Mu Reference

mu version *0.0.24*

Type keywords and aliases

supertype	*T*	
bool	`()`, `:nil` are false, otherwise true	
condition	*keyword,* see ***Exception***	
list	*cons* or `()`, `:nil`	
frame	*cons*, see ***Frame***	
`:null`	`()`, `:nil`	
`:asyncid`	*async*	async future id
`: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*
`:map`	*map*	*key/value* hash
`:stream`	*stream*	file or string type
`:struct`	*struct*	typed vector
`:symbol`	*symbol, sym*	LISP-1 symbol
`:vector`	*vector, string, str*	

`:char :t :byte :fixnum :float`

Heap

hp-info	*vector*	heap static information

`#(:t type pages pagesize)`

hp-stat	*vector*	heap allocations

`#(:t :type size total free ...)`

hp-size *T*	*fixnum*	heap occupancy in bytes

Frame

frame binding: `(fn . #(:t …))`

frames	*list*	active *frame binding* list
fr-pop *fn*	*fn,*	pop *function's* top frame binding
fr-push *frame*	*cons*	push frame binding
fr-ref *fix fix*	*T*	frame id, offset

Struct

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

Symbol

boundp *sym*	*bool*	is *symbol* bound?
keyword *str*	*key*	*keyword* from *string*
make-sy *str*	*symbol*	uninterned *symbol*
sy-ns *sym*	*key*	*symbol* namespace
sy-name *sym*	*string*	*symbol* name binding
sy-val *sym*	*T*	*symbol* value binding

Special Forms

:async *fn . list*	*async*	create *future* context
:lambda *list . list'*		
	function	anonymous function
:quote *form*	*list*	quoted form
:if *form T T'*	*T*	conditional

Core

apply *fn list*	*T*	apply *function* to *list*
eval *form*	*T*	evaluate *form*
eq *T T'*	*bool*	*are T* and *T'* identical?
type-of *T*	*keyword*	
***await**`:async`	*T*	return value of async future
***abort**`:async`	*T*	abort future
compile *form*	*T*	*mu* form compiler
view *form*	*vector*	vector of object
repr *bool T*	*T*	tag representation conversion: if *bool* is (), return 8 byte *fixnum* vector of argument tag bits, otherwise convert argument byte vector to tag
fix *fn form*	*T*	fixpoint of *function* on *form*
gc *bool*	*bool*	garbage collection, verbose
exit *fix*		exit process with return code

Fixnum

fx-mul *fix fix'*	*fixnum*	product
fx-add *fix fix'*	*fixnum*	sum
fx-sub *fix fix'*	*fixnum*	difference
fx-lt *fix fix'*	*bool*	*fix < fix'?*
fx-div *fix fix'*	*fixnum*	quotient
logand *fix fix'*	*fixnum*	bitwise and
logor *fix fix'*	*fixnum*	bitwise or

Float

fl-mul *fl fl'*	*float*	product
fl-add *fl fl'*	*float*	sum
fl-sub *fl fl'*	*float*	difference
fl-lt *fl fl'*	*bool*	*fl < fl'?*
fl-div *fl fl'*	*float*	quotient

Conses and Lists

%append *list T*	*list*	append
car *list*	*list*	head of *list*
cdr *list*	*T*	tail of *list*
cons *T T'*	*cons*	(*form . form'*)
length *list*	*fixnum*	length of *list*
nth *fix list*	*T*	*n*th *car* of *list*
nthcdr *fix list*	*T*	*n*th *cdr* of *list*

Vector

make-sv *keyword list*		
	vector	typed vector from list
sv-len *vector*	*fixnum*	length of *vector*
sv-ref *vector fix*	*T*	*n*th element
sv-type *vector*	*key*	type of *vector*

Map

make-mp	*map*	make a new map
mp-add *map T T'*		
	map	add pair to map
mp-get *map T*	*T*	reference map
mp-has *map T*	*bool*	is key resident?
mp-size *map*	*fixnum*	size of map
mp-list *map*	*list*	map contents

