

$termvar, x, f$	term variable
$typevar, \alpha$	type variable
$integer, i$	integer
s	string
b	boolean
k	index

nat, n	$::=$	natural numbers
	0	zero
	$n + 1$	successor
$const$	$::=$	constants
	noop	no-op
	wait	wait
	selfdestruct	self destruct
	move	move
	turn	turn
	grab	grab
	place	place
	give	give
	install	install
	make	make
	has	inventory test
	count	inventory count
	drill	drill
	build	build
	salvage	salvage
	reprogram	reprogram
	say	say
	log	log
	view	view
	appear	appear
	create	create
	whereami	location query
	blocked	front query
	scan	scan
	upload	upload
	ishere	cell query
	whoami	self name query
	random	random
	run	run
	if	if
	inl	left injection
	inr	right injection
	case	case analysis
	fst	first projection
	snd	second projection
	force	force
	return	return
	try	try
	raise	raise exception
	not	not
	neg	negate
	eq	equal to
	neq	not equal to
	lt	less than
	gt	greater than

		leq		less-or-equal
		geq		greater-or-equal
		add		addition
		sub		subtraction
		mul		multiplication
		div		division
		exp		exponentiation
d	::=			direction
		left		
		right		
		back		
		forward		
		north		
		south		
		east		
		west		
		down		
$term, t$::=			term
		$()$		unit value
		$const$		constant
		d		direction literal
		i		integer literal
		s		string literal
		b		boolean literal
		x		variable
		$\lambda x. t$	bind x in t	function abstraction
		$t_1 t_2$		function application
		let $x = t_1$ in t_2	bind x in t_2	let
		def $x = t$ end		definition
		$x \leftarrow t_1; t_2$	bind x in t_2	bind
		(t_1, t_2)		pair
		$\{t\}$		delay
		(t)	S	
$basety, B$::=			base type
		$()$		unit
		int		integers
		string		strings
		dir		directions
		bool		booleans
$type, \tau$::=			monotype
		α		variable
		B		base type
		cmd τ		command type
		$\{\tau\}$		delay type
		$\tau_1 + \tau_2$		sum type
		$\tau_1 \times \tau_2$		product type

	$\begin{array}{ l} \tau_1 \xrightarrow{n;\Delta;\Xi} \tau_2 \\ (\tau) \end{array}$	function type S
<i>capability</i> , κ	$\begin{array}{ l} ::= \\ \text{GOD} \\ \text{BUILD} \end{array}$	capability
<i>capset</i> , K	$\begin{array}{ l} ::= \\ \bullet \\ K, \kappa \\ (K) \end{array}$	capability set S
<i>capstack</i> , Δ, Ξ	$\begin{array}{ l} ::= \\ \bullet \\ K \triangleright \Delta \end{array}$	capability stack
Γ	$\begin{array}{ l} ::= \\ \bullet \\ \Gamma, x :^n \tau; \Xi \end{array}$	type context empty context

$\boxed{\Gamma \vdash t : \tau; \Delta; \Xi}$ In context Γ , t has type τ and requires evaluation and execution capabilities Δ and Ξ

$\overline{\Gamma \vdash () : (); \bullet; \bullet}$	TYPE_UNIT
$\overline{\Gamma \vdash d : \mathbf{dir}; \bullet; \bullet}$	TYPE_DIR
$\overline{\Gamma \vdash i : \mathbf{int}; \bullet; \bullet}$	TYPE_INT
$\overline{\Gamma \vdash s : \mathbf{string}; \bullet; \bullet}$	TYPE_STRING
$\overline{\Gamma \vdash b : \mathbf{bool}; \bullet; \bullet}$	TYPE_BOOL
$\frac{x :^0 \tau; \Xi \in \Gamma}{\Gamma \vdash x : \tau; \bullet; \Xi}$	TYPE_VAR
$\frac{\Gamma, x :^n \tau_1; \Xi_1 \vdash t : \tau_2; \Delta_2; \Xi_2}{\Gamma \vdash \lambda x. t : \tau_1 \xrightarrow{n; \Delta_2; \Xi_2} \tau_2; \bullet; \bullet}$	TYPE_LAM
$\frac{\Gamma \vdash t_1 : \tau_1 \xrightarrow{n; \Delta_1; \Xi_1} \tau_2; \Delta_2; \Xi_2 \quad \Gamma \vdash t_2 : \tau_1; \Delta_3; \Xi_3}{\Gamma \vdash t_1 t_2 : \tau_2; \Delta_1 \cup \Delta_2 \cup \Delta_3; \Xi_1 \cup \Xi_2 \cup \{\Xi_3\}^n}$	TYPE_APP
$\frac{\Gamma \vdash t_1 : \tau_1; \Delta_1; \Xi_1 \quad \Gamma, x :^n \tau_1; \Xi_1 \vdash t_2 : \tau_2; \Delta_2; \Xi_2}{\Gamma \vdash \mathbf{let} x = t_1 \mathbf{in} t_2 : \tau_2; \Delta_1 \cup \Delta_2; \{\Xi_1\}^n \cup \Xi_2}$	TYPE_LET
$\frac{\Gamma^- \vdash t : \tau; \Delta; \Xi}{\Gamma \vdash \{t\} : \{\tau\}; \bullet \triangleright \Delta; \bullet \triangleright \Xi}$	TYPE_DELAY
$\frac{\Gamma \vdash t : \{\tau\}; K_1 \triangleright K_2 \triangleright \Delta; K_3 \triangleright \Xi}{\Gamma^- \vdash \mathbf{force} t : \tau; (K_1 \cup K_2) \triangleright \Delta; \Xi}$	TYPE_FORCE
$\frac{\Gamma \vdash t_1 : \tau_1; \Delta_1; \Xi_1 \quad \Gamma \vdash t_2 : \tau_2; \Delta_2; \Xi_2}{\Gamma \vdash (t_1, t_2) : \tau_1 \times \tau_2; \Delta_1 \cup \Delta_2; \Xi_1 \cup \Xi_2}$	TYPE_PAIR
$\frac{\Gamma \vdash t_1 : \mathbf{cmd} \tau_1; \Delta_1; \Xi_1 \quad \Gamma, x :^n \tau_1; \Xi_1 \vdash t_2 : \mathbf{cmd} \tau_2; \Delta_2; \Xi_2}{\Gamma \vdash x \leftarrow t_1; t_2 : \mathbf{cmd} \tau_2; \Delta_1 \cup \Delta_2; \Xi_1 \cup \{\Xi_2\}^n \cup \Xi_2}$	TYPE_BIND

Definition rules: 13 good 0 bad
Definition rule clauses: 21 good 0 bad