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Pascasarjana MSI **Indonesian Computer University 2012**

MSI-1 BU



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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.

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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



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

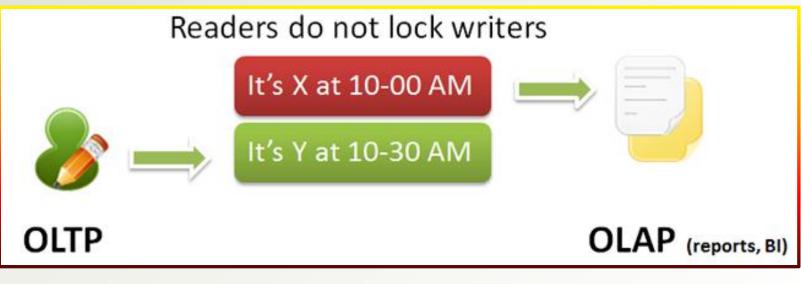


Firebird supports a number of hardware and software platforms: Windows, Linux, MacOS, HP-UX, AIX, Solaris and more. It runs on at x386, x64 and PowerPC, Sparc and other hardware platforms, and supports an easy migration mechanism between these platforms. Firebird is included into the following Linux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



Multi-generation architecture

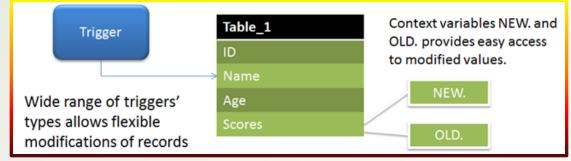
One of the key Firebird features is its multi-generational architecture, which enables the development and support of hybrid OLTP and OLAP applications. This makes a Firebird database capable of serving simultaneously as both an analytical and an operational data store, because readers do not block writers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



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



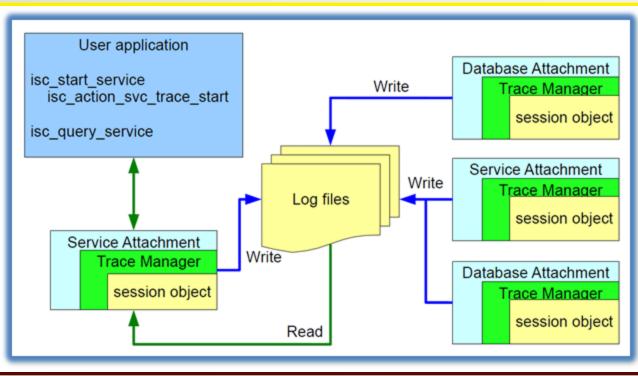
	AS BEGIN POST_EVENT 'MY_VIP_EVENT1'; END
Events received by all subscribers	END



Logging and monitoring

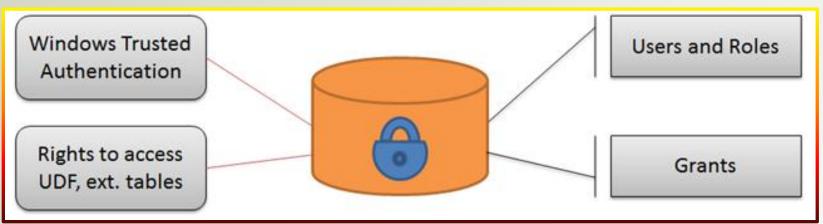
Firebird offers Trace API and rich set of monitoring tables (MON\$)

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





□ 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)



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!





