Mu Runtime Reference

mu namespace, version *0.2.5*

type keywords and aliases

supertype	*T*	
bool	(),:nil are false, otherwise true	
condition	*keyword,* see **Exception**	
list	:cons or (),:nil	
:null	(),:nil	
:char	*char*	
:cons	*cons*	
:fixnum	*fixnum, fix*	56 bit signed integer
:float	*float, fl*	32 bit IEEE float
:func	*function, fn*	function
:keyword	*keyword, key*	symbol
:ns	*namespace, ns*	namespace
:stream	*stream*	file or string type
:struct	*struct*	typed vector
:symbol	*symbol, sym*	LISP-1 symbol
:vector	*vector, string, str*	
	:bit :char :t	
	:byte :fixnum :float	

Features

```
[dependencies]
default = [ "env", "procinfo", "std", "nix", "sysinfo" ]
```

env	**heap-room**	*vector*	allocations
	#(:t *:type size total free …*)		
	heap-info	*list*	heap info
	(*type page-size npages*)		
	heap-size *keyword*	*fixnum*	type size
	heap-free	*fixnum*	bytes free
	env	*list*	env state
	core	*list*	core state
nix	**uname**		
std	**command**, **exit**		
sysinfo	**sysinfo** (disabled on macOS)		
procinfo	**process-mem-virt**	*fixnum*	virtual memory in bytes
	process-mem-res	*fixnum*	reserve in bytes
	process-time	*fixnum*	microseconds
	time-units-per-sec	*fixnum*	
prof	**prof-control**		enable
semispace			semispace heap

Special Forms

:lambda *list . list'*	*function*	anonymous *function*
:quote *form*	*list*	quoted form
:if *form T T'*	*T*	conditional

Reader/Printer

read *stream bool T*	*T*	read stream object
write *T bool stream*	*T*	write escaped object

Core

null/	*ns*	null namespace
apply *fn list*	*T*	apply *fn* to *list*
eval *form*	*T*	evaluate *form*
eq *T T'*	*bool*	*T* and *T'* identical?
type-of *T*	*key*	type keyword
compile *form*	*T*	*mu* form compiler
view *form*	*vector*	vector of object
%if *fn fn' fn"*	*bool*	**:if** implementation
repr *T*	*vector*	tag representation
unrepr *vector*	*T*	tag representation

vector is an 8 element :byte vector of little-endian argument tag bits.

fix *fn T*	*T*	fixpoint of *fn*
gc	*bool*	garbage collection

Frames

%frame-stack	*list*	active *frames*
%frame-pop *fn*	*fn*	pop *function's* top frame binding

frame binding: (*fn .* #(:t *…*))

%frame-push *frame*	*cons*	push frame
%frame-ref *fn fix*	*T*	*function*, offset

Symbols

boundp *symbol*	*bool*	is *symbol* bound?
make-symbol *string*	*symbol*	uninterned *symbol*
symbol-namespace *symbol*		
	ns	*namespace*
symbol-name *symbol*	*string*	name binding
symbol-value *symbol*	*T*	value binding

Fixnums

mul *fix fix'*	*fixnum*	product
add *fix fix'*	*fixnum*	sum
sub *fix fix'*	*fixnum*	difference
less-than *fix fix'*	*bool*	*fix < fix'*?
div *fix fix'*	*fixnum*	quotient
ash *fix fix'*	*fixnum*	arithmetic shift
logand *fix fix'*	*fixnum*	bitwise and
logor *fix fix'*	*fixnum*	bitwise or
lognot *fix*	*fixnum*	bitwise complement

Floats

fmul *fl fl'*	*float*	product
fadd *fl fl'*	*float*	sum
fsub *fl fl'*	*float*	difference
fless-than *fl fl'*	*bool*	*fl < fl'*?
fdiv *fl fl'*	*float*	quotient

Conses/Lists

append *list*	*list*	append lists
car *list*	*T*	head of *list*
cdr *list*	*T*	tail of *list*
cons *T T'*	*cons*	(*T . T'*)
length *list*	*fixnum*	length of *list*
nth *fix list*	*T*	nth *car* of *list*
nthcdr *fix list*	*T*	nth *cdr* of *list*

Vectors

make-vector *key list*	*vector*	specialized vector from list
vector-length *vector*	*fixnum*	length of *vector*
vector-type *vector*	*key*	type of *vector*
svref *vector fix*	*T*	nth element

Streams   *n*

standard-input   *stream*   std input *stream*
standard-output   *stream*   std output *stream*
error-output   *stream*   std error *stream*

open `type dir` *string bool*

               stream   open *stream*
                        raise error if *bool*

        `type`   `:file`   `:string`
        `dir`   `:input` `:output` `:bidir`

close *stream*   *bool*   close *stream*
openp *stream*   *bool*   is *stream* open?

