

Interaction Nets and Concurrency

Damiano Mazza

Institut de Mathématiques de Luminy

Dipartimento di Filosofia Università “Roma Tre”

mazza@iml.univ-mrs.fr

<http://iml.univ-mrs.fr/~mazza>

January 2, 2005

Abstract

Interaction Nets (IN) are a model of distributed computation introduced by Lafont [Laf90], which can be seen as a generalization of Girard’s multiplicative proof-nets [Gir87]. They admit an extremely simple system of universal combinators [Laf97], which has a very natural algebraic semantics in the style of the so-called Geometry of Interaction (GoI, [Gir88]).

Even though IN are Turing-complete, their strong determinism prevents them from expressing concurrent behavior. In his Ph.D. thesis [Ale99], Vladimir Alexandriev has defined several non-deterministic extensions of IN. We consider here what he called Interaction Nets with Multiple Principal Ports (INMPP), and we show that they are a very expressive model of concurrent computation by encoding within them the π -calculus (without sums or match). We also show that INMPP too admit a surprisingly simple system of universal combinators, which is an extension of Lafont’s system. These combinators may be the key to the definition of a “cuncurrent GoI”, possibly throwing a bridge between the worlds of logic and concurrency.

References

- [Ale99] Vladimir Alexandriev. *Non-deterministic Interaction Nets*. Ph.d. thesis, University of Alberta, 1999.
- [Gir87] Jean-Yves Girard. **Linear Logic**. *Theoretical Computer Science*, 50(1):1–102, 1987.
- [Gir88] Jean-Yves Girard. **Geometry of Interaction I: interpretation of Systef F**. In *Proceedings of Logic Colloquium ’88*, pages 221–260. ASL, North Holland, 1988.
- [Laf90] Yves Lafont. **Interaction Nets**. In *Conference Record of the Seventeenth Annual ACM Symposium on Principles of Programming Languages*, pages 95–108. ACM SIGACT and SIGPLAN, ACM Press, 1990.
- [Laf97] Yves Lafont. **Interaction Combinators**. *Information and Computation*, 137(1):69–101, 1997.