Distributed Reasoning

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November 8, 2022

Cloud computing is a distributed computing paradigm which provides on demand computing services. This elastic platform is a convenient choice parallelization of reasoning jobs, which is sometime bottle-necked by resource constraints of cloud computing nodes, since completion of a reasoning task may need hours, or even months. For example, AWS Lamdba [1], which is a serverless cloud computing platform has nine minutes of timeout per job. A solver running a job in lambda has to terminate at that time-out, and the computation done so far by the solver would get wasted. At Amazon Research, me and my colleagues have explored this issue. Our exploration led to the design, implementation, and evaluation of a novel reasoning solving framework [2], which is capable of saving the current state of a systematic solver at any point of its execution, migrating the saved state to a different computing node, and then restoring the saved state by using the same solver, or even by using a different solver.

In the future, I intend to explore more avenues in distributed reasoning. In particular, I want to explore the following two issues: (i) In our work at Amazon research, we observed that migrating states often improves the performance of the extended solvers for true formulas. This is surprising, since the migration involves some overhead, and a slight loss of performance is expected. The reason of this phenomenon is not understood. I plan to investigate this surprising phenomenon, that could improve the understanding of reasoning in the cloud. This understanding will not only help to achieve a reassuring deployment of state migrating solvers in the cloud, but also could lead to improvement of sequential solvers. (ii) Existing cloud based solvers employ both systematic and local search based algorithms that cooperate between themselves. My planned framework `CoopReason` will be a good fit for cloud based reasoning, since it is based on the notion of cooperation. I plan to extend `CoopReason` for cloud computing platforms.

I envision that in the near future, reasoning will be available as a service in the cloud, enabling millions of users around the globe to automate their reasoning needs. I expect that my contributions in distributed reasoning will play a vital role towards this vision.

References

[1] Serverless computing - aws lambda, amazon web services. `https://aws.amazon.com/lambda/`, 2014.

[2] Armin Biere, Md Solimul Chowdhury, Marijn J. H. Heule, Benjamin Kiesl, and Michael W. Whalen. Migrating solver state. In *Proceedings of SAT-2022*, volume 236 of *LIPIcs*, pages 27:1–27:24.