Firebird performance counters in details

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Firebird Project
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Thank you

IBObjects
Upscene
CopyCat
REDSOFT
SITA SOFTWARE
IBPhoenix
IBSurgeon
MOSCOW EXCHANGE
24-25 OCTOBER PRAGUE
Firebird Conference 2014
Firebird Conference 2014

Analysing bottlenecks

Disk

- Database
- Temporary files

Analysing bottlenecks

- **Disk**
  - Database
  - Temporary files
- **Memory**
  - Static (cache)
  - Dynamic (pools)
  - Shared

Analysing bottlenecks

CPU, waits, etc

- Real execution time
- User/kernel time
- Was time spent for work or waiting?
- What operations were performed?

Legacy performance counters

Page level

- Fetches, reads, marks, writes
- Shared in SS, per connection in CS
- Available via API

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Record level

- Selected (seq/idx), inserted, updated, deleted etc
- Per connection and per table
- Available via API

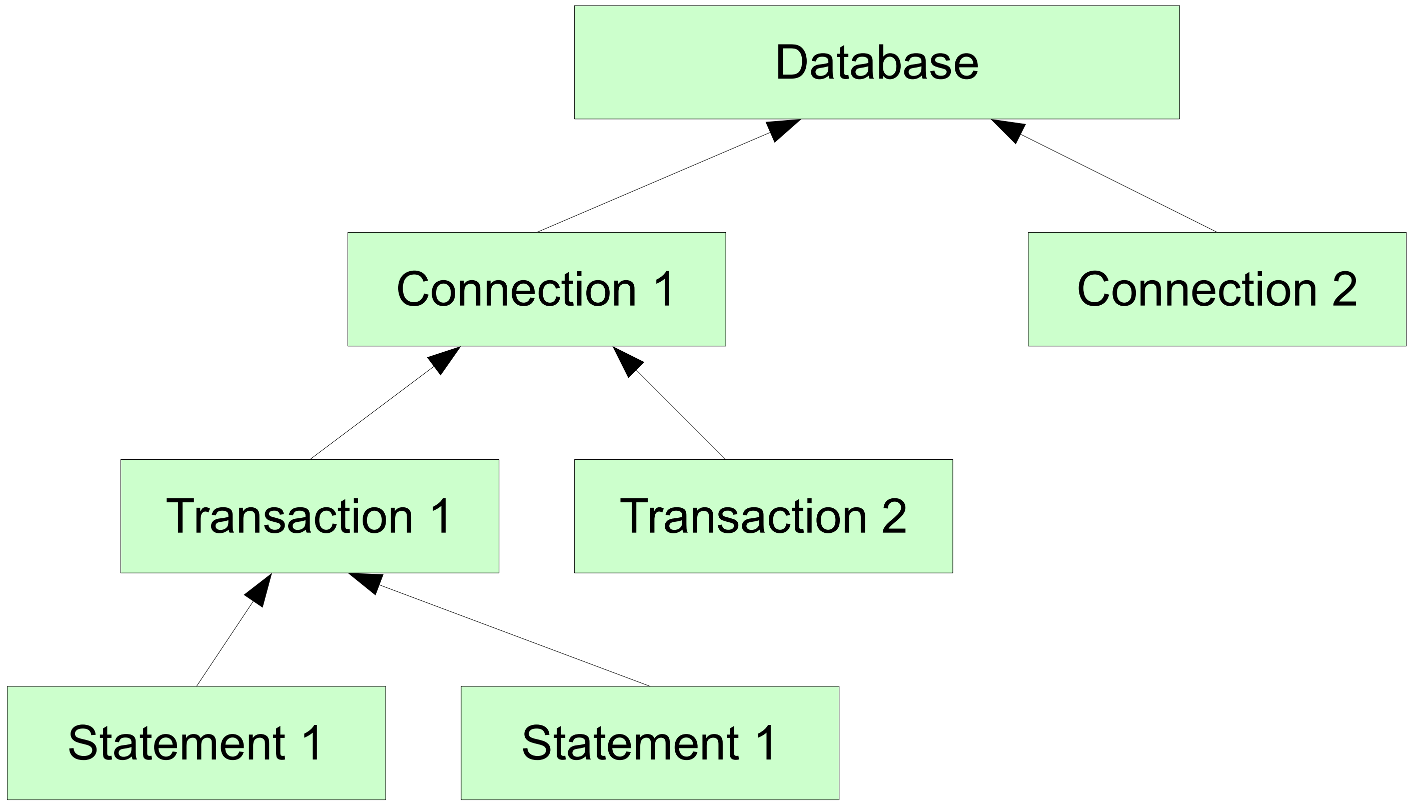
Improvements in Firebird 2.x

Multi-level aggregated counters

- Database (SS only)
- Connection
- Transaction
- Statement
- Nested PSQL call (procedure / trigger)

Improvements in Firebird 2.x

Multi-level aggregated counters



Improvements in Firebird 2.x

New interfaces

- Monitoring tables
- Trace/audit

Page level counters

Page reads

- From disk to the page cache (physical reads)
- Usually means a cache miss

Page level counters

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- **Page fetches**
  - Access page in cache (logical reads)
  - Includes both cache hits and cache misses
  - Corresponds to a shared page lock / latch

Page level counters

- Page reads
  - From disk to the page cache (physical reads)
  - Usually means a cache miss
- **Page fetches**
  - Access page in cache (logical reads)
  - Includes both cache hits and cache misses
  - Corresponds to a shared page lock / latch
  - Cache hit ratio = 1 - reads / fetches ???

Page level counters

Page writes

- From the page cache to disk (physical writes)
