What's New in Firebird 2.1
Session: C20

Thomas Steinmaurer DI
Industrial Researcher
Software Competence Center Hagenberg (SCCH)
http://www.scch.at

LogManager Series
Upscene Productions
http://www.upscene.com

Overview

- § Multi-language Session
- § Development Branches
- § On-Disc-Structure (ODS) 11.1
- § SQL / PSQL Language Enhancements
- § Performance
- § Administration
- § Security
- § International Language Support

Multi-language Session

- This is a multi-language session
  - English with an Austrian dialect
  - German with an Austrian dialect (on request)

- The primarily used language is English, but
  - Feel free to request a translation of parts of the session in German
  - Feel free to ask questions in German and **get answers** in German
  - Feel free to talk to me in English **AND** German during the conference

- How will this work out?
  - I don‘t know. We will see. :-)

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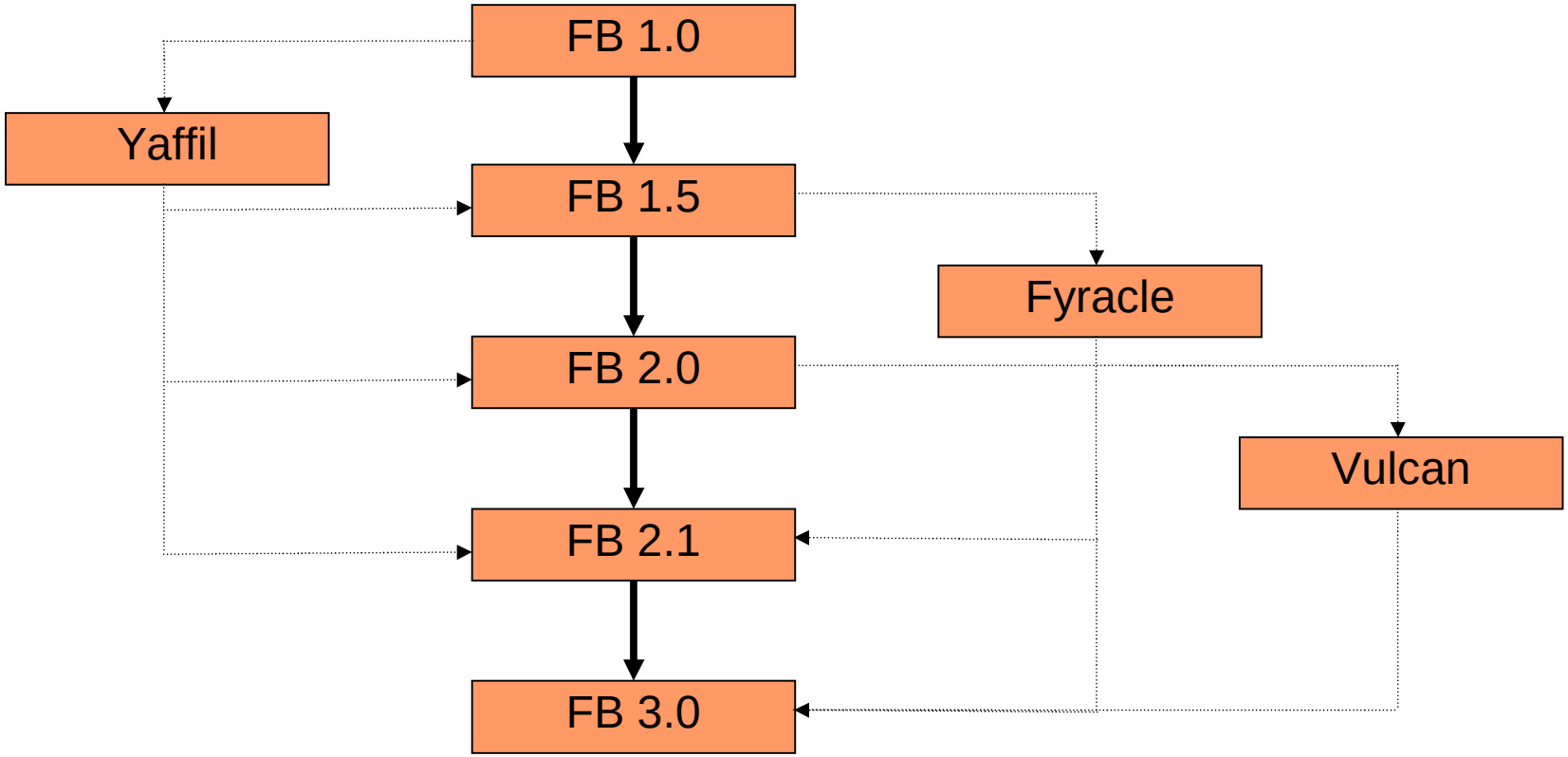
Development Branches



