# Chapter 13 – vlib – V’s standard library

## 13.1 Overview of the standard library

The V-distribution contains over 50 standard built-in modules for common functionality, like math, os, etc… as a whole designated as the *standard library*. This vlib is for the most part written in V itself, but still depends heavily upon C interop, in particular for some low level routines. It is intended to be comprehensivelike the standard library in Go, not bare-bones like that in Rust.

The API in all modules (included package os) is the same for all systems (Windows, Linux, ...).

Vlib modules are imported in your program via the import statement (see ch. 11).

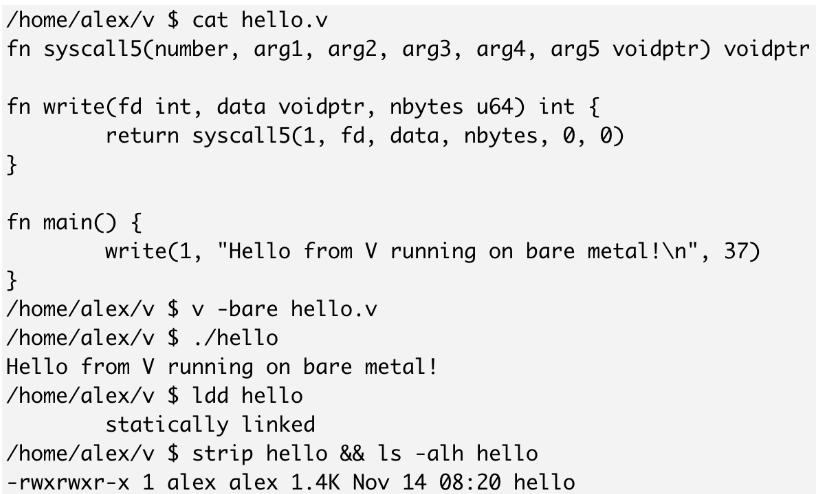
The vlib folder contains only the V source code, comprising some 2 Mb. (??) When your app is compiled, the relevant parts of Vlib are compiled with it each time a compilation is done.

The C dependency: V is a language that builds upon C to make it fast and cross-platform. V stdlib uses *libc* for some functions, in particular on non-Linux systems, since it's their only official API. Everything that uses unstable and/or private syscalls is going to keep using libc, things like sprintf will be replaced with native V code. Removing libc completely would only work on Linux.

On libc dependency: <https://github.com/vlang/v/wiki/On-libc-usage-(early-draft)>

# V now runs on bare metal (freestanding) (Nov 16 2019): <https://github.com/vlang/v/issues/2761>

No libc or vlib is needed. From now on V can be used for embedded, kernel development, etc.



Works on Linux!

Vlib modules:

Docs can be obtained with the command: v doc module

For example: v doc os

V doc http

(?? Nov: doesn’t work on Windows: V panic: failed to open file "C:\Users\CVO\.vmodules/vlib/os.vh"

Doesn’t work on Linux either)

Here is an overview of the most important vlib modules. In the following sections, we elaborate on some of them,discussing concrete programs and applications.

arrays: see ch 7

benchmark: contains simple methods to benchmark the execution of V code, see § 13.??

bitfield: manipulating arrays of bits

builtin: contains v's predeclared functions and types (including strings, arrays, maps); this is always by default imported in a V program, also in the REPL.

[compiler](https://vlang.io/pkg/compiler) : V compiler as a module

[crypto](https://vlang.io/pkg/crypto):

[aes](https://vlang.io/pkg/crypto.aes): AES encryption (formerly Rijndael), as defined in U.S. Federal Information Processing Standards Publication 197

[cipher](https://vlang.io/pkg/crypto.cipher): Standard block cipher modes that can be wrapped around low-level block cipher implementations

[encoding](https://vlang.io/pkg/base64):

[base64](https://vlang.io/pkg/base64): Encoding and decoding of base64 as defined in RFC 4648

[binary](https://vlang.io/pkg/encoding.binary): Simple translation between numbers and byte sequences and encoding and decoding of varints

[csv](https://vlang.io/pkg/encoding.csv): Reads and writes comma-separated values (CSV) files

gg: Hardware accelerated Graphics library using OpenGL (DirectX, Vulkan, Metal support soon)

gl: OpenGL wrapper

gx: Constants and helpers for drawing

http: contains functionality for parsing HTTP requests/replies, provides an extensible HTTP server and a basic client;

json: JSON-support is built-in: encoding and decoding of JSON as defined in RFC 7159, see § 13.??

log: contains logging facilities

math: contains the basic mathematical constants and functions.

