Geo2Tag performance evaluation

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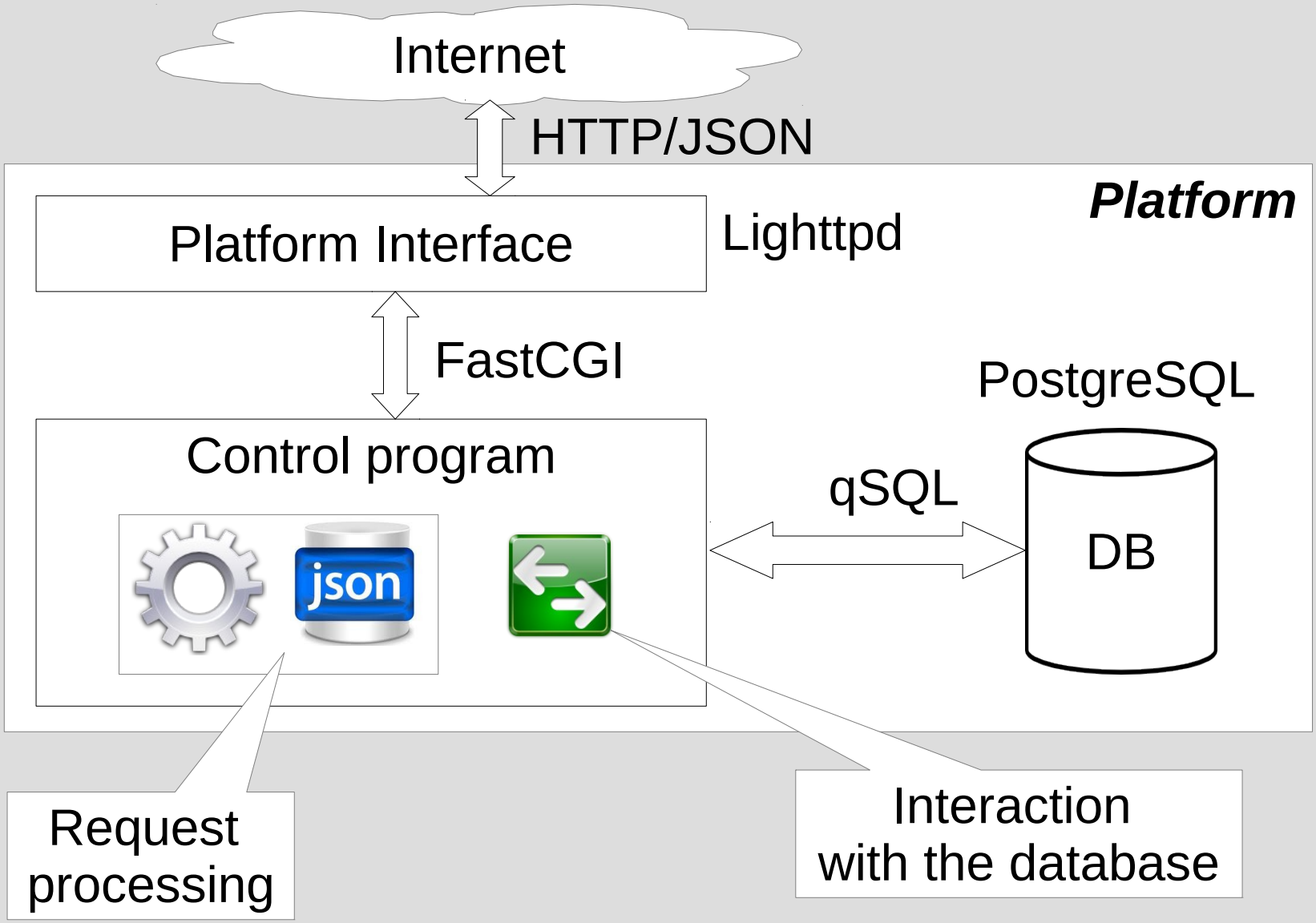
Motivation

- **Geo2Tag Location-Based Services platform** was started as project for students who want to get an Open Source development experience
- With increasing number of functions which are supported by platform performance requirements also increased
- Platform performance evaluation was never performed

Goals

- Investigate the most frequent REST requests to platform performed by users;
- Measure performance (processing time) of the most frequent requests;
- Determine bottlenecks in request processing;
- Maximize performance of request processing and DB synchronization;

Platform architecture



Client-server interaction modeling

- The most frequent REST requests were found using modeling of **LocationClient** app behavior
- Modeling was performed using Markov chains theory
- Request executions were used as non-absorbing states of Markov chain
- Client application shutting down was used as absorbing state of Markov chain