Source: „Firebird 2.x and 3.0: the Foreseeable Future“ presentation by Paul Beach at the RMLL conference 2007, France

Development Branches

§ Branch / Initial Release / Current Release / State

Branch	Initial Release	Current Release	State
FB 1.0.x	1.0.0 / 12.03.2002	1.0.3 / 04.06.2003	Closed
FB 1.5.x	1.5.0 / 23.02.2004	1.5.4 / 08.02.2007	Bugfixing
FB 2.0.x	2.0.0 / 12.11.2006	2.0.3 / 27.09.2007	Bugfixing
FB 2.1.x	Alpha 1 / 28.03.2007	Beta 2 / 18.10.2007	Beta / QA
FB 3.0.x	-	-	Development

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On-Disc-Structure (ODS) 11.1

- Firebird 2.1 uses an ODS with version 11.1
- Firebird 2.1 can work with databases with an ODS of 11.0 (FB 2.0) or 10.x (FB 1.5) as well, but
- ODS 11.1 is mandatory for particular Firebird 2.1 features, like:
  - Monitoring tables, database triggers, global temporary tables
- How do I check the ODS version of my database?
  - Run *gstat –h <your_database>*
- How do I get an ODS 11.1 database?
  - Create a new database under the Firebird 2.1 server, or
  - Backup your existing database with FB 1.5 / FB 2.0 and restore the backup file with the Firebird 2.1 server

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SQL / PSQL Language Enhancements

- Firebird 2.0 introduced a lot of new SQL / PSQL language enhancements
- Firebird 2.1 adds a bunch of more, which makes your database development even easier, e.g.:
  - New built-in functions
  - Database Triggers
  - Global Temporary Tables
  - Common Table Expressions
  - UPDATE OR INSERT statement
  - LIST() function
  - Domains in PSQL (yeah, yeah, yeah!)
  - And more ...

SQL Language Enhancements

- New built-in functions
  - ABS, ACOS, ASCII_CHAR, ASCII_VAL, ASIN, ATAN, ATAN2, BIN_AND, BIN_OR, BIN_SHL, BIN_SHR, BIN_XOR, CEIL\CEILING, COS, COSH, COT, DATEADD, DATEDIFF, DECODE, EXP, FLOOR, GEN_UUID, HASH, LEFT, LN, LOG, LOG10, LPAD, MAXVALUE, MINVALUE, MOD, OVERLAY, PI, POSITION, POWER, RAND, REPLACE, REVERSE, RIGHT, ROUND, RPAD, SIGN, SIN, SINH, SQRT, TAN, TANH, TRUNC

SQL Language Enhancements

- Database Triggers
  - Aren‘t bound to tables, but to the database in general
  - Can fire for the following global events:
    - ON CONNECT
    - ON DISCONNECT
    - ON TRANSACTION START
    - ON TRANSACTION COMMIT
    - ON TRANSACTION ROLLBACK

⇨ DEMO!