For example: *greatest\_common\_divisor.v*

import math

fn main() {

  res := **math.gcd**(4585, 1589)

  println(res) // 7

}

For some common mathematical constants and operations, see *math\_op.v*

To see an example of calculations at work: see *nbody.v, spectral.v*

os: gives a platform-independent interface to operating-system functionality

mysql:

pg:

sqlite: connecting to databases of various types, see $ 13.??

strings: contains functions for manipulating and processing strings.

rand: contains routines for generating pseudo-random numbers

runtime: For example (see runtime.v):

import runtime

println(runtime.**nr\_cpus()**) // 4

time:  contains basic functionalities for working with times and dates (see $4.??)

ui: cross-platform ui library

vweb: v’s web framework

## 13.2 os module

The module’s design is Unix-like; it hides the differences between various operating systems to give a consistent view of files and other OS-objects.

Some of the example code can be found in os\_examples.v, unless otherwise mentioned.

See § 5.1 for detecting the operating system with $if.

Command-line arguments: these are given by os.args, which is of type []string;

for example: os.args[1] is the first command-line parameter.

See os\_args.v:

import os

fn main() {

    for ix, arg in os.args {

      println('$ix: $arg')

    }

}

/\* When called as:  os\_args A 1 Hello          This prints out:

E:\Vlang\The\_Way\_to\_V\Chapter\_9\_Modules>os\_args A 1 Hello

0: os\_args

1: A

2: 1

3: Hello

\*/

The first element os.args[0] is the program name without the .v extension. To skip this first element, you would do:

    for i := 1; i < os.args.len; i++ {

        println(os.args[i])

    }

A simple example of parsing options can be found in option\_parser() (see Vcasino/vcasino.v)

Exercise: Use a stack to program a primitive console calculator, usign reverse polish notation (see *calc1.v* and *calc.v*)

Using the **flag** module for parsing command line arguments: see example hn\_top.v in § 13.7

Get environment variables: *os\_env.v*

import os

fn main() {

  home := **os.getenv**('PATH')

  println(home)

}

Detecting some properties of the OS: *os\_props.v*

os.**executable**() - a cross platform function that returns full path to current executable.

Getting input from the terminal:

In this example, input from the user is collected via the os.get\_line function: this retrieves a single line from the console - or in other words an input terminated by a single [ENTER key](https://en.wikipedia.org/wiki/Enter_key).

see *os\_get\_line.v*

Here is a guessing example guessing\_game.v:

// Guess a random number between 1 and 100

import (

  os    // contains the I/O functions

  rand  // to generate a random number to guess

  time  // to seed the random number generating algorithm

)

const (

    max\_nr\_guess = 10

)

fn main() {

// 1 - Generate random number:

    t := time.now()

    s := t.calc\_unix()

    rand.seed(s) // calls C.srand(s)

    secret := rand.next(100) // random number from 1 to 100 for the user to guess

    mut nr\_guess := 0

// 2 - Game loop:

    for {

        println('Please guess a number from 1-100 or stop(S) and press <Enter>')

      guess := **os.get\_line().trim\_space()**          // input from user

        if guess == 'S' {

            println('Game stopped')

            return

        }

        nr\_guess += 1

        if nr\_guess > max\_nr\_guess {

            println('Sorry, too much guessing, the secret number was: $secret')

            println('Game over')

            return

        }

        println('You guessed $guess on turn $nr\_guess')

      iguess := **guess.int()** // convert guess to integer

        if iguess > secret {

            println('Too big!')

        } else if iguess < secret {

            println('Too small!')

        } else if iguess == secret {

            println('Congratulations! You guessed the secret number $secret in $nr\_guess turns!')

            return                      // end loop

        } else {

            print('Incorrect! ')

        }

    }

    println('Thanks for playing the game!')

