

Using Session Types for Reasoning About Boundedness in the π -Calculus

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The notion of depth-bounded processes was introduced by Meyer in [2]. A process P is depth-bounded at level k if there is an upper bound k , such that any reduction sequence for P will only lead to successor processes with at most k active bound names. The class of depth-bounded processes is expressive and contains a variety of other classes of tractable subsets of the π -calculus.

It is known that notions of termination and coverability are decidable for depth-bounded processes. For any given k , it is decidable if a process P is depth-bounded at level k ; however, it is undecidable if there exists a k for which P is depth-bounded [2].

In a more recent paper [1], D’Oswaldo and Ong have introduced a type system for depth-boundedness which is a sound characterization of depth-boundedness: If P is well-typed, then P is depth-bounded.

We present two binary session type systems that capture depth-boundedness and name-boundedness in the π -calculus. The advantages of using session types are the following: Firstly, session type disciplines make it straightforward to keep track of where names appear. The linear nature of linear session names ensures that every name of this kind will at every point during a computation, when the name is in use, be found in precisely two parallel components. Secondly, the session type disciplines are resource-conscious; we can therefore ensure that new bound names are only introduced whenever existing bound names can no longer be used.

References

- [1] Emanuele D’Osualdo and Luke Ong. A type system for proving depth boundedness in the pi-calculus. *CoRR*, abs/1502.00944, 2015.
- [2] Roland Meyer. On boundedness in depth in the pi-calculus. In Giorgio Ausiello, Juhani Karhumäki, Giancarlo Mauri, and C.-H. Luke Ong, editors, *Fifth IFIP International Conference On Theoretical Computer Science - TCS 2008, IFIP 20th World Computer Congress, TC 1, Foundations of Computer Science, September 7-10, 2008, Milano, Italy*, volume 273 of *IFIP*, pages 477–489. Springer, 2008.