

VisualizeSLE: A Visual Editor for Separation Logic Entailments

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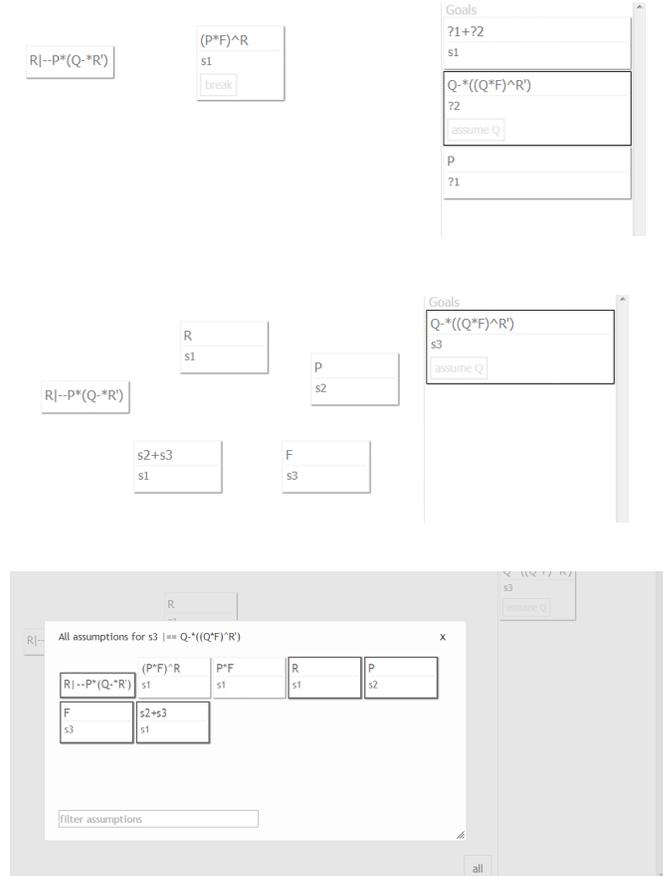
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Proposal. Separation logic has seen widespread use in program verification, both for hand proofs [Rey02] and in automated tools [BCO06]. Verifying programs requires many applications of the rule of consequence, but proving entailments by hand can be tricky. Automated tools work well for simple patterns, but often break down when formulae become complex (e.g., by including \rightarrow^*). Mechanical checkers have some advantages over paper proofs, but can be difficult to use. We propose VisualizeSLE, a visual proof editor for separation logic entailments. VSLE combines the advantage of machine checking while enabling a more intuitive “whiteboard-style proof”. The goal of our tool is to shift the cognitive load for user via graphical structures and to support the user by encouraging organization and management of intermediate proof steps (e.g., save, retrieval, replay).

A human’s working memory is limited in terms of the amount of information it can hold and the operations it can perform on that information [Swe88]. Working memory load can be divided into *intrinsic load*, which is due to the inherent complexity of the problem; *germane load*, which in our case relates to the size of the separation logic proof we are trying to construct; and *extraneous load*, which is the organizational and representational overhead of the tools being used [Kir02]. Our tool attempts to reduce germane load via appropriate visual metaphors [CG12] and to reduce extraneous load [Kir02] through effective interface design. We believe that these advances will free up cognitive resource to process the intrinsic and remaining germane load.

Screen shots. The VSLE interface is divided into two parts. On the left, we have the workspace, for the current objects being manipulated. Since we hide assumptions that have not been used recently, we also include an “all” button to access the hidden assumptions. On the right, we put the goals. Each goal and assumption is represented by a stickynote metaphor. A common format¹ for our notes is a formula over (supported by) a state, i.e., P supported by a_2 , which corresponds to the notation $a_2 \models P$. We have a similar format in which one set of states is over another set of states, indicating equality, i.e., $a_2 \oplus a_3 = s_1$. We use the standard symbol \vdash for entailment between formulae. Our eventual goal is to output these proofs into a nice human-readable format (via ASCII and LaTeX) as well as a machine-readable (and hence checkable) format (Coq). Please check out a video demo of our prototype at <http://www.comp.nus.edu.sg/~hobor/vsl>.

¹We are still working on getting the fonts, symbols, etc. into a LaTeX style.



References

- [BCO06] Josh Berdine, Cristiano Calcagno, and Peter O’Hearn. Smallfoot: Modular automatic assertion checking with separation logic. In *FMCO 2005*, 2006.
- [CG12] J. Cheon and Michael M. Grant. The effects of metaphorical interface on germane cognitive load in web-based instruction. In *Educational Technology Research and Development*, volume 60, pages 399–420, 2012.
- [Kir02] Paul A. Kirschner. Cognitive load theory: implications of cognitive load theory on the design of learning. In *Learning and Instruction*, volume 12, pages 1–10, 2002.
- [Rey02] John Reynolds. Separation logic: A logic for shared mutable data structures. In *LICS 2002: IEEE Symposium on Logic in Computer Science*, pages 55–74, July 2002.
- [Swe88] J Sweller. Cognitive load during problem solving: Effects on learning. In *Cognitive Science*, volume 12, pages 257–285, 1988.