flush s*tream*   *bool*   flush output *steam*
get-string *stream*   *string*   from *string stream*

read-byte *stream bool* *T*

              byte   read *byte* from *stream,* error on eof, *T:* eof value

read-char *stream bool T*

              char   read *char* from *stream,* error on eof, *T:* eof value

unread-char *char stream*

              char   push *char* onto *stream*

write-byte *byte stream*   *byte*   write *byte* to *stream*
write-char *char stream*   *char*   write *byte* to *stream*

Namespaces   *.*

make-namespace *str*   *ns*   make *namespace*
namespace-map   *list*   list of mapped *namespaces*

namespace-name *ns*   *string*   *namespace* name
intern *ns str value*   *symbol*   intern bound symbol
find-namespace *str*   *ns*   map *string* to *namespace*

find *ns string*   *symbol*   map *string* to *symbol*

namespace-symbols *ns list*   *namespace symbols*

Exceptions   *n*

with-exception *fn fn'*   *T*   catch exception

        fn - `(:lambda (obj cond src) . body)`
        fn' - `(:lambda () . body)`

raise *T keyword*   raise exception on *T* with condition:

`:arity`   `:div0`   `:eof`   `:error`   `:except`
`:future`   `:ns`   `:open`   `:over`   `:quasi`
`:range`   `:read`   `:exit`   `:signal`   `:stream`
`:syntax`   `:syscall` `:type`   `:`*`unbound`* `:under`
`:write`   `:storage`

Structs   *t*

make-struct *key list*   *struct*   of type *key* from *list*
struct-type *struct*   *key*   *struct* type *keyword*
struct-vec *struct*   *vector*   of *struct* members

mu library API   *I*

```
[dependencies]
mu_runtime = {
    git = "https://github.com/Software-Knife-and-Tool/mu.git",
    branch=main
}

use mu_runtime::{ Condition, Config, Env, Exception, Result,
Tag };

impl Env {
  const VERSION: &str

  fn config(config: Option<String>) → Option<Config>
  fn new(config: &Config, Option<(Vec<u8>, Vec<u8>)> → Env
  fn apply(&self, func: Tag, args: Tag) → Result<Tag>
  fn compile(&self, form: Tag) → Result<Tag>
  fn eq(&self, func: Tag, args: Tag) → bool;
  fn exception_string(&self, ex: Exception) → String
  fn eval(&self, exp: Tag) → Result<Tag>
  fn eval_str(&self, exp: &str) → Result<Tag>
  fn load(&self, file_path: &str) → Result<bool>
  fn read(&self, st: Tag, eofp: bool, eof: Tag) → Result<Tag>
  fn read_str(&self, str: &str) → Result<Tag>
  fn image(&self) → Result<(Vec<u8>, Vec<u8>)>
  fn err_out(&self) → Tag
  fn std_in(&self) → Tag
  fn std_out(&self) → Tag
  fn write(&self, exp: Tag, esc: bool, st: Tag) → Result<()>
  fn write_str(&self, str: &str, st: Tag) → Result<()>
  fn write_to_string(&self, exp: Tag, esc: bool) → String
```

Reader Syntax   *x*

`;`   comment to end of line
`#|...|#`   block comment

`'`*form*   quoted form
`` ` ``*form*   backquoted form
`` ` ``*(…)*   backquoted list (proper lists)
`,`*form*   eval backquoted form
`,@`*form*   eval-splice backquoted form

`(…)`   constant *list*
`()`   empty *list*, prints as `:nil`
`(… . .)`   dotted *list*
`"…"`   *string, char vector*
`\`   single escape in strings

`#*…`   bit vector
`#x…`   hexadecimal *fixnum*
`#.`   read-time eval
`#\.`   *char*
`#(:type …)`   *vector*
`#s(:type …)`   *struct*
`#:symbol`   uninterned *symbol*

`"`` ` ``,;`   terminating macro char
`#`   non-terminating macro char

`!$%&*+-.`   symbol constituents
`<>=?@[]|`
`:^_{}~/`
`A..Za..z`
`0..9`

`0x09 #\tab`   whitespace
`0x0a #\linefeed`
`0x0c #\page`
`0x0d #\return`
`0x20 #\space`

mu-sys   *.*

`mu-sys: 0.0.2: [celq] [file…]`

`c: name:value,…`   runtime configuration
`e: form`   eval and print result
`l: path`   load from path
`q: form`   eval quietly