Concurrency: Theory, Languages and Programming

– Pi Calculus Examples –

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Replication via Recursion

In the presence of process identifiers, recursion means that a process identifier defined by

can be used in any process term by means of instantiation. Note that could also be used like this within itself . . .

Using recursion, how can we model/simulate replication? Define a process identifier that, when triggered, “behaves roughly like” □

Recursion via Replication

Using replication, recursion can be modeled through:

1. invent name to stand for identifier
2. for any ,
let denote the result of replacing any call by
3. replace by

Example:

Unbounded Buffers

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where

Follow the sequence to convince yourself that the buffer process is indeed a buffer (FIFO) and that it can grow unboundedly.

Note the “type” of the stored values . . .

Note the behavior of empty cells inside a buffer “chain”.

Elastic Buffers

Make the buffer elastic,
i.e., make empty cells disappear!

Several design decisions to be taken concern the question *when* an empty cell should cut itself out of a chain and die.

- if empty cell is next to a full/empty cell?
- if empty cell is left/right to a cell?
- should it be *allowed* (suicide)
  or *forced* (murder) to die?

One goal of this exercise is to make you think about how to argue for or against that the various design decisions above lead to equivalent solutions.

Elastic Buffers: Setup

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where

Elastic Buffers: cut-when-left

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Elastic Buffers: cut-when-right

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