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`	
`:null`	`()`, `:nil`	
`:char`	*char*	
`:cons`	*cons*	
`:fixnum`	*fixnum, fix*	56 bit signed int
`: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”, “mu”, “std”, “prof”, “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
mu/nix	**uname**		
mu/std	**command**, **exit**		
mu/sysinfo	**sysinfo** (disabled on macOS)		
mu/prof	**prof-control**		toggle enable

configuration API

```
config string format:

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

  N: unsigned integer
  GCMODE: none | auto | demand
  HEAPTYPE: semispace | bump    // needs semispace feature
```

Special Forms

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

Core

null/	*ns*	null namespace
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 :by`te` 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*	*sym*	uninterned *symbol*
symbol-namespace *sym*	*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` *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 *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

make-namespace *str*	*ns*	make *namespace*
namespace-name *ns*	*string*	*namespace* name
intern *ns str value*	*symbol*	intern symbol
find-namespace *str*	*ns*	map *string* to *namespace*
find *ns string*	*symbol*	map *string* to *symbol*
namespace-symbols *ns list*		*symbol* list

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, Config, Env, Exception,
          Core, Mu, Result, Tag };

impl Mu {
  const VERSION: &str

  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 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
```