A Gentle Adventure Mechanising Message Passing Concurrency Systems

An experience report/walkthrough.

VEST 2021

Based on work by: David Castro Pérez, Francisco Ferreira, Lorenzo Gheri, and Nobuko Yoshida.
The Story so Far

Nobuko
The Story so Far

Nobuko

Francisco
The Story so Far

Let’s work on mechanisation!

Nobuko

Francisco
The Story so Far

Let's do binary session types as a case study. It should be easy!
The Story so Far

Nobuko
Francisco
David
The Story so Far

Nobuko

Francisco

David
The Story so Far

It was quite a bit of time and effort, but we finished it!
The Story so Far

Nobuko
Francisco
David
Now there’s four of us. Let’s try multiparty types this time. It should be easy!
The Story so Far
This Brings us to Today (1)

• We formalised:
  • Binary Session Types (subj. red.)
  • Multiparty Types (trace equivalence).
  • Zooid: An executable process language (certified type checking).

• Tools we used:
  • The Coq proof assistant.
  • Locally Nameless (LN) binders.
  • Ssreflect to structure proofs.
  • Parametrised Coinduction (PACO) to do coinduction.
This Brings us to Today (2)
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- We want to talk about:
  - Our case study, binary session types.
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  • The EMTST tool for LN with multiple scopes.
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We prepared ‘smol’ versions of the systems.
Offline Material Available

Code to fiddle with (and maybe even contribute).

- Repository for the reduced systems:
  - http://github.com/emtst/gentleAdventure
Outline

For real this time.

• David with an introduction to Ssreflect.
• Francisco will present a smol-EMTST.
• David will talk about smol-Zooid, a DSL for multiparty processes.
• Lorenzo will present the proof that makes smol-Zooid a certified DSL.
• If there is time, we want to say something about some ideas for the future.
Introduction to Ssreflect