KTH ROYAL INSTITUTE
OF TECHNOLOGY

Degree Project in Technology

First cycle, 15 credits

This is the title in the language of the thesis

A subtitle in the language of the thesis

FAKE A. STUDENT
FAKE B. STUDENT

Stockholm, Sweden, 2024

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A subtitle in the language of the thesis

FAKE A. STUDENT

FAKE B. STUDENT

Bachelor's Programme in Information and Communication Technology
Date: January 26, 2024

Supervisors: A. Busy Supervisor, Another Busy Supervisor, Third Busy Supervisor
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School of Electrical Engineering and Computer Science
Host company: Företaget AB
Swedish title: Detta är den svenska översättningen av titeln
Swedish subtitle: Detta är den svenska översättningen av undertiteln

0.1 Inference Rules

$$\text{T-TASK}\ \frac{x : C; ocap \vdash t : \tau \qquad \Gamma; a \vdash b : Q \rhd Box[C]}{\Gamma; a \vdash task(b)\{x \Rightarrow t\} : Q \rhd Task[C]}$$

$$\text{T-ASYNC}\ \frac{Perm[Q] \in \Gamma \qquad \Gamma \setminus Perm[Q]; a \vdash s : \sigma \qquad \Gamma; a \vdash x : Q \rhd Task[C]}{\Gamma; a \vdash async(x)\{s\} : \bot}$$

$$\text{T-FINISH}\ \frac{\Gamma; a \vdash t : \tau}{\Gamma; a \vdash finish\{t\} : null}$$

$$\text{E-TASK}\ \frac{L(b') = b(o,p)}{\begin{array}{l} H, \{(f, \langle L,\ let\ x = task(b')\{x \Rightarrow t\}\ in\ s,\ P\rangle^l)\} \uplus TS \\ \rightsquigarrow\ H, \{(f, \langle L[x \to task(b(o,p),t)],\ s,\ P\rangle^l)\} \uplus TS \end{array}}$$

$$\text{E-ASYNC}\ \frac{\begin{array}{c} L(y) = task(b(o,p),t) \qquad p \in P \\ T_1 = (f, \langle L,\ s,\ P\rangle^\epsilon) \qquad T_2 = (f, \langle [x \to o],\ t,\ \emptyset\rangle^\epsilon) \end{array}}{\begin{array}{l} H, \{(f, \langle L,\ async(y)\{s\},\ P\rangle^l \circ FS)\} \uplus TS \\ \rightsquigarrow\ H, \{T_1, T_2\} \uplus TS \end{array}}$$

$$\text{E-FINISH1}\ \frac{T = (f', \langle L,\ t,\ P\rangle^\epsilon) \qquad f' fresh}{\begin{array}{l} H, \{(f, \langle L,\ let\ x = finish\{\ t\ \}\ in\ s,\ P\rangle^l \circ FS)\} \uplus TS \\ \rightsquigarrow\ H, \{(f, \langle FINISH\, f'\rangle \circ \langle L[x \to null],\ s,\ P\rangle^l \circ FS)\} \uplus \{T\} \uplus TS \end{array}}$$

$$\text{E-FINISH2}\ \frac{\nexists (f', FS) \in TS}{\begin{array}{l} H, \{(f, \langle FINISH\, f'\rangle \circ FS)\} \uplus TS \\ \rightsquigarrow\ H, \{(f, FS)\} \uplus TS \end{array}}$$

$$\text{E-TASK-DONE}\ \frac{}{H, \epsilon \uplus TS \rightsquigarrow TS}$$

$$\text{WF-VAR}\ \frac{\begin{array}{c} L(x) = null \vee \\ L(x) = o \wedge typeof\,(H, o) <: \Gamma(x) \vee \\ L(x) = b(o,p) \wedge \Gamma(x) = Q \rhd Box[C] \wedge typeof\,(H, o) <: C \end{array}}{H \vdash \Gamma; L; x}$$

$$\text{WF-PERM}\ \frac{\begin{array}{c} \gamma : permTypes(\Gamma) \longrightarrow Pinjective \\ \forall x \in dom(\Gamma). \\ (\Gamma(x) = Q \rhd Box[C] \wedge L(x) = b(o,p) \wedge Perm[Q] \in \Gamma \vee \\ \Gamma(x) = Q \rhd Task[C] \wedge L(x) = task(b(o,p), t) \wedge Perm[Q] \in \Gamma) \\ \Longrightarrow \gamma(Q) = p \end{array}}{\vdash \Gamma; L; P}$$

$$\text{WF-ENV}\ \frac{\begin{array}{c} dom(\Gamma) \subseteq dom(L) \\ \forall x \in dom(\Gamma). H \vdash \Gamma; L; x \end{array}}{H \vdash \Gamma; L}$$

$$\text{T-FRAME1}\ \frac{\begin{array}{cc} \Gamma; a \vdash t : \sigma & l \neq \epsilon \Longrightarrow \sigma <: C \\ H \vdash \Gamma; L & H \vdash \Gamma; L; P \end{array}}{H \vdash \langle L,\ t,\ P \rangle^{l} : \sigma}$$

$$\text{T-FRAME2}\ \frac{\begin{array}{cc} \Gamma; x : \tau; a \vdash t : \sigma & l \neq \epsilon \Longrightarrow \sigma <: C \\ H \vdash \Gamma; L & H \vdash \Gamma; L; P \end{array}}{H \vdash^{\tau}_{x} \langle L,\ t,\ P \rangle^{l} : \sigma}$$

$$\text{T-FRAME-NA}\ \frac{H \vdash F^{\epsilon} : \sigma \qquad H \vdash FS}{H \vdash F^{\epsilon} \circ FS}$$

$$\text{T-FRAME-NA2}\ \frac{H \vdash^{\tau}_{x} F^{\epsilon} : \sigma \qquad H \vdash FS}{H \vdash^{\tau}_{x} F^{\epsilon} \circ FS}$$

$$\text{T-FRAME-A}\ \frac{H \vdash F^{x} : \sigma \qquad H \vdash^{\sigma}_{x} FS}{H \vdash F^{x} \circ FS}$$

$$\text{T-FRAME-A2}\ \frac{H \vdash^{\tau}_{x} F^{y} : \sigma \qquad H \vdash^{\sigma}_{y} FS}{H \vdash^{\tau}_{x} F^{y} \circ FS}$$

$$\text{T-VAR}\ \frac{x \in dom(\Gamma)}{\Gamma; a \vdash x : \Gamma(x)}$$