Dependent Merges and First-Class Environments (Artifact)

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Abstract

This artifact contains the mechanical formalization of the calculi associated with the paper Dependent Merges and First-Class Environments. All of the metatheory has been formalized in Coq theorem prover. The paper studies a statically typed calculus, called E_i, with first-class environments. The main novelty of the E_i calculus is its support for first-class environments, together with an expressive set of operators that manipulate them.

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Keywords and phrases First-class Environments, Disjointness, Intersection Types

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Related Article Jinhao Tan and Bruno C. d. S. Oliveira, "Dependent Merges and First-Class Environments", in 37th European Conference on Object-Oriented Programming (ECOOP 2023), LIPIcs, Vol. 263, pp. 34:1–34:32, 2023. `https://doi.org/10.4230/LIPIcs.ECOOP.2023.34`

Related Conference 37th European Conference on Object-Oriented Programming (ECOOP 2023), July 17–21, 2023, Seattle, Washington, United States

Evaluation Policy The artifact has been evaluated as described in the ECOOP 2023 Call for Artifacts and the ACM Artifact Review and Badging Policy.

1 Scope

All of the metatheory and theorems stated in paper can be found in the artifact. There are two directories in the artifact: the calculus directory contains the definition and proofs of the main calculus, and the extension directory contains the definition and proofs of the extension with fixpoints.

1.1 Proof structure

- `Language.v` contains the definitions of the calculi.
- `Infra.v` contains some helper relations for proofs.
- `SubDis.v` contains properties of the subtyping and disjointness.
- `Determinism.v` contains the proofs of the determinism property.
- `TypeSafety.v` contains the proofs of the progress and type preservation properties.
- `Encoding.v` contains the proofs of the well-typed encoding of λ_i.

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1.2 Correspondence between paper and Coq proofs

Paper	File	Name in Coq
Lemma 2	`SubDis.v`	1. dis_sym; 2. dis_and; 3. dis_dom; 4. dis_rcd; 5. dis_arr; 6. dis_super
Lemma 4	`Determinism.v`	disjoint_val_consistent
Lemma 5	`Determinism.v`	value_closed
Lemma 6	`Determinism.v`	casting_unique
Theorem 7	`Determinism.v`	gen_step_unique
Corollary 8	`Determinism.v`	step_unique
Lemma 9	`TypeSafety.v`	casting_progress
Lemma 10	`TypeSafety.v`	casting_trans
Lemma 11	`TypeSafety.v`	consistent_after_casting
Lemma 12	`TypeSafety.v`	casting_preservation
Theorem 13	`TypeSafety.v`	gen_progress
Theorem 14	`TypeSafety.v`	gen_preservation
Corollary 15	`TypeSafety.v`	progress
Corollary 16	`TypeSafety.v`	preservation
Corollary 17	`TypeSafety.v`	gen_type_safety
Corollary 18	`TypeSafety.v`	type_safety
Theorem 20	`Encoding.v`	encoding_complete
Theorem 22	`SubDis.v`	algo_dis_eqv

2 Content

The artifact package includes:

- Coq formalization of the calculi discussed in paper
- `README.md`: the instructions of compliling the artifact
- `paper.pdf`: the companion paper

3 Getting the artifact

The artifact endorsed by the Artifact Evaluation Committee is available free of charge on the Dagstuhl Research Online Publication Server (DROPS). In addition, the Coq formalization within the artifact is also available at `https://github.com/tjhao/ecoop2023`.

4 Tested platforms

Any system with Docker available can access, compile, and test our artifact. We prepared a configured Docker image (on Docker Hub) containing all code and packages to compile and run our artifact. To build the proofs from scratch, one needs to install Coq and metalib. The detailed instructions can be found inside the `README.md`.

5 License

The artifact is available under Creative Common License on DARTS.

6 MD5 sum of the artifact

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7 Size of the artifact

496 KB