Ben Polk   CSCI 540

David Millman   Fall 2021

Advanced DB Systems – Project Proposal

For the final project, I propose to build a knowledge base. A knowledge base can be described as, "…a special kind of database for knowledge management. It provides the means for computerized collection, organization, and retrieval of knowledge."[1] I would like to take some of the concepts covered in class, and other concepts relevant to database systems, and apply them to the domain of knowledge, in order to build a system capable of querying and managing a knowledge base.

Another way of thinking of the scope of a knowledge base is that, "Knowledge is the information about a [problem] domain that can be used to solve tasks in that domain… A knowledge base is the representation of all of the knowledge that is stored…"[2] Clearly, the type of knowledge and the way it is represented is a foundational decision for any knowledge base. For the purposes of this system, I intend to model the basic constructs and operations of propositional logic. While this is somewhat rudimentary, it also provides a relatively abstract and powerful way of representing different pieces of knowledge, and the way in which those pieces can be combined to derive new knowledge.

A key feature of this system will be its ability to coordinate multiple, potentially concurrent actions from different clients as they interact with and modify the knowledge base. To this end, the system will be implement database ACID properties, although adapted to the context of knowledge management. Atomicity will be met through the use of transactions that either entirely succeed or fail, with an implementation that may make use of write ahead logging. The goal for consistency will be to constantly maintain a consistent set of propositions within the knowledge base; this will require vetting both additions and deletions of knowledge. Isolation will require tracking which pieces of knowledge have been both fully vetted and committed, maintaining concurrency control between clients and ensuring that uncommitted knowledge from one client doesn't affect another. Finally, as with other database systems, durability will be achieved through writing and maintaining knowledge on disk. This will provide opportunities to make use of indexing data structures for faster knowledge access.

Overall, implementing this system should provide the opportunity to apply several database tools and concepts to a domain that is different enough to encourage and require some novel solutions.

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[1] Knyazhansky, M., & Plotkin, T. (2012). Knowledge Bases Over Algebraic Models: Some Notes About Informational Equivalence. *International Journal of Knowledge Management (IJKM), 8*(1), 22-39. doi:10.4018/jkm.2012010102

[2] Poole, D., & Mackworth, A. (2017). Artificial Intelligence: Foundations of Computational Agents, p. 16. Cambridge University Press.

Proposed Initial System Diagram for Propositional Logic Transactional Knowledge Base