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 <u>stored procedures</u>, view and <u>triggers</u>
- Full <u>ACID</u> 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 <u>inetd</u> 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



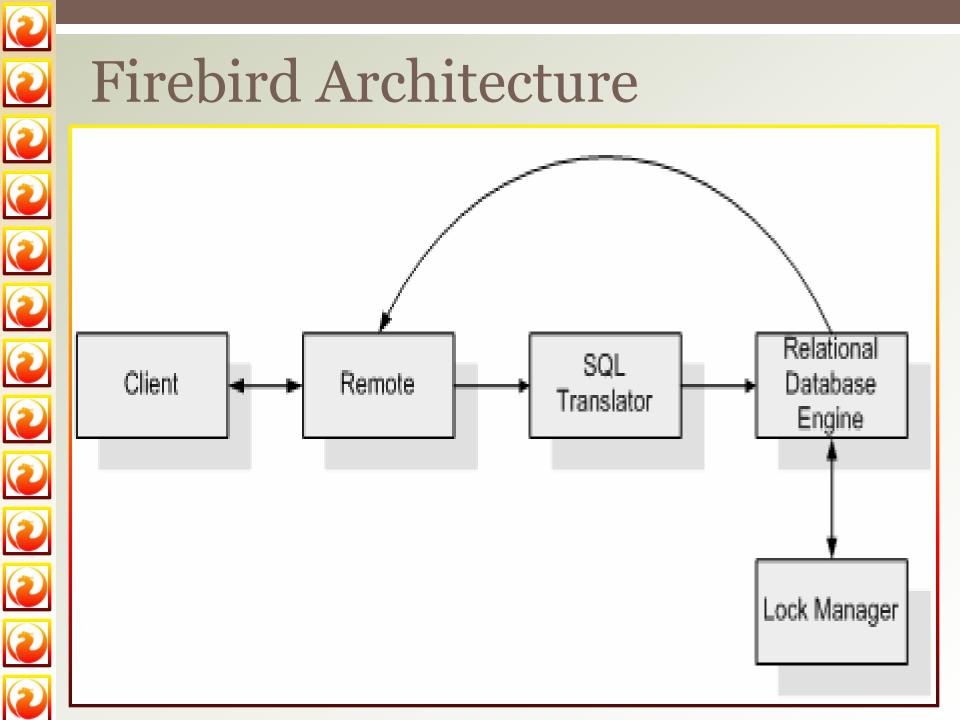
Network Protocol Support

As the Ne

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: <u>\\hostname\path\to\database.fdb</u>
- IPX/SPX: <u>hostname@path\to\database.fdb</u>
- TCP/IP: hostname:path\to\database.fdb

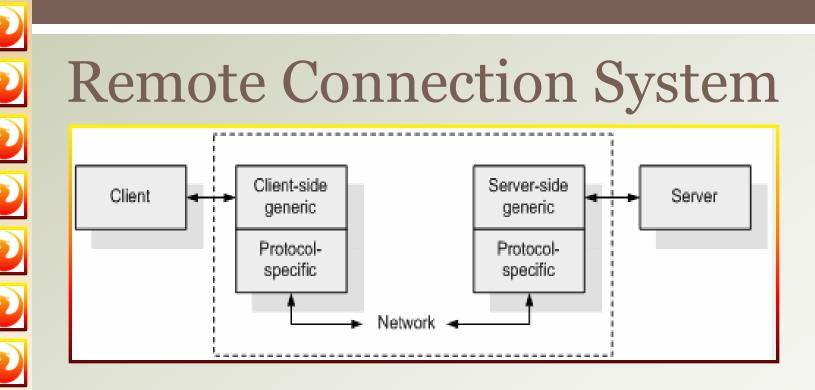




Firebird Architecture

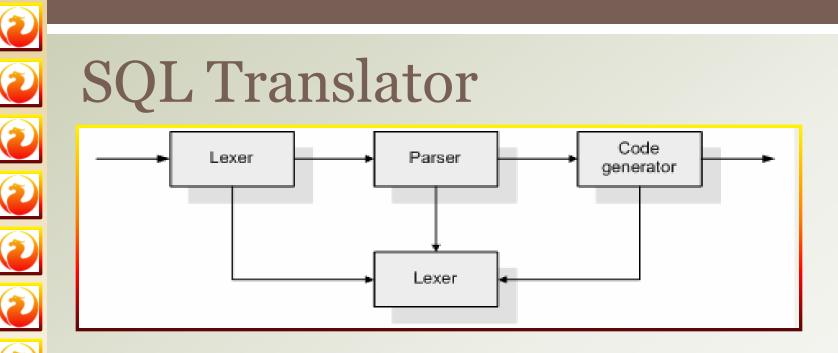
Chan and Yaskhir (2002): Firebird consist of 4 subsystem components and the configuration drawn like a pipe. The subsystem components are:

