Mu Runtime Reference

version *0.2.9*

type keywords and aliases

supertype	*T*	
bool	`()`, `:nil` are false, otherwise true	
condition	*keyword*, see ***Exception***	
list	`:cons` or `()`, `:nil`	
ns	`#s(:ns #(:t` *fixnum symbol*`))`	
`:null`	`()`, `:nil`	
`:char`	*char*	
`:cons`	*cons, list*	
`:fixnum`	*fixnum, fix*	56 bit signed int
`:float`	*float, fl*	32 bit IEEE float
`:func`	*function, fn*	function
`:keyword`	*keyword, key*	symbol
`: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”, “core”, “std”, “nix”, "sysinfo" ]
```

mu/core	***core***	*list*	core state
	delay	*fixnum*	microseonds
	process-mem-virt	*fixnum*	vmem
	process-mem-res	*fixnum*	reserve
	process-time	*fixnum*	microseconds
	time-units-per-sec	*fixnum*	
mu/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
	ns-symbols *ns*|`:nil`		
		list	*symbol* list
mu/nix	***uname***		
mu/std	***command, exit***		
mu/sysinfo	***sysinfo*** (disabled on macOS)		
mu/prof	***prof-control*** *key*	*key* | *vec*	`:on|:off|:get`

configuration API

```
config string format:

“npages:N, gc-mode:GCMODE, page-size:N, heap-type:HEAPTYPE”

  N: unsigned integer
  GCMODE: none | auto | demand
  HEAPTYPE: bump
```

special forms

`:lambda` *list . list’*	*function*	anonymous *fn*
`:alambda` *list . list’*	*function*	anonymous *fn*
`:quote` *T*	*list*	quoted form
`:if` *T T’ T”*	*T*	*conditional*

core

apply *fn list*	*T*	apply *fn* to *list*
compile *form*	*T*	*mu* form compiler
eq *T T’*	*bool*	*T* and *T’* identical?
eval *form*	*T*	evaluate *form*
type-of *T*	*key*	type keyword
view *form*	*vector*	vector of object
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 binding: (*fn* . `#(:t …)`)

%frame-stack	*list*	active *frames*
%frame-pop *fn*	*fn*	pop *function’s* top frame binding
%frame-push *frame*	*cons*	push frame
%frame-ref *fn fix*	*T*	*function*, offset

symbols

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

fixnums

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

floats

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

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*	*n*th *car* of *list*
nthcdr *fix list*	*T*	*n*th *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*	*n*th element

streams

standard-input	*stream*	std input *stream*
standard-output	*stream*	std out *stream*
error-output	*stream*	std error *stream*
open *`type dir`* *str 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 *stream*	*bool*	flush *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*
write-char *char stream*	*char*	write *char*
read *stream bool T*	*T*	read *stream*
write T *bool stream*	*T*	write with escape

namespaces

defined namespaces: mu, keyword, null

make-namespace *str*	*ns*	make *namespace*
namespace-name *ns*|`:nil`	*string*	*namespace* name
intern *ns*|`:nil` *str value*	*symbol*	intern symbol in *namespace*
find-namespace *str*	*ns*	map *string* to *namespace*
find *ns*|`:nil` *string*	*symbol*	map *string* to *symbol*

exceptions

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

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

Mu library API

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

use mu::{ Condition, Core, Env, Exception,
          Mu, Result, Tag };

impl Mu {
  fn apply(_: &Env, _: Tag, _: Tag) → Result<Tag>
  fn compile(_: &Env, _: Tag) → Result<Tag>
  fn config(_: Option<String>) → Option<Config>
  fn core() → &Core
  fn eq(_: Tag, _: Tag) → bool;
  fn err_out() → Tag
  fn eval_str(_: &Env, _: &str) → Result<Tag>
  fn eval(_: &Env, _: Tag) → Result<Tag>
  fn exception_string(_: &Env, _: Exception) → String
  fn load(_: &Env, _: &str) → Result<bool>
  fn make_env(_: &Config) → Env
  fn read_str(_: &Env, _: &str) → Result<Tag>
  fn read(_: &Env, _: Tag, _: bool, _: Tag) → Result<Tag>
  fn std_in() → Tag
  fn std_out() → Tag
  fn version() → &str
  fn write_str(_: &Env, _: &str, _: Tag) → Result<()>
  fn write_to_string(_: &Env, _: Tag, _: bool) → String
  fn write(_: &Env, _: Tag, _: bool, _: Tag) → Result<()>
}
```

Reader Syntax

`;`	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*
`#:`	uninterned *symbol*
`` "`,; ``	terminating macro char
`#`	non-terminating macro char

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

character designators

```
0x09 #\tab
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
```