- At transaction commit/rollback
- Cache is full of dirty pages
- Asynchronous notification is received (CS/SC)
- Immediately after modification

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Page marks

- Access page in cache (logical writes)
- Corresponds to an exclusive page lock / latch

Record level counters

Sequential record reads

- Records retrieved through a full table scan
- Includes sweep

Indexed record reads

- Records retrieved positionally
- Includes bitmap index scans, index navigational walks, DBKEY based retrievals

Record level counters

Record inserts, updates, deletes

Pretty obvious, huh?

Record level counters

- Record inserts, updates, deletes
  - Pretty obvious, huh?
- **Record backouts**
  - Latest (uncommitted) version removed
  - Happens after savepoint rollback, explicit or implicit
  - May happen after transaction rollback

Record level counters

Record purges

- Old versions removed while keeping the primary version in place
- Outdated versions found while chasing

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Record purges

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Record expunges

- Whole version chains removed, along with the primary version
- Record is deleted and nobody is interested

New record level counters in v3.x

Record repeated reads

- Record is retrieved multiple times
- BEFORE triggers
- Sort-based updates/deletes

New record level counters in v3.x

- **Record repeated reads**
  - Record is retrieved multiple times
  - BEFORE triggers
  - Sort-based updates/deletes
- **Record locks**
  - Record is selected usng WITH LOCK clause

New record level counters in v3.x

Record waits

- Attempts to update/delete/lock record owned by a concurrent active transaction
- Transaction is in the WAIT mode

New record level counters in v3.x

Record waits

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- Transaction is in the WAIT mode

Record conflicts

- Unsuccessful attempts to update/delete/lock record owned by a concurrent active transaction
- UPDATE CONFLICT is reported