Exception

with-ex *fn fn' T* catch exception
fn - `(:lambda (obj cond src) . body)`
fn' - `(:lambda () . body)`

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

```
:arity  :eof    :open   :read
:write  :error  :syntax :type
:div0   :stream :range  :except
:ns     :over   :under  :unbound
```

Stream

std-in *symbol* standard input *stream*
std-out *symbol* standard output *stream*
err-out *symbol* standard error *stream*

open `type direction` *string*
stream open *stream*
`type - :file :string`
`direction - :input :output`

close *stream* *bool* close *stream*
openp *stream* *bool* is *stream* open?
eof *stream* *bool* is *stream* at end of file?
flush *stream* *bool* flush output steam
get-str *stream* *string* from *string stream*

rd-byte *stream bool T*
byte read *byte* from *stream,* error on eof, *T:* eof value
rd-char *stream bool T*
char read *char* from *stream,* error on `eof`, *T:* `eof` value
un-char *char stream*
char push *char* onto *stream*

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

System

real-tm *T* *fixnum* system clock secs
run-us *T* *fixnum* process time *µs*

namespaces

make-ns *keyword*
key make namespace
untern *keyword string*
symbol intern unbound symbol
intern *keyword string value*
symbol intern bound symbol
ns-find *keyword string*
symbol map *string* to *symbol*
ns-syms *keyword*
list namespace's symbols

Reader/Printer

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

mu library API

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

use mu::{Condition, Config, Exception,
         Mu, Result, System, Tag}

config string format: "npages:N,gcmode:GCMODE"
GCMODE - { none, auto, demand }

const Mu::VERSION: &str
Mu::new(config: &Config)-> Mu
Mu::config(config: String) -> Option<Config>
Mu::apply(&self, func: Tag, args: Tag)-> Result
Mu::eq(&self, func: Tag, args: Tag) -> Result
Mu::eval(&self, expr: Tag) -> Result
Mu::compile(&self, form: Tag) -> Result
Mu::read(&self, stream: Tag, eofp: bool, value: Tag) -> Result
Mu::write(&self, form: Tag, esc: bool, stream: Tag) -> Result
Mu::get_string(&self, stream: Tag) -> Result
Mu::write_string(&self, str: String, stream: Tag) -> Result
Mu::from_u64(&self, tag: u64) -> Tag
Mu::as_u64(&self, tag: Tag) -> u64
Mu::std_in(&self) -> Tag
Mu::std_out(&self) -> Tag
Mu::err_out(&self) -> Tag

System::new(config: &Config)-> System
System::config(config: String) -> Option<Config>
System::mu(&self)-> &Mu
System::eval(&self, expr: &String) -> Result
System::error(&self, ex: Exception) -> String
System::read(&self, string: String) -> Result
System::write(&self, expr: Tag, escape: bool) -> String
System::load(&self, file_path: &String) -> Result
```

Reader Syntax

;	comment to end of line
#|...|#	block comment
'form	quoted form
`form	backquoted form
`(...)	backquoted list (proper lists only)
,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
#x	hexadecimal *fixnum*
#\c	*char*
#(:type ...)	*vector*
#s(:type ...)	*struct*
#:symbol	uninterned *symbol*
"`,;	terminating macro char
#	non-terminating macro char
!$%&*+-. <>=?@[]| :^_{}~/ A..Za..z 0..9	symbol constituents
0x09 #\tab	whitespace
0x0a #\linefeed	
0x0c #\page	
0x0d #\return	
0x20 #\space	

Runtime

```
mu-local: x.y.z: [-h?pvcelq] [file…]

?: usage message
h: usage message
c: [name:value,…]
e: eval [form] and print result
l: load [path]
p: pipe mode (no repl)
q: eval [form] quietly
v: print version and exit
```