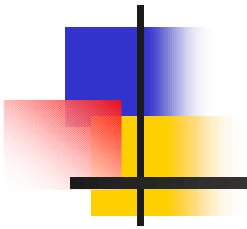


Making Ambients More Robust

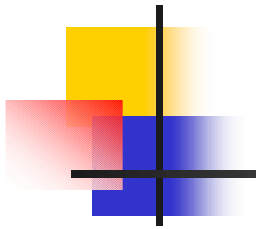
Xudong Guan

Distributed Computing Technology Center

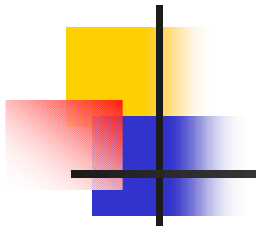
Shanghai Jiao Tong University

WCC-ICS2000, Beijing, Aug 22th, 2000

Calculi for wide area and mobile computation



- The pushing forces behind:
  - Internet, laptop, WAP, H21;
  - Network computing, mobile agent;
- A few examples (related work):
  - λ-dist @ Tokyo U.
  - Variations of π-calculus
  - Distributed Join calculus
  - Seal calculus

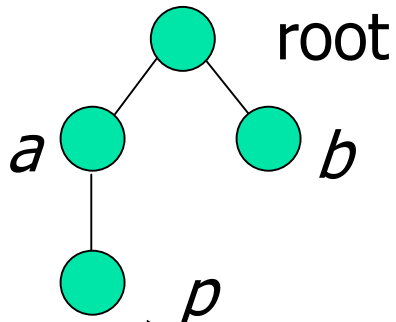


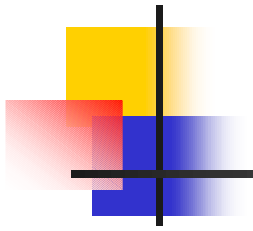
Ambient calculi

- Mobile Ambient (MA)
- Safe Ambient (SA)
- Robust Ambient (ROAM) - this work

The Mobile Ambient calculus

- An example:
  $a[p[out\ a.in\ b.\langle M\rangle]] \mid b[open\ p.(x).P\ ]$
- Ambient
  - $a[...]$, $p[...]$, $b[...]$
- Capabilities
  - Movement (*in*、*out*), action (*open*)
- Local communication
  - output: $\langle M\rangle$, input: $(x).P$





The grave interference in MA

- $h[\,] \mid n[in\ h \mid m[out\ n.P]]$

- first *in* *then* *out*:
  $\rightarrow\ h[n[m[out\ n.P]]] \ \rightarrow\ h[n[\,] \mid m[P]]$

- first *out* then *in*:
  $\rightarrow\ h[\,] \mid n[in\ h] \mid m[P] \ \rightarrow\ h[n[\,]] \mid m[P]$

Safe Ambient

The key of the reduction order

- $h[\overline{in}\ h] \mid n[\overline{out}\ n.in\ h \mid m[out\ n.P]]$

  $\rightarrow h[\overline{in}\ h] \mid n[in\ h] \mid m[P]$

  $\rightarrow h[n[\ ]] \mid m[P]$

  coactions($\overline{in}$, $\overline{out}$, $\overline{open}$) guarantee the reduction order and eliminate the grave interference in MA

Malicious tampering of coactions in SA

- $n[in\ m.\overline{open}\ n.P] \mid m[\overline{in}\ m.open\ n.Q] \mid h[in\ m]$

desired redex

- $n[in\ m.\overline{open}\ n.P] \mid m[\overline{in}\ m.open\ n.Q] \mid h[in\ m]$

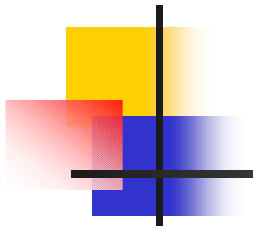
malicious tampering

Solution: Explicit coaction parameter

- $n[in\ m.open\ n.P] \mid m[\overline{in}\ n.open\ n.Q] \mid h[in\ m]$

  This coaction could only be consumed by n

- hence the Robust Ambient calculus

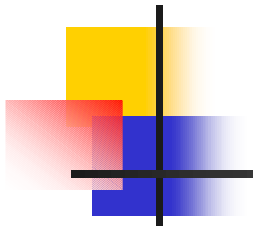


Type system for ROAM

- Mobility - mobile, immobile
- Threads - 0, 1, 1^+, n
  - Why 1^+ ? Example:

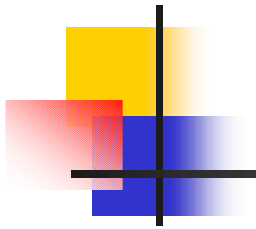
$$n[open\ m.P \mid m[Q]]$$

Assume Q is single threaded,
n seen to be single threaded as well, but this depends on P ...



The expressiveness of ROAM

- Firewall crossing
- Asynchronous π-calculus
  - Message exchange in named ambients
- Can even encode π-calculus with pure ROAM calculus (without message exchange) - our next paper.
  - Substitution and message exchange in named ambients



Thank you!

- For more information, please visit:
  Xudong Guan's Mobile Ambient page at:

  http://go.163.com/~mobileambient/

  (online papers, researchers, other resources related to Ambient calculi)