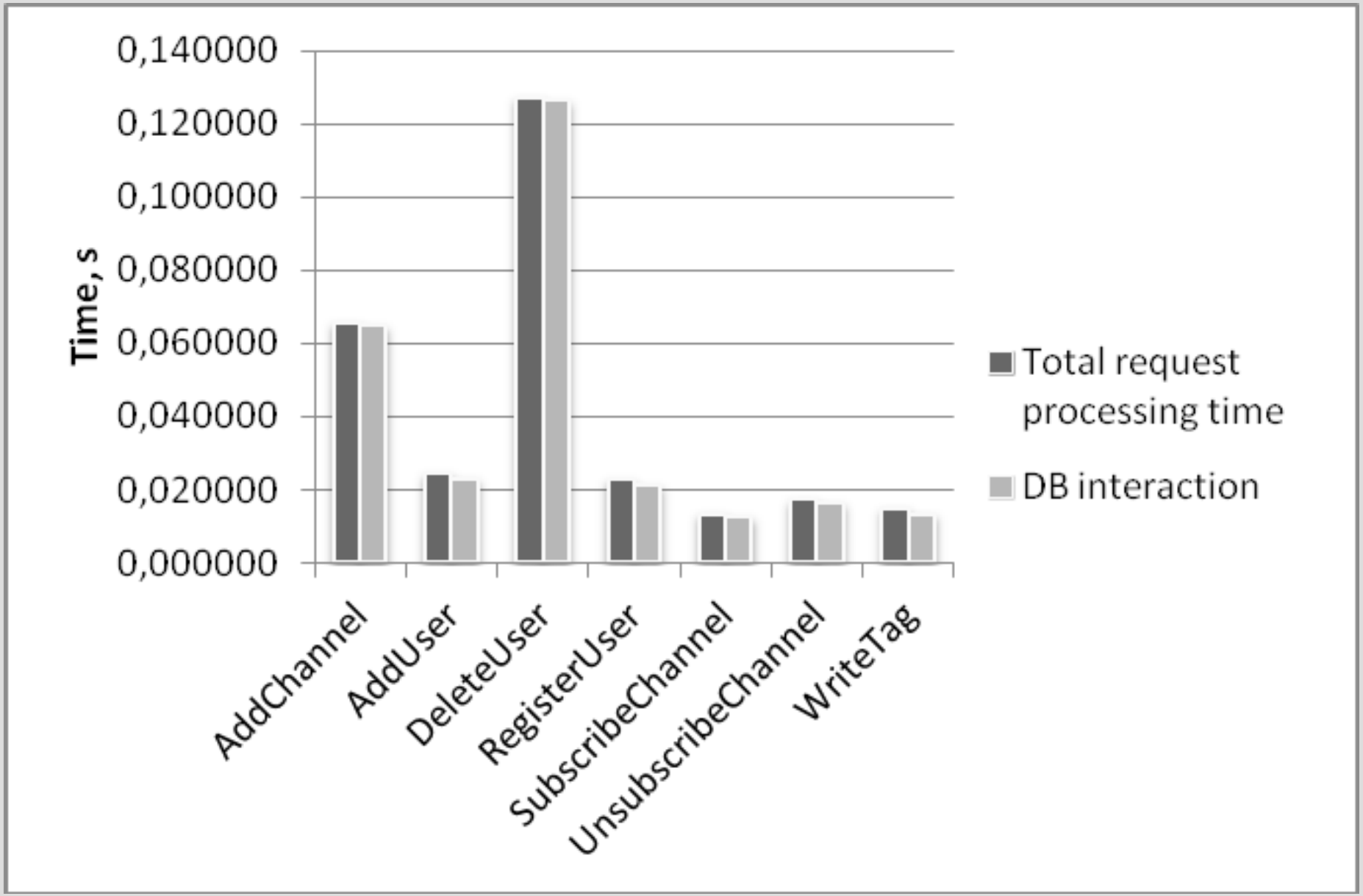
Client-server interaction modeling

- During numerical experiments average number of each request executions before absorbtion were calculated
- Modeling was performed for different initial states and tagging frequency
- As a result of modeling **WriteTag** and **LoadTags** requests had the biggest average number of executions for all conditions

Control program profiling

- For determining bottlenecks during request processing profiling performed
- For each write request whole processing time and DB interaction time were measured
- In average DB interaction takes ~95% of request processing time
- DB interaction is bottleneck!

Control program profiling



Platform optimizations

- DB synchronization optimizations:
  - Thread synchronization refactoring (less locks – more performance)
  - Algorithm for making decisions about need of DB synchronization
- DB structure optimization
  - Number of tables for tags storage were decreased to one – **WriteTag** processing speed increased

DB synchronization

- Algorithm which determines does system need DB synchronization or not
  - Periodical check with user-defined period (**UPDATE_INTERVAL**)
  - Comparison between actual number of transactions to DB and transactions number counted by platform
  - If difference is more than **TRANSACTION_DIFF** value than synchronization is performed, else nothing happens
  - Variation of **UPDATE_INTERVAL** and **TRANSACTION_DIFF** allows to achieve different ratios “performance/data consistency”

Request performance measurement

- Performance were measured for **WriteTag** and **LoadTag** requests in system before and after optimization
- Processing time and errors data were collected
- For **LoadTag** set of experiments were performed with different number of tags in DB – from 0 to 54000 with step of 1000 tags. For each tag value 10000 **LoadTags** requests where performed
- For **WriteTag** performance measurement was performed as sequentially increase of tags number in system from 0 to 12000 by sending **WriteTag** request

Results comparison

- Maximum, minimum, average, variance of request processing time and number of errors where compared for both systems
- **LoadTags**
  - Maximum processing time decreased
- **WriteTag**
  - Average time decreased by 47.5%
  - Maximum time decreased tenfold
  - Variance of time decreased hundredfold

Conclusions

- During performance evaluation where achieved next results:
  - Math model of client application was created
  - Bottleneck of request processing was found
  - Performance of request processing was optimized
- Future plans:
  - Support NoSQL or GIS-oriented DB
  - Support lock-free algorithms and data structures

Questions & Answers

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