Typing Rules and Evaluation rules

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1 Fork

$$\frac{\Gamma|\mathbb{L} \vdash t:\ T}{fork\{\ t\ \}:\ Thread\ T} \qquad \text{(T-FORK)}$$

$$\frac{t_1 \rightarrow t'_1}{fork\{\ t_1\ \} \rightarrow fork\{\ t'_1\ \}} \qquad \text{(E-FORK)}$$

$$\frac{\Gamma|\mathbb{L} \vdash t:\ Thread\ T}{wait\ t\ :\ T} \qquad \text{(T-WAIT)}$$

$$\frac{t \rightarrow t'}{wait\ t\ \rightarrow wait\ t'} \qquad \text{(E-WAIT)}$$

$$\frac{\Gamma|\mathbb{L} \vdash t:\ Thread\ T}{wait\ t\ :\ T} \qquad \text{(T-WAITFORK)}$$

$$\frac{t_1 \rightarrow t'_1}{wait\ t_1 \rightarrow wait\ t'_1} \qquad \text{(E-FORK)}$$

$$wait\ fork\{\ v\ \}\ \rightarrow v \qquad \text{(E-WAITFORK)}$$

2   Mutex

$$\frac{}{\Gamma|\mathbb{L} \vdash mutex < X >: \ Mutex \ X} \quad \text{(T-Mutex)}$$

$$\frac{\Gamma|\mathbb{L} \vdash x: \ Mutex \ X \qquad \Gamma \vdash v : T}{ref < x > v: \ Ref < X > T} \quad \text{(T-RefMutex)}$$

$$\frac{t_1 \to t_1'}{ref < x > t_1 \to ref < x > t_1'} \quad \text{(E-RefMutex)}$$

$$\frac{\Gamma|\mathbb{L} \vdash t_1 : Ref < X > T \qquad X \in \mathbb{L}}{\Gamma|\mathbb{L} \vdash !t_1 : T} \quad \text{(T-DerefMutex)}$$

$$\frac{\Gamma|\mathbb{L} \vdash t_1 : Ref < X > T \qquad \Gamma \vdash t_2 : T \qquad X \in \mathbb{L}}{\Gamma|\mathbb{L} \vdash t_1 := t_2 : Unit} \quad \text{(T-AssignMutex)}$$

$$\frac{t_1|\mu \to t_1'|\mu'}{ref < x > \ t_1|\mu \to ref < x > \ t_1|\mu} \quad \text{(E-RefMutex)}$$

$$\frac{l \notin dom(\mu)}{ref < x > \ v|\mu \to l|\mu, l \mapsto v} \quad \text{(E-RefV)}$$

$$\frac{t_1|\mu \to t_1'|\mu'}{!t_1|\mu \to !t_1'|\mu} \quad \text{(E-Deref)}$$

$$\frac{\mu(l) = v}{!l|\mu \to v|\mu} \quad \text{(E-DerefLoc)}$$

$$\frac{t_1|\mu \to t_1'|\mu'}{t_1 := t_2|\mu \to t_1' := t_2|\mu} \quad \text{(E-Assign1)}$$

$$\frac{t_2|\mu \to t_2'|\mu'}{v := t_2|\mu \to v := t_2'|\mu} \qquad \text{(E-Assign2)}$$

$$\frac{\mu(l) = v}{l := v|\mu \to unit|\mu, l \mapsto v} \qquad \text{(E-AssignV)}$$

3 Lock

$$\frac{tail(\mathbb{L}) <_{lex} X \qquad \Gamma|\mathbb{L} \vdash t_1 : Mutex\ X \qquad \Gamma|(\mathbb{L}, X) \vdash t_2 : T}{lock\ t_1\ t_2 : T} \qquad \text{(T-Lock)}$$

$$\frac{t_1 \to t_1'}{lock\ t_1\ t_2 \to lock\ t_1'\ t_2} \qquad \text{(E-Lock1)}$$

$$\frac{t_2 \to t_2'}{lock\ v_1\ t_2 \to lock\ v_1\ t_2'} \qquad \text{(E-Lock2)}$$

$$lock\ v_1\ v_2 \to v_2$$
$$\text{(E-LockV)}$$