}

Exercises:

* Cube.v
* Sum\_input.v

(see by\_example\exercises)

Another example: see *Vcasino/vcasino.v*

For another input reading routine, containing additional checks to test for an empty line, and to test that the string is a number:, function get\_bet\_nbr().

When the input is a string: line := os.get\_line().trim\_space().to\_lower()

Working with files:

The os module uses optionals in all functions that return `File`.

A file’s size in bytes is given by:

os.**file\_size**(file\_name)

Check whether a file exists with: os.**file\_exists**(path)

*(see word\_counter\_book.v)*

Get directory of the program: **os.dir(os.args[1])** (?? Or 0)

is\_link(), is\_dir()

How to traverse a directory and get its contents?  os.ls('.') returns ?[]string

On Linux: os.ls(pwd)

The function os.cp() can be used for copying files and directories.

Opening a file:

fn read\_log() {

**f := os.open(****'log.txt')**

**defer { f.close() }**

...

if !ok {

// defer statement will be called here, the file will be closed

return

}

...

// defer statement will be called here, the file will be closed

}

When opening a file explicitly, this is followed immediately by a defer block to close the file in all cases at the end of the function?

Reading in a file follows the general pattern:

import os

text := **os.read\_file**(path)**or{**

**eprintln(err)**

**}**

read\_file() reads the whole contents of the file into a string text, signature: os.read\_file(path) string

(Example: see word\_counter.v)

How to read in a file line by line:

Use the method read\_lines, which has the signature: os.read\_lines(path) ?[]string

lines := os.**read\_lines**(filepath) or {

println(**'**File not found!**')**

return

}

Then you can iterate over the lines as follows: for line in lines { … }

Or pick a random line with: lines[rand.next(lines.len)]

For an example, see hangman/hangman.v

An alternative: contents := os\_.read\_file(path) or { }

lines := contens.split\_into\_lines()

(see faker module ch 14)

Writing to a file: see *file\_write.v*

import os

fn test\_file\_creation() {

    file\_name := './new\_file.txt'

    content := 'text'

**os.write\_file**(file\_name, content)

    assert content.len == os.file\_size(file\_name)

**os.rm**(file\_name)

}

test\_file\_creation()

This is done by using the os.write\_file function, which overwrites an existing file with that name.

os.rm deletes the file.

Filtering a log file: (see *filter\_log.v*):

import os

// Print file lines that starth with "DEBUG:"

fn main() {

  // `read\_file` returns an optional (`?string`), it must be checked

  text := os.read\_file('app.log') or {

    eprintln('failed to read the file')

    return

  }

lines := text.split\_into\_lines()

  for line in lines {

    if line.starts\_with('DEBUG:') {

      println(line)

    }

  }

}

Executing commands: (see *os\_exec.v*)

This is done with the os.system function, which takes a command string:

import os

fn run(cmd string) {

  if **os.system(cmd)** != 0 {

    panic('"$cmd" failed')

  }

}

// on Windows:

run('dir')

run('copy a b') // => The system cannot find the file specified.

// on nix\*:

//execute a command and fetch result string.

os.ls('pwd')

The vup script uses os.exec (see c:\v\tools\vup.v)

## 13.2B cli module

This library contains functionality parsing command-line flags and executing command. It uses os.

You can make a Command object, which has a method parse for parsing command-line flags.

For an example of its use: see *cli.v:*

## 13.2C clipboard module

This library contains functionality working with the OS clipboard. It uses os.

See: *clipboard\_test.v*

## 13.2D eventbus module

A module to provide eventing capabilities using pub/sub.

See v\<lib\eventbus\README.md

For an example, see: *eventbus.v*, which use module some\_module.

## 13.2E filepath module

?? example

## 13.3 json module - Decoding and encoding JSON.

JavaScript Object Notation (JSON) is a lightweight data-interchange format that is easy for humans to read and write. Furthermore, equally simple for machines to generate and/or parse. JSON is completely language agnostic and that's why it's the ideal interchange format (to read more about JSON visit: [json.org](http://json.org/)).

Support for the very popular JSON format is built-in in V.

