Firebird on the road from v4 to v5

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Firebird Conference 2019
Berlin, 17-19 October

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Maintenance

Firebird 2.5

- v2.5.9 was released in June 2019
- >20 bugfixes, 3 improvements
- Discontinued

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Firebird 3.0

- v3.0.4 was released in October 2018
- v3.0.5 is expected in Q4 2019
- >60 bugfixes, 6 improvements
- Supported until v5 is out

Firebird 4.0 progress

Features introduced in Alpha 1

- ODS 13

- 32KB page size

- Metadata names as long as 63 characters

- Incremental restore via nbackup

- Predefined system roles and fine-grained DBA permissions

- Timeout for statements and connections

- Aggregated roles

- SQL SECURITY declaration for PSQL objects

- Batch API

Firebird 4.0 progress

Features introduced in Beta 1

- Built-in logical replication

- Statement-level read consistency in RC transactions

- Intermediate garbage collection

- DECFLOAT data type

- NUMERIC/DECIMAL up to 38 digits

- Support for time zones

- Built-in cryptographic functions

- Encrypted database support for GBAK

- Pooling of external connections

Firebird 4.0 progress

Progress of the past year

- ✦ Beta 1 was released in February 2019

- ✦ 55 bugs fixed since

- ✦ 12 features and improvements added

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Most interesting

- Snapshots shared among transactions

- Built-in functions converting binary string to hexadecimal representation and vice versa

- Lateral derived tables

- RECREATE USER statement

Firebird 4.0 progress

Features being reworked

- Native INT128 instead of DECFLOAT-based integer
  for longish NUMERIC/DECIMAL data types

- Flexible binding for new data types

- New logic for query restarts in READ CONSISTENCY transactions

- Issues with time zones (regions)
  and ICU dependency on the client side

- Schema-driven replication customization

Firebird 4.0 progress

Where we stand now

- Beta 2 in Q4 2019
- Release Candidate in Q1 2020
- Final release in Q2 2020

Firebird 4.0 preview

DECFLOAT data type

- Introduced in IBM DB2

- Now part of the standard (SQL:2016)

- Stores decimal values precisely

- DECFLOAT / DECFLOAT(16) / DECFLOAT(34)

- 64-bit or 128-bit storage (IEEE 754)

- Supported by all built-in functions

- Intermediate calculations with 34 decimal digits

Firebird 4.0 preview

DECFLOAT special functions

- COMPARE_DECFLOAT — compare exactly (w/o specials)

  COMPARE_DECFLOAT(2.17, 2.170) = 2

- NORMALIZE_DECFLOAT — remove trailing zeroes

  NORMALIZE_DECFLOAT(12.0) = 12

  NORMALIZE_DECFLOAT(120) = 1.2E+2

- QUANTIZE — scale by pattern

  QUANTIZE(1234, 9.999) = 1234.000

- TOTALORDER — compare exactly with specials

  -nan < -snan < -inf < -0.1 < -0.10 < -0 < 0
  0 < 0.10 < 0.1 < inf < snan < nan

Firebird 4.0 preview

DECFLOAT management

- Works at the session level
- SET DECFLOAT ROUND <mode>

    CEILING, UP, HALF_UP, HALF_EVEN, HALF_DOWN, DOWN, FLOOR, REROUND

- SET DECFLOAT TRAPS TO <traps-list>

    DIVISION_BY_ZERO, INEXACT, INVALID_OPERATION, OVERFLOW, UNDERFLOW

Firebird 4.0 preview

NUMERIC / DECIMAL improvements

- Maximum precision is extended to 38 decimal digits

- Backed by native 128-bit signed integer

- INT128 is not directly surfaced (so far)

- Intermediate calculations with
  either NUMERIC(38) or DECFLOAT(34)

Firebird 4.0 preview

Time zone support

- TIME[STAMP] WITHOUT TIME ZONE

- TIME[STAMP] WITH TIME ZONE

- Extra two bytes for time zone information

- Time zone can be defined via the region name, e.g.
  `'10:00 America/Los_Angeles'`
  or via the hours:minutes displacement from GMT, e.g.
  `'10:00 -08:00' or '10:00 -08'`

- Time / timestamp part is stored (compared, sorted) as UTC

- Time zone is stored «as is»

Firebird 4.0 preview

Time zone support

- AT expression translates the value to another time zone
  ```
  select current_timestamp at time zone
  'America/Sao_Paulo'
  or
  select timestamp '2018-01-01 12:00 GMT' at local
  ```

- EXTRACT is extended
  ```
  TIMEZONE_HOUR and TIMEZONE_MINUTE
  ```

- Changed CURRENT_TIME and CURRENT_TIMESTAMP to return UTC time

- Added LOCALTIME and LOCALTIMESTAMP to return legacy (WITHOUT TIME ZONE) time

Firebird 4.0 preview

Time zone management

- Default time zone for all sessions can be defined in firebird.conf (DefaultTimeZone setting)