SQL Language Enhancements

§ Global Temporary Tables (GTT)

- Have been implemented in the Fyracle branch and got merged into the Firebird 2.1 branch
- Metadata of GTT are:
  - Stored in the system tables like any other tables
  - Visible for all database connections
- Data of GTT are temporary:
  - For the lifetime of a transaction (ON COMMIT DELETE), or
  - For the lifetime of a database connection (ON COMMIT PRESERVE)
- The engine will remove temporary data automatically
- There is no garbage collection with GTT involved

SQL Language Enhancements

§ Global Temporary Tables (GTT)

- Syntax

```
CREATE GLOBAL TEMPORARY TABLE <table_name>
<table_elements>
[ON COMMIT {PRESERVE | DELETE} ROWS]
```

➡ DEMO!

SQL Language Enhancements

§ Common Table Expression (CTE)

- Have been implemented in the Fyracle branch and got merged into the Firebird 2.1 branch
- Allows the „in-advance“ definition of a named query for later use
- Example:

```
with c (fullname) as (
  select firstname || lastname from customer
)
select * from c;
```

SQL Language Enhancements

- Common Table Expression (CTE)
  - CTE can be used for recursive queries
  - In < FB 2.1 a recursive selectable stored procedure (RSSP) was necessary to query hierarchical data
  - Less memory and CPU overhead with a recursive CTE compared to a RSSP
  - A fixed hard-coded max. recursion depth of currently 1024

SQL Language Enhancements

§ Common Table Expression (CTE)

- Example for a recursive CTE:

```
with recursive r (id, name, region_id, hierarchy) as
  (
    select id, name, region_id, 1
      from region
      where id = 1
    union all
    select r2.id, r2.name, r2.region_id, r.hierarchy + 1
      from region r2, r
      where r.id = r2.region_id
  )
select * from r where hierarchy < 3;
```

Root element

Sub elements

➡ DEMO

SQL Language Enhancements

§ UPDATE OR INSERT statement

- Updates an existing or inserts a new record based on a matching clause
- In < FB 2.1, a stored procedure with appropriate exception handling was necessary
- Example for an UPDATE OR INSERT statement:

```
update or insert into facility (id, name)
values (1, 'Truck Parking') matching (id);
```

- You can even combine the UPDATE OR INSERT statement with the RETURNING clause!

⇨ DEMO

SQL Language Enhancements

§ LIST() function

- Allows you to concatenate (field) values with a user-defined separator
- In < FB 2.1, a stored procedure was necessary
- Example:

```
select list(name, ';') from facility;
```

➡ DEMO

PSQL Language Enhancements

§ Domains in PSQL

- In Firebird 2.1 it‘s possible to use domains in PSQL for local variable and SP parameter declarations
- An exciting new feature for PSQL developers
- A new TYPE OF clause has been introduced in PSQL
- There are two ways to use domains in PSQL
  - With the TYPE OF clause: Domain‘s data type only
  - Without the TYPE OF clause: Domain‘s data type and DEFAULT definition, CHECK constraint, ...

PSQL Language Enhancements

§ Domains in PSQL

- Example:

```
CREATE DOMAIN D_MYINT AS INTEGER;

CREATE PROCEDURE SP (
  I1 TYPE OF D_MYINT,
  I2 D_MYINT)
RETURNS (
  O1 TYPE OF D_MYINT,
  O2 D_MYINT)
AS
DECLARE VARIABLE V1 TYPE OF D_MYINT;
DECLARE VARIABLE V2 D_MYINT;
BEGIN
...
END
```

➡ DEMO

SQL / PSQL Language Enhancements

- And more ...
  - Collations (COLLATE clause) in PSQL
  - CREATE COLLATION DDL statement
  - Various VARCHAR operations (e.g. concatentation, UPPER, TRIM, ...) can be invoked on BLOB sub_type 1 as well
  - New ENGINE_VERSION context variable in SYSTEM namespace (accessible via RDB$GET_CONTEXT)
  - Usage of column aliases in VIEW definition
    - Example:

```
CREATE VIEW V_CUSTOMER AS
SELECT
  ID
  , FIRSTNAME AS FNAME
  , LASTNAME AS LNAME
FROM
  CUSTOMER;
```