V generates code for json encoding and decoding at compile-time. No reflection is used, which results in much better performance. V doesn't need runtime information to decode JSON, because it achieves it via codegen. All information about types is known at compilation time.

The function json.decode(Struct, data) can translate the JSON string data to the fields of struct Struct, provided they have the same names and type. The first argument of the json.decode function is the type to decode to. The second argument is the JSON string. (?? Make a little sketch). The function json.encode(Struct) generates a JSON string for serialization or communication; it takes a Struct value and converts it to a JSON string.

Here are some simple examples:

Listing 13.2 json.v:

import json

struct User {

      name string

      age  int

      last\_name string [json:lastName]

}

fn main() {

      data := '{ "name": "Frodo", "lastName": "Baggins", "age": 25 }' // JSON string

      user := json.decode(User, data) or {

              eprintln('Failed to decode json-string $data')

              return

      }

      println(user.name)

      println(user.last\_name)

      println(user.age)

      // JSON string with an array of struct values

      customers\_string := '[{ "first\_name": "Vitor", "last\_name": "Oliveira", "hometown": "Rio de Janeiro" }, { "first\_name": "Don", "last\_name": "Nisnoni", "hometown": "Kupang" }]'

      customers := **json.decode([]Customer, customers\_string)** or {

            eprintln('Failed to parse json')

            return

      }

      // Print the list of customers

      for customer in customers {

            println('$customer.first\_name $customer.last\_name: $customer.hometown')

      }

// Generate a JSON string:

      customer := Customer{first\_name: "Vitor" last\_name: "Oliveira" hometown: "Rio de Janeiro"}

      encoded\_json := json.encode(customer)

      println(encoded\_json)

      expected := '{"first\_name":"Vitor","last\_name":"Oliveira","hometown":"Rio de Janeiro"}'

      assert encoded\_json == expected

     // back and forth:

      customer2 := json.decode(Customer, encoded\_json) or {

            eprintln('Failed to parse json')

            return

      }

      encoded\_json2 := json.encode(customer2)

      println(encoded\_json2)

      assert(encoded\_json == encoded\_json2)

}

/\* Output:

Frodo

Baggins

25

Vitor Oliveira: Rio de Janeiro

Don Nisnoni: Kupang

{"first\_name":"Vitor","last\_name":"Oliveira","hometown":"Rio de Janeiro"}

{"first\_name":"Vitor","last\_name":"Oliveira","hometown":"Rio de Janeiro"}

\*/

If the field name is different in the JSON file, it can be specified: custom json field names can be added between [json: ]:

struct User { last\_name string **[json:lastName]** }

Use the `skip` attribute in the struct description to skip certain fields:      foo Foo [skip]

You can also have a raw JSON field, whose content is taken literally: point string **[raw]**

This is used in the following example *json2.v* (we use asserts to test the values instead of printing them out):

import json

struct User {

  age         int

  nums        []int

  last\_name   string  [json:lastName]

  is\_registered bool  [json:IsRegistered]

  typ int  [json:'type']

}

struct Color {

  space string

  point string [raw]

}

fn parse\_user() {

  s := '{"age": 10, "nums": [1,2,3], "type": 0, "lastName": "Johnson", "IsRegistered": true}'

  u := json.decode(User, s) or {

    exit(1)

  }

  assert u.age == 10

  assert u.last\_name == 'Johnson'

  assert u.is\_registered == true

  assert u.nums.len == 3

  assert u.nums[0] == 1

  assert u.nums[1] == 2

  assert u.nums[2] == 3

  assert u.typ == 0

}

fn encode\_user() {

  usr := User{ age: 10, nums: [1,2,3], last\_name: 'Johnson', is\_registered: true, typ: 0}

  expected := '{"age":10,"nums":[1,2,3],"lastName":"Johnson","IsRegistered":true,"type":0}'

  out := **json.encode(usr)**

  assert out == expected

}

fn raw\_json\_field() {

    color := json.decode(Color, '{"space": "YCbCr", "point": {"Y": 123}}') or {

        println('Error while decoding color!')

        return

    }

    assert color.point == '{"Y":123}'

    assert color.space == 'YCbCr'

}

parse\_user()

encode\_user()

raw\_json\_field()

