VisualizeSLE:
A Visual Editor for Separation Logic Entailments

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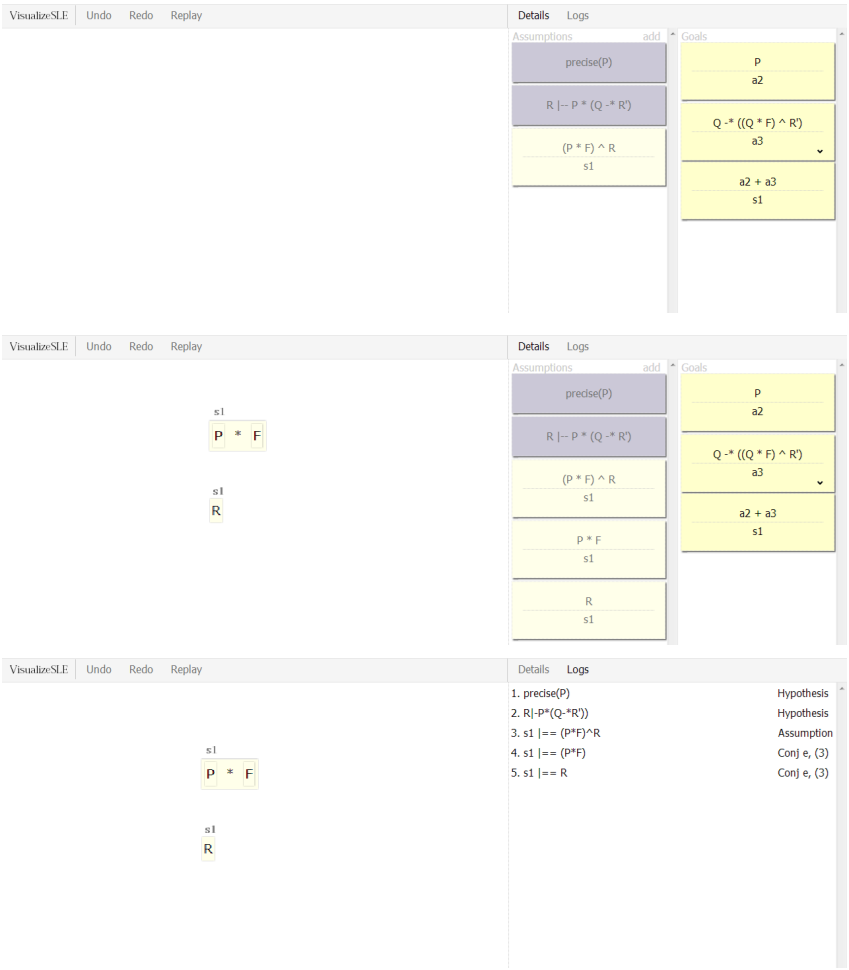
Proposal. Separation logic has seen widespread use in program verification, both for hand proofs [Rey02] and in automated tools [BCO06]. Verifying programs often requires many applications of the rule of consequence, but proving entailments by hand can be tricky. Automated tools work well for simple patterns, but often break down quickly when the formulae become complex (*e.g.*, by using $-\!\!*$). Mechanical checkers have some advantages over paper proofs, but can be extremely painful to use. We propose VisualizeSLE, a visual proof editor for separation logic entailments. VSLE combines the advantage of machine checking while enabling a more visual and intuitive "whiteboard-style proof". A key goal of our tool is to shift the cognitive load for user by using graphical structures and to support the user by encouraging organization and management of the 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 through 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 three parts. On the left, we have the workspace, for the current objects being manipulated. In the middle, we have the assumptions that are not currently being considered. On the right, we put the goals. Each goal and assumption is represented by a stickynote metaphor. A common format[1] 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, and track which formulae are precise.

Our first screen shot shows these metaphors in a setting in which we have some goals and assumptions but have not yet dragged anything into the leftmost workspace for immediate attention. Our second shows an intermediate state in the proof, in which we have selected the assumption $s_1 \models (P * F) \wedge R$ and then broken the conjunction into two pieces. Our final screen shot shows the "log", i.e., the current proof state. 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 scripts).

[1] We are still working on getting the fonts, symbols, etc. to match a LaTeX style.



References

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