Design and Implementation of a MongoDB Driver for Prolog

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1 Diary

- March 29. Wrote a decoder that decodes {hello: world} and {hello: 32}. Learned some DCG and rewrote the parser with it.
- March 30. Researched how SWI interacts with C. Wrote a bytes8_to_double function in C and managed to integrate it with the rest of the system. Separated bson into separate files, encoder and decoder. Should think about researching PlUnit by now. Thought about and tried PlUnit. Works fine. But how to organize tests? Implemented all bit-hacking in C for the time being. Works. Simple. Fun. Started looking at PlDoc. Generating actual docs seems like a hassle, probably won't do it. But the important thing is unit tests, and some comments inside the source. Started fleshing out the report slightly, with some ideas and stubs.
- March 31. Restructured project folder. Better including of modules now, I think. Starting to write nice unit tests. Continued with the decoder a little, the complex BSON example works. Wrote nice TextMate snippets for test boilerplating. Rewrote Makefile, yet again. Added make test, for instance.
- April 1. When trying to fix proper decoding of strings I ran into issues with Unicode. Finally found SWI-Prolog's memory files, which can be written to and then read back using a different encoding. Five line fix. Implemented a variant that might be more efficient. Might. (And like five times longer, but clean though.) Cleaned up the tests. Implementing the

rest of the decoder should be straight-forward now. Next week. It. Will. Be. Awesome.

- April 2 (weekend). Looked into the Prolog module system again and started adding prefixes ("memory_file:", "builtin:") to SWI predicate calls. "builtin" isn't an actual module, but since it works anyway (it enters the module builtin and calls the predicate from there) I decided to use it. Documented predicates in bson_bits. Fixed a bug with bytes_to_integer/5 because it wasn't using a 32-bit integer. Now it uses int32_t. Started using maplist/2. Found a library(apply_macros) that claims to speed up maplist etc. simply by loading it.

- April 3 (weekend). All use_module directives now use an empty list in order to ensure that the module is loaded, but nothing is imported. This forces me to add the appropriate module prefixes to calls. Benchmarked the unicode converter and the old shorter code outperformed the new longer code with more than a factor of three. I guess this is due to more stuff being done by the C library and not Prolog. Anyway, the old code is faster and much shorter – win-win. Also replaced a crappy to-codes-and-then-to-atom conversion with a straight-to-utf8-atom library routine, which made it even faster. A keeper.

- April 4. Refactored decoder slightly. Added relation term_bson/2 to bson, which calls necessary subpredicate. Moved tests into separate files: they were getting too long, and separating them makes it easier to write them simultaneously. As long as tests and implementation are close to each other, I am okay. (Impl in .pl and tests in .plt next to each other.) The decoder should now be feature complete. It does minimal error checking, but it should be able to parse all element types. It might still need some cleaning though. Added version predicates to bson. Made comments more in line with PlDoc.

2 Background

From spec:

[MongoDB is a young document-oriented database system that has started to gain much attention recently. Document-orientation involves removing rigid

database schemas and advanced transactions, in favor of flexibility. Document-orientation also promotes a certain degree of denormalization which allows embedding documents into each other, leading to potentially much better performance by avoiding the need for expensive join operations.

Prolog, being an untyped language, agrees with the document-oriented approach of relaxing manifests in order to create more dynamic and flexible systems. Embedding terms in other terms is natural in Prolog, and embedding documents in other documents is natural in MongoDB.

Many drivers exist, both official and unofficial, that enable the use of MongoDB from various programming languages. At the time of writing, no such driver for Prolog seems to exist.]

3 Method

Research other drivers, docs.

Test-driven development.

4 Result

- BSON encoder/decoder
  - Some parts written in C. Why? (Basically didn't know how to easily handle bytes-to-float in Prolog.)
  - Discuss data structures, term [key:value] maps to bytelist [4,1,7,9,3,...] etc.
  - Design choices: text as "" and symbol as atom
- Network communication
  - How does the communication work? Out of scope?
- MongoDB API
  - Thoroughly discuss design of wrapper API, how lists and structures are represented etc.

5 Discussion

- Portability
  - Tested on Mac, SWI, GCC, etc.
- Efficiency
- Future
  - BSON implementation in C? Already exists, I think.
  - More advanced features

6 Conclusion

Difficulties? Did it work? Is it usable?

7 Literature

Chodorow, K. & Dirolf, M. (2010) *MongoDB: The Definitive Guide.* Sebastopol, United States of America: O'Reilly Media, Inc.