New record level counters in v3.x

Backversion reads

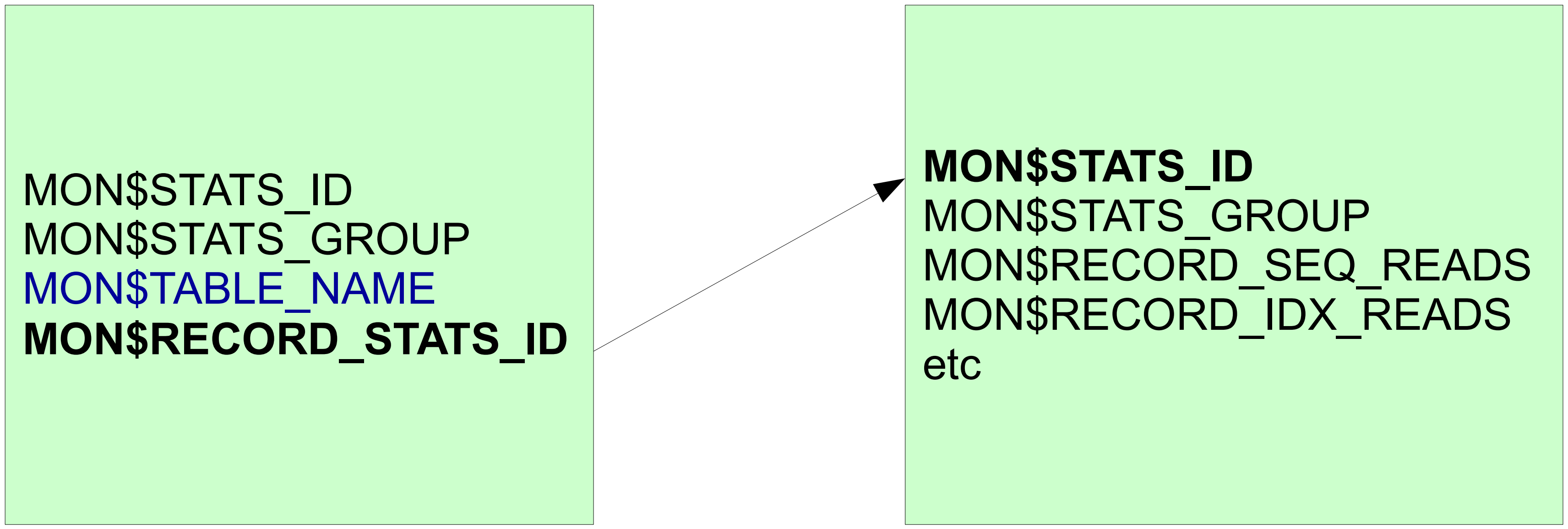
- Versions chased while finding a visible one
- Means old snapshots

New record level counters in v3.x

- **Backversion reads**
  - Versions chased while finding a visible one
  - Means old snapshots
- **Fragment reads**
  - Fragmented records
  - Means extra page fetches/reads

New record level counters in v3.x

MON$TABLE_STATS **MON$RECORD_STATS**



TODO: page level counters

Page writes (expanded)

- Regular writes (immediate / commit / rollback)
- Overflow writes
- Asynchronous writes

TODO: page level counters

Page writes (expanded)

- Regular writes (immediate / commit / rollback)
- Overflow writes
- Asynchronous writes

Page waits

- How many times page requests waited
- Shows contention inside the page cache

TODO: index counters

Possible metrics

- Index scans
- Node inserts / deletes
- Bucket splits / merges
- Keys scanned / compared while searching

Reported per index

- MON$INDEX_STATS

TODO: temporary space counters

Operation metrics

- Reads / writes resolved through the cache
- Reads / writes redirected to temp files

I/O amount metrics

- Bytes read / written through the cache
- Bytes read / written from/to temp files

TODO: time statistics

Elapsed time

- Total inside the engine
- Spent in the user space
- Spent in the system / kernel space

TODO: time statistics

Elapsed time

- Total inside the engine
- Spent in the user space
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Wait time

- Database (and maybe temp files) I/O
- Page cache waits
- Transaction waits

TODO: integration

Collecting the statistics

StatsD, CollectD

Reporting / analyzing

Graphite / Graphene

Other tools

Nagios, Cacti, Zabbix

Questions?

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