Here is a more concrete example, reading in a file and decoding the contents as json: *json\_file.v*

import os

import json

struct Extract {

        origin string

        target\_language string

        category int

        source string

        source\_language string

        target string

    }

fn main() {

    file := os.read\_file('weblate-memory.json') or {

        eprintln('Error opening file!')

        return

    }

    users:= json.decode([]Extract, file) or {

        eprintln('Failed to decode json')

        return

    }

    for u in users {

      println(u.source)

      println(u.target)

    }

}

/\* Output:

Card callback failure

କାର୍ଡ଼ କଲବ୍ୟାକ ଅସଫଳ

Sink callback failure

ସିଙ୍କ କଲବ୍ୟାକ ଅସଫଳ

\*/

See also § 13.4 get\_albums.v

## 13.3B ftp module

?? example

## 13.4 http module

Example 1: *links\_scraper.v*

**import net.http**

fn main() {

  html := **http.get\_text(**'https://news.ycombinator.com')   (1)

  mut pos := 0

  for {

    pos = **html.index\_after**('https://', pos + 1) (2)

    if pos == -1 {

      break

    }

    end := html.index\_after('"', pos)

    println(**html[pos..end]**) (3)

  }

}

The function get\_text(URL) in line (1) gets the html text of the URL in one big string html.

(?? When URL is wrong, an error is printed:

Error 10057 sending data to server (1)

Error performing handshake

Not sure where this comes from)

In line (2) during an infinite loop, all http links are searched and copied out in line (3) to be printed.

The loop stops when no more http link could be found.

/\* Example output:

https://news.ycombinator.com

https://news.bloomberglaw.com/privacy-and-data-security/facebook-google-donate-heavily-to-privacy-advocacy-groups

https://www.intel.com/content/www/us/en/support/topics/idsa-cip.html#CollectedData

https://www.vogons.org/viewtopic.php?f=46&amp;t=69184

https://blog.floydhub.com/a-pirates-guide-to-accuracy-precision-recall-and-other-scores/

https://arstechnica.com/tech-policy/2019/11/google-search-results-have-more-human-help-than-you-think-report-finds/

https://en.wikipedia.org/wiki/Crinkle\_crankle\_wall

https://ahajournals.org/doi/full/10.1161/circulationaha.111.061770

https://github.com/norvig/paip-lisp/issues/10

https://www.1843magazine.com/culture/look-closer/hokusai-old-man-crazy-to-paint

https://github.com/khstangherlin/monker

https://www.scmp.com/lifestyle/food-drink/article/3037576/highs-and-lows-lowell-cafe-americas-first-cannabis-cafe-where

https://github.com/dosycorp/browsergap.ce

https://medium.com/through-the-looking-glass/colossal-holograms-b7f86f5925bd

https://www.nytimes.com/2019/11/14/science/stars-black-hole-milky-way.html

https://www.joshmcguigan.com/blog/understanding-serde/

https://www.currentaffairs.org/2019/11/the-innocent-pleasure-of-trespassing

https://www.collectorsweekly.com/articles/how-boomboxes-got-so-badass/

https://littlemountainman.github.io/2019/11/27/selfdrivingfun/

https://www.scottaaronson.com/blog/?p=4414

https://www.pnas.org/content/early/2019/11/11/1907883116

https://www.reuters.com/article/us-interpol-encryption-exclusive/exclusive-interpol-plans-to-condemn-encryption-spread-citing-predators-sources-say-idUSKBN1XR0S7

https://www.wbur.org/hereandnow/2019/11/15/amtrak-profit-train-ceo-richard-anderson

https://www.shacknews.com/article/114982/world-on-fire-the-oral-history-of-fallout-and-fallout-2

https://blog.benjojo.co.uk/post/userspace-usb-drivers

https://www.reuters.com/article/us-apple-germany-apple-pay/apple-warns-of-risks-from-german-law-to-open-up-mobile-payments-idUSKBN1XP16M

https://www.bfilipek.com/2019/11/perfguidecpu.html

https://github.com/HackerNews/API

\*/

Example 2: *get\_albums.v*

import (

  net.http

  json

)

struct Album {

  user\_id int

  id int

  title string

}

fn get\_albums() []Album {

  response := http.**get**('https://jsonplaceholder.typicode.com/albums') or {

    panic("Couldn't find the albums page" )