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Performance

- Optimized network protocol
  - Much better performance on slow networks (e.g. WAN)
  - More intelligent packet batching
  - Packet size of the response from the server to the client is now the size of the real length of the contained data
  - In a real-world test scenario, ~50% fewer API round-trips and thus ~40% fewer TCP round-trips necessary
- Windows 64-bit Release to leverage > 2GB/3GB main memory
- Optimized index operations
  - Improved multiple index scans with AND conditions
  - Improved sparse bitmap operations

Performance

- Increased Lock Manager limits & defaults
- Deprecated page size of 1K and 2K
  - Firebird 2.1 can open existing databases with 1K or 2K page size though
- Garbage Collection improvement
  - Back record versions of active transactions aren‘t read by the garbage collection anymore

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Administration

§ Monitoring Tables

- A set of new system tables to monitor your Firebird database
- They allow you to see what‘s going on in your database
- Monitoring tables are per-database and **not** server-wide!
- You need ODS 11.1 (or higher) to use them
- Table names start with MON$
- You can query them like any other (system) table
- Cancelling a long-running query „might“ be possible by invoking a DELETE statement on MON$STATEMENTS

⇨ DEMO

Administration

§ Monitoring Tables

Table	Purpose
MON$DATABASE	General information on the database like file/path name, ODS, sweep interval, OIT, OAT, ...
MON$ATTACHMENTS	Established database connections, including IP address, remote process ID, remote process name, ...
MON$TRANSACTIONS	Information about transactions, their state, isolation level, ...
MON$STATEMENTS	Information about statements currently running
MON$CALL_STACK	Call stack of active PSQL requests
MON$IO_STATS	Number of page reads/writes/fetches ...
MON$RECORD_STATS	Number of records read sequentially/indexed, inserted/updated/deleted ...

Administration

§ Multi-Server-Instances

- Firebird 2.1 allows you to setup several instances as a Windows service more easily
- Used TCP port (<port>) must be configured via the „RemoteServicePort“ configuration parameter in „firebird.conf“
- The command-line tool „instsvc“ allows you to specify the name of the instance with the new -name switch
- Connecting to a particular instance with <host>/<port>:path_or_alias

⇨ DEMO

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Security

- Many security issues have been addressed in Firebird 2.0
  - New security database „security2.fdb“
  - Better password encryption
  - User can change their own password
  - No direct database connection to the security database possible anymore
  - Bugfixes for security vulnerabilities (buffer overflows, ...)
- Firebird 2.1 goes a step further and beside fixing security issues and vulnerabilities, it also supports Windows Trusted Authentication now!

Security

- Windows Trusted Authentication
  - Available on Windows only
  - Logged in Windows user can be used for authentication to a Firebird database
  - By-passes the Firebird security database
  - SQL privileges can be granted to Windows user and will be evaluated as such
  - User of the Windows Administrators group get connected as SYSDBA, thus CURRENT_USER returns SYSDBA and not the Windows user
    - Possibly a new SQL standard compliant context variable SYSTEM_USER will be added to return the real Windows user, even if the user is part of the administrators group

Security

§ Windows Trusted Authentication

- Authentication mode configurable via the new „Authentication“ configuration parameter in „firebird.conf“:
  - Native, Trusted, Mixed (Default)
- New –tru[sted] switch for several Firebird command-line tools to force Windows Trusted Authentication

⇨ DEMO

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International Language Support

- Firebird 2.0 comes with a totally revamped internationalization module
- Firebird 2.1 moves this part forward, including:
  - CREATE/DROP COLLATION statement
  - SHOW COLLATION in isql
  - UNICODE collations can be applied to any character set
  - ...

➡ More on international language support in Firebird in the „Character Sets and Unicode in Firebird“ session held by Stefan Heymann

Thanks for your attention!

Besten Dank für Ihre Aufmerksamkeit!

Questions / Fragen?

thomas.steinmaurer@scch.at

t.steinmaurer@upscene.com

Enjoy the conference!

Viel Spaß auf der Konferenz!