- 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



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

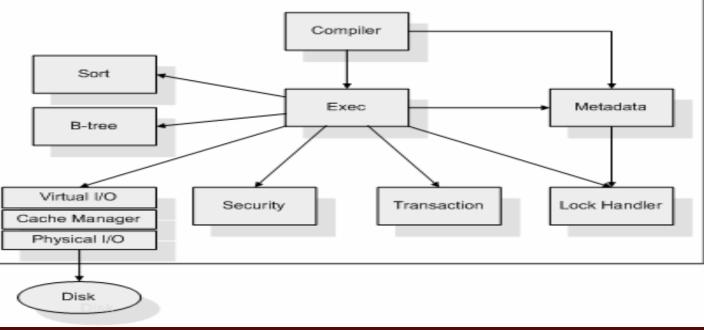


DSQL subsystem translates requests from SQL to the BLR.



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

A Relational DB Engine A Sort B Sort B - tree

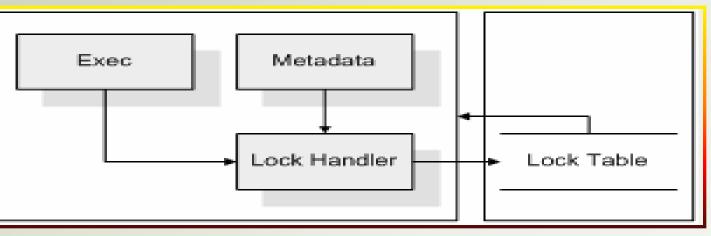


JRD (Jim's Relational Database) is a subsystem that performs the actual data collection. JRD subsystem executes the request and returns the result of the execution.

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



To begin, Double click on Firebird.exe Setup application

Choose the Installation LanguageClick OK

The Welcome Setup Wizard DisplayClick Next

Installation (2)

Please read the following important information before continuing.	~
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.	
INTERBASE PUBLIC LICENSE Version 1.0 1. Definitions. 10.1. "Commercial Use" means distribution or otherwise making the Covered Code available to a third party. 1.1. "Contributor" means each entity that creates or contributes to the creation of Modifications. 1.2. "Contributor Version" means the combination of the Original Code, prior Modifications used by a Contributor, and the Modifications made by that particular Contributor.	
1.3. "Covered Code" means the Original Code or Modifications or the combination of	л
I accept the agreement	
I do not accept the agreement ralish	
< Back Next >	
Setup - Firebird Information Please read the following important information before continuing.	•
Setup - Firebird	•
Setup - Firebird	•
Setup - Firebird Information Please read the following important information before continuing. When you are ready to continue with Setup, click Next.	

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)

ect Destination Location	
Where should Firebird be installed?	G
Setup will install Firebird into the f	following folder
	laioning roldor.
To continue, click Next. If you would like t	to select a different folder, click Browse.
C:\Program Files\Firebird\Firebird_2_5	Browse
At least 1.5 MB of free disk space is requir	red.
	< Back Next > Cance
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tup - Firebird elect Components Which components should be installed?	; clear the components you do not want to
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Select the destination location to the install the program

Click Next

Select the type of Installation, there is 4 type of installation

Click Next	Select Components Which components should be installed?	G
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	Full installation of Server and development tools.	•
	Server components	9.0 MB
	🔘 Classic Server binary	3.6 MB
	Super Server binary	3.7 MB
	Developer and admin tools components Client components	9.4 MB 0.8 MB
		0.0 MB
	Current selection requires at least 24.2 MB of disk space. English —]
	< Back	lext > Cance

Installation (4)

