries in some Linux distributions.
- Taking version upgrades into account, the project estimates the installed base of Firebird 2.X, at between two and three million development and production servers.
- For all versions, we estimate about 5 million copies.

# Vendor adoption

- Since no commercial licensing is involved, a precise number is hard to give, but we estimate the number of application builders that include Firebird as part of their commercial deployments to be in the thousands.
- Government agencies, both military and civil, that incorporate Firebird into their systems are becoming noticeable, too.

# Customer base

- Again, a precise number is hard to give, but a conservative estimate would be around the 100K mark.
- These appear to be typically departmental workgroup solutions running Windows workstations with Windows client applications or browser clients over a Firebird back-end on Linux or Windows.
- In Russia, Eastern Europe and Brazil, Firebird has seen significant uptake in the financial world (in some of those countries, Firebird has rapidly become the second most popular choice

# Now some Delphi Code

Demo

# Q&A

- Questions

# Thanks

- further questions: [hklemt@ibexpert.com](mailto:hklemt@ibexpert.com)