

# Long-distance interaction between caller and callee

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$t ::=$		term
	$v$	value
	$x$	variable
	$t \ t$	application
$v ::=$		value
	$c$	constant
	$\lambda x : \tau . t$	abstraction
$\tau ::=$		type
	$\kappa$	type of constants
	$\sigma \rightarrow \sigma$	arrow type
$\sigma ::=$		type with effects
	$E \ ! \ \tau$	effect annotation
$E ::=$		effect set
	$\emptyset_\varepsilon$	empty effect
	$E, \varepsilon$	effect extension
$\Gamma ::=$		context
	$\emptyset_\Gamma$	empty context
	$\Gamma, x : \tau$	variable binding

Figure 1: Syntax

$$\boxed{\Gamma \vdash t : \sigma}$$

$$\frac{}{\Gamma \vdash c : \emptyset_\varepsilon ! \kappa} \text{ (T-CONSTANT)}$$

$$\frac{x : \sigma \in \Gamma}{\Gamma \vdash x : \sigma} \text{ (T-VARIABLE)}$$

$$\frac{\Gamma, x : \tau \vdash t : \sigma}{\Gamma \vdash \lambda x : \tau . t : \tau \rightarrow \sigma} \text{ (T-ABSTRACTION)}$$

$$\frac{\Gamma \vdash t_1 : E_1 ! \tau_1 \quad \Gamma \vdash t_2 : E_2 ! (\tau_1 \rightarrow E_3 ! \tau_2)}{\Gamma \vdash t_2 t_1 : E_1, E_2, E_3 ! \tau_2} \text{ (T-APPLICATION)}$$

$$\frac{\Gamma \vdash t : E ! \tau}{\Gamma \vdash t : E, \varepsilon ! \tau} \text{ (T-WEAKEN)}$$

$$S = \{s_1 = t_1, \dots, s_n = t_n\}$$

$$\Gamma \vdash t_i : E_i ! \tau_i$$

$$\sigma_i = \varepsilon ! \tau_i$$

$$\Phi(\varepsilon) = \{s_1 = \sigma_1, \dots, s_n = \sigma_n\}$$

$$\Gamma, s_1 : \sigma_1, \dots, s_n : \sigma_n \vdash t : E ! \tau$$

$$\frac{\Gamma, s_1 : \sigma_1, \dots, s_n : \sigma_n \vdash t : E ! \tau}{\Gamma \vdash \text{provide } S \text{ as } \varepsilon \text{ in } t : E - \varepsilon, E_1, \dots, E_n ! \tau} \text{ (T-PROVIDE)}$$

Figure 2: Typing rules