S	elect Start Menu Folder Where should Setup place the program's shortcuts?
	Setup will create the program's shortcuts in the following Start Menu folder. To continue, click Next. If you would like to select a different folder, click Browse.
	Firebird 2.5 (Win32) Browse
Englis	Don't create a Start Menu folder
چا چ	tup - Firebird
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	tup - Firebird elect Additional Tasks Which additional tasks should be performed? Select the additional tasks you would like Setup to perform while installing Firebird, then click Next. Very Use the Guardian to control the server?
	tup - Firebird elect Additional Tasks Which additional tasks should be performed? Select the additional tasks you would like Setup to perform while installing Firebird, then click Next. V Use the Guardian to control the server? Run Firebird server as:
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Select the start Menu Folder (optional)

Click Next

Select additional Tasks that you need Click Next

Installation (5)

	Click Install to continue with the installation, or click Back if you want to	review or
	change any settings.	
	Destination location: C:\Program Files\Firebird\Firebird_2_5	^
	Setup type: Full installation of Server and development tools.	E
	Selected components: Server components	
	Super Server binary Developer and admin tools components Client components	
	Start Menu folder:	-
English		r
	Sack Install	Cancel
	C Back Install	Cancel
	Sack Install	
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	< Back Install tup - Firebird stalling Please wait while Setup installs Firebird on your computer.	
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The permission display for you about Ready to Install

Click Install

The installation Progress Wait until the progress bar done

Installation (6)

Information	12
Please read the follo	owing important information before continuing.
When you are ready	y to continue with Setup, click Next.
Firebird 2.5.	1 (Windows Build)
o Introductio	
o Intended Us	ers
o Known Issue o Features in	s h this release (all platforms)
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Setup - Firebird	Completing the Firebird Setup Wizard Setup has finished installing Firebird on your computer. The application may be launched by selecting the installed icons. Click Finish to exit Setup.

The installation information Setup

Click Next

Installation Complete Wizard Display Click Finish

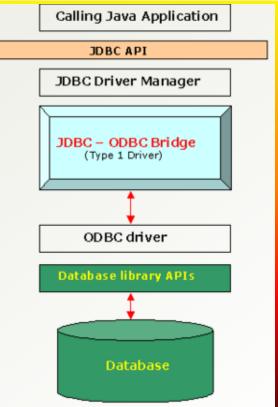
Connectivity (APIs)

- 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) <u>JCA/JDBC</u>:
 - <u>Jaybird</u>, an Open Source (LGPL) Type 4 JCA/JDBC driver.
 - b) <u>.NET/Mono</u>:
 - Firebird NETProvider
 - c) <u>ODBC</u>:
 - <u>ODBCFBLib</u>, open source ODBC driver for Windows and Linux.
 - <u>Easysoft ODBC driver</u> (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
 Calling Java Application

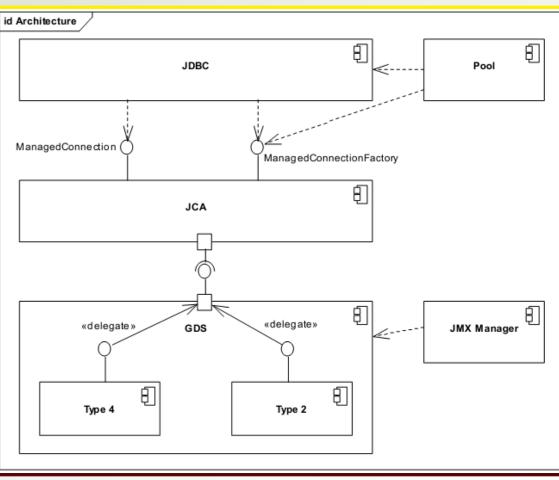




JDBC: JayBird Architecture

- **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 Embedded Server feature
- Multiplatforms (windows, linux, unix)
- Minimum Footprint
- UDF supports
- Have a big community
- driver support easy to get and free

0 0 3 1

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.

