Balzer 3

(from POV providing process
+ are sending
− are receiving

Curry - Howard Correspondence:

linear propositions	session types	polarity
$A \,\&\, B$	external choice	− (client can choose)
$A \oplus B$	internal choice	+
$A \multimap B$	channel input	−
$A \otimes B$	channel output	+
1	termination	+

Cut (view as spawning a new process)

$$\frac{\Delta \vdash P :: (x:A) \qquad \Delta', x:A \vdash Q :: (z:C)}{\Delta, \Delta' \vdash x \leftarrow P; Q :: (z:C)}\ \text{cut}$$

parallel composition in π-calculus
also can view as spawning a process

$$\frac{}{y:A \vdash \text{fwd}\ x\ y :: (x:A)}\ \text{ID}$$

forward x to y
form of delegation

cut gives rise to computational flavor

computational meaning to correspondence

cut reduction brings together a left rule
w/ right rule so they can talk w/ each other

cut reduction

pushes the cut up to a smaller type
s.t. you can cut at the continuations

correspondence of intuitionistic linear logic w/ session types

Operational semantics

Multiset rewriting rules

$S \rightarrow T$

system described by series predicates that hold about that system

rules apply locally

$$proc(c_1, P_{c_1}) \ldots proc(c_n, P_{c_n})$$

c_1: channel along which P offers

P_{c_1}: Process term which currently executing

similar idea to separation logic
(only describe what changes)

termination

(1) $proc(c, wait\ a; Q), proc(a, close\ a)$ ← no continuation since it dies after close

$\rightarrow proc(c, Q)$

(note: this is a local definition)

[client] [provider]

(&) $proc(c, a.l_h; Q), proc(a, case\ a\ of\ \overline{l \Rightarrow P})$

$\rightarrow proc(c, Q), proc(a, P_h)$

(cut) $proc(a, x \leftarrow P; Q_x)$

$\rightarrow proc(a, [b/x]Q), proc(b, P)$

(b is fresh)

(fwd) $proc(a, fwd\ a\ b)$

$\rightarrow a = b$

(could also keep alive and forward process)

type safety

progress & preservation

session fidelity

do we satisfy preservation in linear setting

guarantee only one client

client / provider always align

Ω empty configuration
or set of proc predicates

$\Omega ::= \cdot \mid proc(a, P_a), \Omega'$

well (typed formed) configs
offers channels in Δ

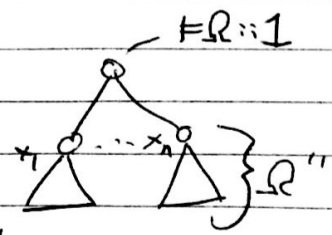
Preservation If $\vdash \Omega :: \Delta$

and $\Omega \mapsto \Omega'$

then $\vdash \Omega' :: \Delta$

delta Δ

Ω is really a tree, has root
other nodes w/ other subtrees



at top level, going to offer session of type 1

induct over configuration, level-by-level

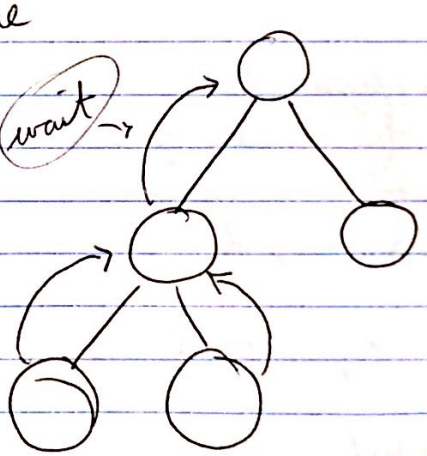
$\Omega'' :: (x_1 : B_1, \cdots, x_n : B_n)$

Progress (came across this while trying to deal w/ deadlock)

right rule
willing to talk
along offering channel

when left & right rule meet
denote synchronization points

in general, if it were not a tree, there could be a circularity creating (wait) → deadlock



globally always be one process able to step