

# EU TYPES WG 3: Types in Programming

Moderator: Andreas Abel

`andreas.abel@gu.se`

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

TYPES Conference 2017

Budapest

29 May 2017

# 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).

## Some research topics of WG 3 (from 2016)

- Dependently typed programming
- Linear dependent types and session types
- Parametricity
- Other modalities (variance, irrelevance)
- Complexity analysis using types
- Type systems for security/privacy
- Type-safe meta- and generic programming
- Compiling dependent types
- Termination checking
- Universe polymorphism
- Partiality inside type theory
- Liquid/refinement typing
- Reactive programming

# Workshop Type-Theoretic Tools (POPL 2017, Paris)

- Joint workshop of WGs 2–4, organized by Assia and Keiko.
- WG3-related talks:
  - *A Case Study in Programming Coinductive Proofs in Beluga: Howe's Method* (David Thibodeau, Alberto Momigliano, Brigitte Pientka)
  - *Needle & Knot: A Framework for Meta-Theoretical Specifications with Binding* (Steven Keuchel, Klara Mardirosian, Tom Schrijvers)
  - *Equations: a tool for dependent pattern-matching* (Cyprien Mangin, Matthieu Sozeau)
  - *Iris: a framework for higher-order concurrent separation logic in Coq* (Robbert Krebbers)
  - *agdARGS - Declarative Hierarchical Command Line Interfaces* (Guillaume Allais)

## Short Term Scientific Missions in WG3

Guest	Institute	Host	Institute
Amin Timany	KU Leuven (BE)	Lars Birkedal	Aarhus U (DK)
<i>Logical relations for effectful programming languages</i>			
Victor Miraldo	U Utrecht (NL)	Pierre E Dagan	LIP6 Paris (FR)
<i>Structure Aware Version Control</i>			
Petros Stefaneas	NTU Athens (EL)	Silvia Ghilezan	U Novi Sad (RS)
<i>Type-Checking Conditional Purpose-Based Privacy Policies in the pi-calculus</i>			
Nobuko Yoshida	Imp C London (UK)	Silvia	
<i>Precise asynchronous subtyping for multiparty session types</i>			
Joao P Pizani Flor	U Utrecht (NL)	Mary Sheeran	Chalmers (SE)
<i>Parallel and sequential circuits in Agda</i>			
Stephan Adelsberger	WU Vienna (AT)	Anton Setzer	Swansea U (UK)
<i>Object-Oriented Programming in Dependent Type Theory</i>			

## WG3 topics at this meeting

- Meta-programming
  - Type-Safe Code Generation (Thomas Winant, J. Cockx, D. Devriese)
  - Contextual Types (Francisco Ferreira, D. Thibodeau, B. Pientka)
- Modal typing
  - Resource typing (Guillaume Allais; D. Kesner and P. Vial)
  - Irrelevance (A. Abel, A. Vezzosi, T. Winterhalter)
  - Parametricity (A. Nuyts, A. Vezzosi, D. Devriese)
- Containers
  - Monadic containers (T. Altenkirch and G. Pinyo)
  - Container monads (T. Uustalu and N. Veltri)
- Processes (B. Igried and A. Setzer)
- Effects (M. Bärenz and S. Seufert)
- Bitcoins (A. Setzer)

## Challenges and focus topics

- Impact a greater audience (dependent Haskell)
- Monadic dependently typed programming:  
Implement a (d.t.) programming language with well-scoped syntax!
- Can we compile better with dependent types? (Idris)
- Dependently-typed meta-programming
- Advance and utilize modal/quantitative type theories  $x :^m A \vdash t : B$
- ...

## Events

- ICFP and FSCD, 3 - 9 Sep 2017
- Type-Driven Development TyDe 2017, 3 Sep 2017, with ICFP  
*2 page extended abstracts until 7 June*
- POPL 2018 (7 Jul) and CPP 2018 (6 Oct), 8 - 13 Jan 2018
- WG 3 meeting early 2018



# Old Slides



## Working Group 3: Types for programming

Type-based programming increases the security, reliability, resilience and reusability of software as evidenced by the increasingly popularity of strongly typed languages and the widespread use of types in applied programming language research.

The notion of type-based programming includes

- 1 programming languages that provide strong type systems that are either checked statically (Java, Haskell, Agda, ML) or dynamically (Scheme)
- 2 and to a limited extend also untyped languages (JavaScript, Tcl, PHP) that can only be analysed by third party tools,
- 3 as well as software engineering practises that use type theory.

# Activities, Milestones, and Major Deliverables

## Activities:

- 1 In year 1: set up the Working Group; have a joint meeting; define its research agenda.
- 2 In years 2, 3, 4: joint meeting of the WG; report on the progress in light of the research agenda; discuss and adapt the research agenda if needed.

## Milestones and Major Deliverables:

- 1 Minutes of the WG meeting
- 2 List of output of the past year
- 3 Research agenda

## What we want to do:

- Gather ongoing research efforts: topics, groups, papers
- Stimulate research and collaboration through
  - ① WG 3 meetings (we can invite speakers)
  - ② STSMs
- Document state-of-the-art and research agenda for EU

# Activities

- Dissemination: EUTYPES wiki
- Industrial contacts
- Next meeting WG 3 in Paris, Jan 2017 (POPL)
- ...