  }

  parsed\_albums := json.decode([]Album, response.text) or { return [] }

  return parsed\_albums

}

albums := get\_albums()

for album in albums { println(album) }

/\* Output:

{

  user\_id: 0

  id: 1

  title: quidem molestiae enim

}

{

  user\_id: 0

  id: 2

  title: sunt qui excepturi placeat culpa

}

{

  user\_id: 0

  id: 3

  title: omnis laborum odio

}

{

  user\_id: 0

  id: 4

  title: non esse culpa molestiae omnis sed optio

}

...

\*/

See also § 13.7 news\_fetcher.v

## 13.5 log module

Example:

import log

fn main(){

    mut l := log.Log{log.INFO, 'terminal'}

    l.info('info')

    l.warn('warn')

    l.error('error')

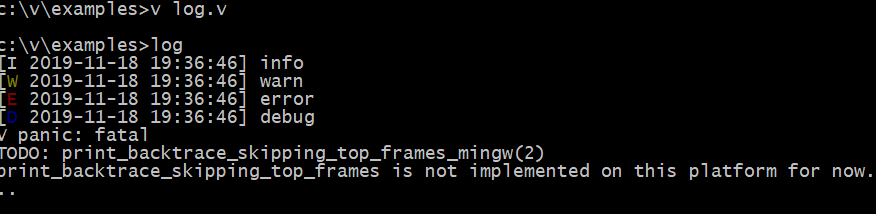
    l.debug('no debug')

    l.set\_level(log.DEBUG)

    l.debug('debug')

    l.fatal('fatal')

}



?? execute on Linux

## 13.6 term module

This allows manipulation of the terminal output properties, see *terminal\_control.v*

import term

fn sleeping\_line(x,y,size int, ch string) {

  mut i := 0

  for i < size {

    term.set\_cursor\_position(x+i,y)

    print(term.bold(term.yellow(ch)))

    i++

  }

}

fn standing\_line(x,y,size int, ch string) {

  mut i := 0

  for i < size {

    term.set\_cursor\_position(x,y+i)

    print(term.bold(term.yellow(ch)))

    i++

  }

}

term.erase\_clear()

sleeping\_line(5,5,5,'\*')

standing\_line(5,5,5,'\*')

sleeping\_line(5,10,5,'\*')

standing\_line(9,5,5,'\*')

term.cursor\_down(5)

print('\n')

println(term.bold(term.red('It Worked!')))

Output:



Another example of its use is hn\_top.v in § 13.7

## 13.7 sync module

The following example *news\_fetcher.v* is taken from V’s examples. The program shows how texts in json format are retrieved from the internet and demonstrates the use of locking and the concept of a WaitGroup from the sync module, in order to synchronize 4 coroutines.

import net.http

import json

import sync

const (

  NR\_THREADS = 4

)

struct Story {

  title string

  url string

}

struct Fetcher {

mut:

  mu      &sync.Mutex

  ids     []int

  cursor  int

  wg      &sync.WaitGroup

}

fn (f mut Fetcher) fetch() {

  for {

    if f.cursor >= f.ids.len {

      return

    }

    id := f.ids[f.cursor]

**f.mu.lock()** (5)

    f.cursor++

**f.mu.unlock()**

    cursor := f.cursor

    resp := http.**get**('https://hacker-news.firebaseio.com/v0/item/${id}.json') or { (6)

      println('failed to fetch data from /v0/item/${id}.json')

      exit(1)

    }

    story := json.decode(Story, resp.text) or { (7)

      println('failed to decode a story')

      exit(1)

    }

    println('#$cursor) $story.title | $story.url')

    f.wg.done()

  }

}

// Fetches top HN stories in 4 coroutines

fn main() {

  resp := http.get('https://hacker-news.firebaseio.com/v0/topstories.json') or { (1)

    println('failed to fetch data from /v0/topstories.json')

    return

  }

  // resp := http.get('https://hacker-news.firebaseio.com/v0/topstories.json')? (1B)

  mut ids := json.decode([]int, resp.text) or { (2)

    println('failed to decode topstories.json')

    return

  }

// keep only 10 top stories:

if ids.len > 10 {

   ids = ids[..10]

