

EU TYPES WG 3: Types in Programming

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(Email me: include "COST WG 3" in subject)

TYPES Conference 2019
Oslo, Norway
11 June 2019

Tasks

- 1 The design, study and deployment in a concrete programming environment of type theories that capture other properties **beyond functional correctness**, for example, *resource usage*, matching *communications*, *secure multi-party* computation, and *modularity*. (Related to WG1)
- 2 Design and deployment of **new strongly typed programming languages**, update of existing languages with refined type systems based on the findings of this work group.
- 3 Automated reasoning tools and proof assistants, including **type inference** (possibly also for untyped code), **program synthesis**, and **matching** (for example to retrieve a piece of code from a library that should satisfy a given specification).

Progress reports for WG3 I

1 Patrick Bahr and Rasmus Møgelberg

- Modal type theory (RaTT) based on guarded recursion for implementing and verifying reactive programs. Simply-typed version at ICFP 2019: *Simply RaTT: A Fitch-style Modal Calculus for Reactive Programming Without Space Leaks*.

2 Henning Basold:

- A language for probabilistic guarded recursion based on a generalization of the topos of trees to arbitrary well-ordered index categories. CALCO-paper *Coinduction in Flow: The Later Modality in Fibrations*.

3 Lars Birkedal:

- With L. Skorstengaard and D. Devriese: POPL-2019 paper *StkTokens: enforcing well-bracketed control flow and stack encapsulation using linear capabilities* and *Reasoning about a capability machine with local capabilities: Provably safe stack and return pointer management*.

Progress reports for WG3 II

- With A. Karbyshev, K. Svendsen, A. Askarov: POST-2018 paper *Compositional non-interference for concurrent programs via separation and framing*.

④ Jesper Cockx:

- ICFP-2018 paper *Eliminating dependent (co)pattern matching*.

⑤ Bas Spitters: **Opening 7.5MEUR blockchain research center with strong emphasis on type theoretic verification and types in industry**, see

<http://cs.au.dk/research/centers/concordiumaudk/>.

- CSF-2018 paper on types and security (easycrypt): *Computer-aided proofs for multiparty computation with active security* with H. Haagh, A. Karbyshev, S. Oechsner, P-Y. Strub.
- *An Application of Computable Distributions to the Semantics of Probabilistic Programs* with D. Huang, G. Morrisett.
- CoqPL'19: *WIP: Formalizing the Concordium consensus protocol in Coq* with T. Dinsdale-Young, D. Tschudi and S. E. Thomsen.

Short Term Scientific Missions in WG3 I

Guest	Institute	Host	Institute
Paola Giannini	U. del Piemonte Orientale	Violet Ka I Pun	W. Norway U. of Applied Sciences

Using behavioural types and syntactic models of imperative calculi in the formalization and analysis of reliable systems.

Violet Ka I Pun	W. Norway U. Applied Sciences	Ferruccio Damiani	U. Torino
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Behavioural Aggregate Computing for the Internet of Things

Alceste Scalas	Imperial Coll.	Silvia Ghilezan	U. Novi Sad
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Precise subtyping for interleaved multiparty sessions

Nobuko Yoshida	Imperial Coll.	Silvia Ghilezan	U. Novi Sad
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Precise subtyping for interleaved multiparty sessions

Nobuko Yoshida	Imperial Coll.	Dimitrios Kouzapas	U. Cyprus
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A Uniform Framework for Governed Multiparty Session Semantics

Short Term Scientific Missions in WG3 II

Radu Ometita Fac. of Inform., Jorge A. Pérez U. Groningen
Iasi, RO

Using behavioral types for verifying communication correctness in the Scilla language.

Wen Kokke U. Edinburgh Fabrizio Montesi U. Southern DK

Better Late Than Never: A Fully Abstract Semantics for Classical Processes

Simona Kas- U. Novi Sad Alex Simpson U. Ljubljana
terovic

Probabilistic reasoning in lambda calculus

Ohad Kammar U. Edinburgh Matija Pretnar U. Ljubljana

Eff-Bayes: a modular Bayesian inference library with algebraic effects and handlers

Edwin Brady U. St Andrews Nicola Botta ETH Zurich

Abstraction in Idris for Sequential Decision Problems

Short Term Scientific Missions in WG3 III

Paolo Giarrusso EPFL Laussane Lars Birkedal Aarhus U.
Step-indexed logical relations for Dependent Object Types

WG3 topics at this meeting I

- Stephanie Weirich: *A Dependently-Typed Core Calculus for GHC*
- WG3 session (Thu afternoon): Types for programming, metatheory
 - Pedro Rocha and Luís Caires:
Towards Curry-Howard for Shared Mutable State
 - P. Bahr, C. U. Graulund and R. E. Møgelberg:
Simply RaTT: A Fitch-style Modal Calculus for Reactive Programming
 - Kenji Maillard, Danel Ahman, R. Atkey, G. Martinez, C. Hritcu, E. Rivas and E. Tanter: *Dijkstra monads for all*
 - Stefan Monnier and Nathaniel Bos:
How Erasure is Linked to (im)Predicativity
- Friday:
 - Adam Chlipala: *Challenges Scaling Type-Theory-Based Verification to Cryptographic Code in Production*
 - Abhishek Dang and Piyush Kurur: *Verse - An EDSL in Coq for verified low-level cryptographic primitives*

WG3 topics at this meeting II

- Anton Setzer: *A Model of the Blockchain using Induction-Recursion*
- Robert Atkey and James Wood: *Linear metatheory via linear algebra*

Events

- Past:
 - WG meeting at Aarhus University, DK, October 8-9 (Lars Birkedal, Bas Spitters).
 - WG meeting in Krakow, PL, 23-24 February 2019 (Keiko Nakata, Aleksy Schubert).
- Participate:
 - FSCD 2019, 24-30 June, Dortmund, DE.
 - ICFP 2019, 18-23 August, Berlin, DE.
 - Type-Driven Development TyDe 2019, 18 Aug 2019, with ICFP.
 - ITP 2019, 9-12 Sep, Portland, Oregon, US, with Coq Workshop 2019 and Proof Ground: Interactive Proving Contests
 - PPDP 2019, 7-9 Oct, Porto, PT.
- Contribute:
 - POPL 2020 (10 Jul) and CPP 2018 (21 Oct), 19-25 Jan 2020, New Orleans, US.
 - CoqPL 2020 !?

Dissemination

- Results of WG should be more visible.
- Gather results on webpage <https://eutypes.cs.ru.nl>.
- Link from STSMs on <https://eutypes.cs.ru.nl/STSMs> to result (paper, summary).