Post-doc position at INRIA Grenoble – Rhône-Alpes

Logical Causality in Distributed Systems

Background

Establishing liabilities in case of litigation is generally a delicate matter. It becomes even more challenging when IT systems are involved. Generally speaking, a party can be declared liable for a damage if a fault can be attributed to that party and that fault has caused the damage. A key issue is thus to establish convincing evidence with respect to the causality relation between the fault and the damage. This is especially complex when several faults occur and the impact of these faults on the occurrence of the failure has to be assessed.

The notion of causality has been studied for a long time in computer science, but with very different perspectives and goals. In the distributed systems community, causality is seen essentially as a temporal property [2]. In our context, the temporal ordering contributes to the analysis, but it is obviously not sufficient to establish the *logical causality* required to rule on a matter of liability: the fact that an event e_1 has occurred before an event e_2 does not imply that e_1 was the cause for e_2 (or that e_2 would not have occurred if e_1 had not occurred) [1].

Subject

Depending on the background and interests of the candidate, the work may encompass part or all of the following directions:

- Define an abstract notion of logical causality which can accommodate different models of computation.
- Consider more precise definitions of logical causality involving characterizations of the actual (and possibly erroneous) implementation of the components.
- Consider a notion of "group causality" which would apply to sets of actors rather than individual actors. For example, it may be the case that two events involving two actors satisfy together the criteria for necessary causality but none of them would satisfy these conditions individually.
- Study the prevention of causality by construction: e.g., how to design an architecture and contracts so as to avoid certain kinds of causality?
- Implement a prototype and validate the proposed framework on one or more case studies.

Required Skills

Candidates must have a PhD in computer science. Expertise in formal methods and programming experience are required. No specific background in law is expected.

Context

The research will be conducted in the INRIA research center in Grenoble in the context of a multidisciplinary project involving computer scientists and lawyers.

Grenoble is the capital of the French Alps and one of the most active areas in Europe for research in Information and Communication Technologies.

INRIA is the French National Institute for Research in Computer Science and Control. Created in December 1992, the INRIA Rhône-Alpes research unit hosts about 700 people, including more than 150 researchers and the same number of PhD students.

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Contact

The position is for 12 months. Applications, including curriculum vitae and bibliography, and the names and email addresses of two references, should be sent to **Gregor Gössler** and **Daniel Le Métayer**: gregor dot goessler at inria fr and daniel dot le dash metayer at inria fr.

References

[1] G. Gössler, D. Le Métayer, and J.-B. Raclet. Causality analysis in contract violation. In *RV*, LNCS, pages 270–284. Springer-Verlag, 2010.

[2] L. Lamport. Time, clocks, and the ordering of events in a distributed system. *CACM*, 21(7):558–565, 1978.