- Time zone can be overriden per session (via DPB)

- Time zone can be altered at runtime
  SET TIME ZONE <tz>

- Time zone can be reset at runtime
  SET TIME ZONE LOCAL

Further development

User demands

- Release often — publicity is vitally important
- *BUT* nobody wants to upgrade often, due to
    - Production downtime (backup/restore duration)
    - Testing efforts (migration difficulties)

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Problems

- Limited resources
- Aging codebase
- Feature-based release schedule
- *THUS* long intervals between releases

Further development

Possible solution

- Release in smaller steps
  - Less features per release
  - More frequently
- Adopt the «tick-tock» idea
  - Major release: architectural
  - Minor release: technological
- Simplify upgrade paths

Further development

Major release

- Code refactoring
- Major ODS change (and thus b/r requirement)
- A few unique features + basement for others
- Incompatibilities are possible (although minimized)
- Once per 2-3 years

Further development

Minor release

- Minor ODS changes are possible
- Straigtforward upgrade option (no b/r requirement)
- A few features based on the current ODS
- Maximum backward compatibility
- Quite stable, no Alpha / Beta stages
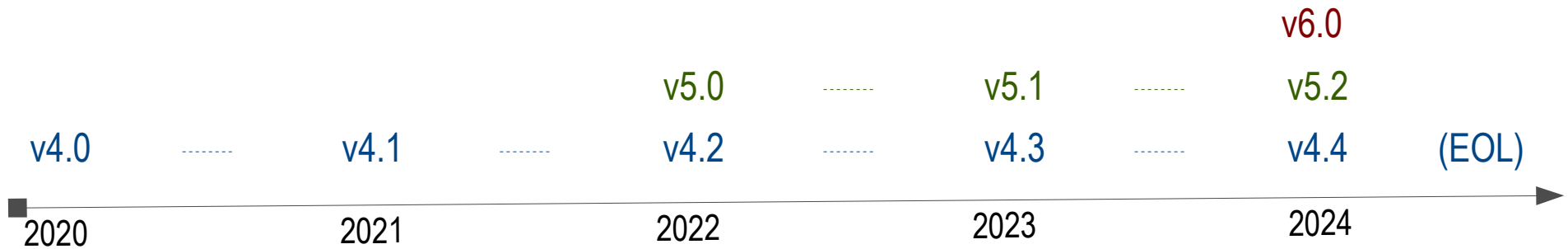- Once per 9-12 months

Further development

Minor ODS management (example)

- Firebird 4.2 introduces ODS 13.2,
  but can work with ODS 13.0 (created by v4.0)
  and ODS 13.1 (created by v4.1)

- In the case you need ODS 13.2 features,
  you upgrade ODS manually

- gfix -upgrade instead of backup/restore

- Upgrade is almost immediate
  (but exclusive DBA access is required)

- Downgrade is possible via backup/restore

Further development

Possible schedule (based on 12/24 months intervals)

				v6.0
v5.0	--------	v5.1	--------	v5.2
v4.0	--------	v4.1	--------	v4.2	--------	v4.3	--------	v4.4	(EOL)

2020   2021   2022   2023   2024

Firebird 4.x evolution

Replication is not a simple «here it is» feature,
rather a start of the long way forward

- Multiple publications/subscriptions scenarios
- Bi-directional (multi-master) replication
- Journal compression / encryption
- Multi-threaded applying on the replica side
- etc

Firebird 4.x evolution

Other changes

- Mostly finished but not yet committed features
  (e.g. TRUNCATE TABLE)

- Some unique features from HQbird and RedDatabase
  that can be backported into ODS13

- Optimizer improvements

- Monitoring / tracing improvements

Planning Firebird 5.0

Top-voted tickets from the tracker

1)	CORE-743	Job / Task Scheduler
2)	CORE-720	Local temporary tables
3)	CORE-776	Database Links
4)	CORE-808	Add support for INTERSECT and EXCEPT data set operators
5)	CORE-796	Create Table as Select ….
6)	CORE-659	GIS implementation (opengis)
7)	CORE-734	Full-Text indexing
8)	CORE-5148	Support native JSON datatype for columns as MySQL / PostgreSql
9)	CORE-738	Add support for SQL Schemas
10)	CORE-670	New database object - Constants

Planning Firebird 5.0

Under the hood

- ✦ ODS 14

- ✦ Longer (unlimited) record size

- ✦ Better on-disk compression

- ✦ New BLR format w/o context limitations

- ✦ Indexing improvements

Planning Firebird 5.0

Technical Task Group

- Firebird Foundation sponsors
- Project administrators
- Core developers

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Decision making

- List of suggested features
- Voting
- Planning board

Questions?