Review of *On the expressiveness of π-calculus for encoding Mobile Ambients.*

The *pi-calculus* by Milner, Parrow and Walker and *Ambient calculus* by Cardelli and Gordon are among the most representative formalisms in concurrency theory. Though they model the same phenomenon, namely mobility (or mobile computation), they do so in a rather different way. In the pi-calculus the entities that move are *links* (often referred as names, channels) and they move in the virtual space of linked processes. In the ambient calculus, *processes* are the entities that move in and out of computing sites.

Milner claimed in [1] that spatial mobility can be reduced to the link mobility, thus the appealing of the calculus is its simplicity and generality. A contribution of this paper is to validate Milner's claim by encoding the ambient calculi into pi calculus. Of course, both calculi are Turing expressive so in principle they can trivially encode each other. However, in concurrency theory one is often interested in satisfying structural and behavioral properties inherent from concurrent and distributed systems. The authors prove that the encoding is compositional for parallel composition, sum, and restriction; in other words it preserves structure of the encoded (ambient) systems. The correctness of the encodings is stated by means of a convincing operational correspondence between source and target terms. The encoding, however, does not preserve divergency but the authors argue that the kind of divergence introduced can be detected and avoided. Another positive aspect of the encoding is that uses links to naturally express the spatial location of processes within ambients, once again supporting Milner's claim about the generality of the pi-calculus. Pi-calculus links has been used to express several data structures such as list and graphs, thus it is natural to use them to express ambients hierarchies that can be seen as tree structures reflecting spatial location and containment.

The paper is general well structured and well written and the encoding is explained with several examples. I do have some reservations about some comments and the

presentation of some mathematical statements in the paper (see below). In particular there are informally defined concepts in statements that should be made more precise (e.g., “Interaction” in Proposition 2). I think the paper is a good contribution to the study of expressiveness as it validates the generality of link mobility and therefore it should be accepted. I suggest the authors, however, to address the issues below.

Corrections and comments:

- Page 2: You haven’t defined what T(.) is
- Page 4: The comment about separated/mixed choice does not really apply since the present encoding introduces divergence: I.e., in principle one could have an encoding of ambients into pi with separate choice that introduces divergence.
- Page 5: Using structural congruence (in particular alpha-conversion) with the muX.P construct as done in the paper causes technical problems: It introduces dynamic scope. Check [2] for exact details.
- Definition 4: Shouldn’t the Q after Qt be Q’ ?
- Definition 5 : Remove “…” at the end of Definition 5?
- Page 13: Api is awkwardly defined as a process but it is a set of processes.
- Proposition 2: The notions of “interaction” is not formally defined.

References:

[1] Communicating and Mobile Systems. **ISBN-10:** 0521658691

[2] On the Expressiveness of Infinite Behavior and Name Scoping in Process Calculi. FoSSaCS 2004: 226-240. 2004.