



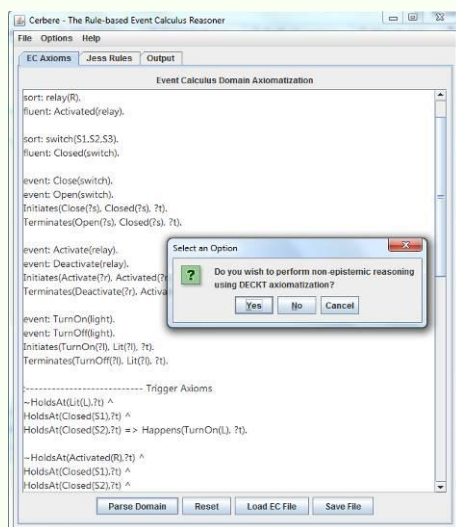
Cerberus – A Logic-based Reasoner for Cognitive Systems

Overview

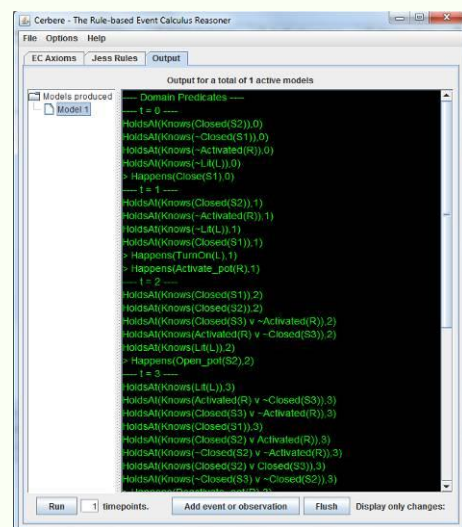
Cerberus (the Causal and Epistemic Rule-Based Event calculus REasoner) is a programming system for the execution of **declarative reasoning tasks** in **dynamic domains**. It can be used to endow intelligent software agents, and autonomous systems in general, with the cognitive skills to reason about their actions, their knowledge, as well as the sensor data acquired at runtime.

The dynamics of the environment and the specifications of agent actions are expressed in the Event Calculus language, and are translated into Jess rules for efficient reasoning.

By implementing Event Calculus axiomatizations as Jess rules, Cerberus succeeds in combining the **expressive power** and **formal semantics** of logic-based languages with the **powerful constructs** needed to perform practical reasoning in real-world domains. The developer is offered a repertoire of choices to manage execution parameters, such as the destructive update of the knowledge base, the introduction of new knowledge on-the-fly or the flushing of outdated knowledge for enhanced memory management.



Event Calculus editor



Runtime inference generation

Target Domains

Cerberus aims to serve two purposes. On the one hand, it allows the design of cognitive systems that react to changes in the environment and execute high-level reasoning tasks. Towards this end, it has been applied in the context of Ambient Intelligence applications, both in order to make inferences about the current activities performed by humans in smart spaces (e.g., for the recognition of the activity of breakfast preparation), as well as to trigger appropriate actions to respond to these activities (e.g., notifications, alerts etc).

On the other hand, the tool intends to also play a pedagogical role, by helping students and researchers learn, understand and systematically represent logic-based action theories by means of an interactive interface. The offline simulation of the developed formalisms help in testing and better understanding the underlying concepts and methods.

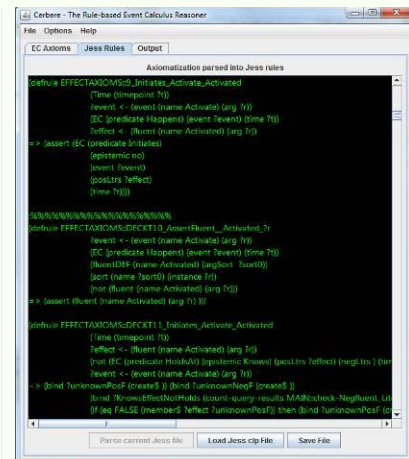
Description

Cerbere is a system for performing automated reasoning using the Event Calculus.

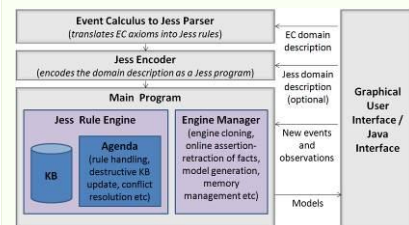
Event Calculus is a well-established technique within AI for representing causal and narrative information in multi-agent dynamic domains. Cerbere builds on two highly expressive dialects of Event Calculus, namely **DEC** and **DECKT**, which can accommodate a wide range of commonsense phenomena, such as concurrency, non-determinism, exogenous events, complex ramifications and others. DECKT in particular, developed by ISL, extends standard Event Calculus with a treatment of epistemic notions, enabling reasoning with incomplete world knowledge and sensing.

Jess, on the other hand, is one of the fastest rule engines for declarative problem solving. It implements the efficient RETE algorithm to enable inference of new knowledge using production rules.

Cerbere incorporates an Event Calculus editor and a Jess rule editor, an interpreter of Event Calculus axiomatizations into Jess rules and a practical graphical interface for real-time execution and monitoring of reasoning tasks.



Jess rule editor



Architecture and information flow

Additional Information

The paper describing Cerbere [1] received the best paper award at the 6th Int. Symposium on Rules in 2012. The paper describing an early version of the DECKT theory implemented by the system was awarded the best student paper at the 5th Hellenic Conference on AI in 2008.

[1] T. Patkos, A. Chibani, D. Plexousakis, Y. Amirat, "A Production Rule-Based Framework for Causal and Epistemic Reasoning", Proceedings of the 6th Int. Symposium on Rules (RuleML'12), pp. 120-135, August 2012, Montpellier, France

[2] T. Patkos, D. Plexousakis, "A Theory of Action, Knowledge and Time in the Event Calculus ", Proceedings of the 5th Hellenic Conference on AI (SETN'08), LNAI 5138, pp. 226-238, Syros, Greece, October 2008.

More details about the system can be found at:

<http://www.csd.uoc.gr/~patkos/deckt.htm>



Cerbere Webpage

Contact details: Theodore Patkos
patkos@ics.forth.gr
www.ics.forth.gr/isl

Dimitris Plexousakis
dp@ics.forth.gr