Progress

Assume: Show:

(1) $\vdash H : *$ (I) $H, TS \rightsquigarrow H', US$

(2) $H \vdash TS, WS$ (II) $\vee\ TS = \emptyset \wedge WS = \emptyset$

(3) H, TS, WS ok (III) $\vee\ FS = F \circ FS'$ where some things null

Case distinction on TS, WS

- $\emptyset, \emptyset$: Done by (II)
- $\emptyset, WS$: I by Reducable Taskset (.pdf)
- $\{(f, k, FS)\} \uplus TS', WS$:

  Case distinction on FS:

  - $\langle L, x, P\rangle^{L} \circ \varepsilon$: $\rightsquigarrow H, T \uplus TS', WS \rightsquigarrow H, TS', WS$ by E-TASK-DONE
  - ε:

    $\langle L, u, P\rangle^{L} \circ FS'$:

    Induction on u:

    See following pages

$F = \langle L, \text{async}(b, x \Rightarrow t)\{u\}, \{p\} \uplus P \rangle^l$

Show: (IV) $L(b) = b(o,p)$

(5) $H \vdash F : \sigma$ by (2), T-FS-A, T-FS-NA
$H \vdash \Gamma ; L$ by prev, T-FRAME1
(7) $\forall x \in dom(\Gamma).\ H \vdash \Gamma ; L ; x$

(6) $\Gamma ; a \vdash \text{async}(b, x \Rightarrow t)\{u\} : \tau$ by (5), T-FRAME1
(9) $\Gamma ; a \vdash b : Q \rhd Box[C]$ by prev, T-ASYNC
(10) $b \in dom(\Gamma)$ by prev, T-VAR
(8) $H \vdash \Gamma ; L ; b$ by prev, (7)

$L(b) = null$
$\lor\ L(b) = o \land typeof(H, o) <: \Gamma(b)$ $\Rightarrow$ false, typeof can never be $Box[C]$
$\lor\ L(b) = b(o,p) \land \Gamma(b) = Q \rhd Box[C] \land typeof(H, o) <: C$ by prev, WF-VAR

$L(b) = null \lor L(b) = b(o,p)$ by (9), T-VAR, prev
(under "(9), T-VAR": $\Gamma(b) = Box[C]$)

$\Downarrow$ shows (III) or $\Downarrow$ (IV)

(V) $p \in P$

$\forall Perm[Q] \in \Gamma.\ \gamma(Q) \in P$ by WF-Perm, injective γ

$\Gamma(b) = Q \rhd Box[C] \land L(b) = b(o,p) \land Perm[Q] \in \Gamma \Rightarrow p \in P$ by WF-PERM, prev
(under the terms, in order: (9), T-VAR; IV; (6), T-ASYNC)

if eval gets stuck (III)
showing (V) doesn't matter

$F = \langle L, \text{let } x = \text{finish } \{t\} \text{ in } s, P \rangle^c$

Show: $\varnothing$

Preconditions of the other rules were not changed. As such, the proofs from LaCasa can be reused. Changes to E-Capture etc. only modify the new tasks.