}

**wg := sync.new\_waitgroup()**

**mtx := sync.new\_mutex()**

  mut fetcher := &Fetcher{ids: ids}

  fetcher.mu = &mtx

  fetcher.wg = &wg

  fetcher.wg.add(ids.len)

  for i := 0; i < NR\_THREADS; i++ { (3)

**go fetcher.fetch()**

  }

**fetcher.wg.wait()** (4)

}

/\* Output:

#1) The cognitive costs of air pollution | https://patrickcollison.com/pollution

#2) Your throat hurts, your brain hurts: the life of the audiobook star | https://www.theguardian.com/books/2019/nov/16/throat-hurts-brain-hurts-secret-life-of-audiobook-stars-tim-dowling

#4) How Containers Work: Overlayfs | https://jvns.ca/blog/2019/11/18/how-containers-work--overlayfs/

#3) Hacker Publishes 2TB of Data from Cayman National Bank | https://twitter.com/DDoSecrets/status/1195899716653010945

#5) MacBook Pro 16" 2019 Teardown | https://www.ifixit.com/Teardown/MacBook+Pro+16-Inch+2019+Teardown/128106

#7) Empathic concern does not reduce partisan animosity: study | https://www.wired.com/story/empathy-is-tearing-us-apart/

#8) Sourcetrail, interactive source explorer, is now free and open-source | https://www.sourcetrail.com/blog/open\_source/

#6) Office noise bothers some people more than others | https://www.bbc.com/worklife/article/20191115-office-noise-acceptable-levels-personality-type

#9) A Dead-Simple Web Stack in Haskell | https://williamyaoh.com/posts/2019-11-16-a-dead-simple-web-stack.html

#10) Music Generates Feelings That Are Only Weakly Bound to the Music | https://whatismusic.info/blog/MusicGeneratesFeelingsThatAreOnlyWeaklyBoundToTheMusic.html

\*/

In line (1) in main() the top-stories URL is fetched. Because http.get returns an ?Response, we need an error block to handle possible get errors. Resp is a Response struct value, and its text property contains the page’s html string. This is decoded in line (2) into an array of ints.

Only the first 10 stories are retained. In line (3) these are fetched by starting 4 coroutines with go. Line (4) assures that the program doesn’t close until all coroutines are finished.

(If instead of block (1) line 1B was used main() would panic if the http.get call went wrong).

In (5) the update to the story’s id cursus is locked: if this were not done, perhaps one story would be fetched multiple times, or a story with a certain id would not be fetched at all. The specific story is then fetched, decode into a Story struct value, and its title and URL are printed out.

Variant: *hn\_top.v* is a version which makes use of module *flag* to parse the number of stories to return, and whether or not to show the article’s url. It also uses module *term* to produce a more formatted terminal output. It doesn’t use a mutex of coroutines to do the job. Also more info is shown from each story:

// see https://github.com/BafS/hn-top/blob/master/hn.v

// run: v run hn\_top.v

// compile: v -o hntop -prod hn\_top.v

import (

  os

  http

  json

  term

  flag

)

const (

  api = 'https://hacker-news.firebaseio.com/v0'

)

struct Story {

  by          string

  descendants int

  kids        []int

  id          int

  score       int

  title       string

  typ         string  [json:'type']

  url         string

}

fn fetch\_story(id int) Story {

  text := http.get\_text('${api}/item/${id}.json')

  story := json.decode(Story, text) or { exit(1) }

  return story

}

fn fetch\_top\_stories(num int) []Story {

  text := http.get\_text('${api}/topstories.json')

  stories\_ids := json.decode([]int, text) or { exit(1) }

  stories\_top\_ids := stories\_ids[..num]

  return stories\_top\_ids.map(fetch\_story(it))

}

fn main() {

  mut fp := flag.new\_flag\_parser(os.args)

  fp.application('hn\_top')

  fp.version('v0.1.0')

  fp.description('Show top HN news')

  fp.skip\_executable()

  top\_num := fp.int('num', 5, 'number of top news to show')

  source\_urls := fp.bool('source\_urls', false, 'show source urls')

  fp.finalize() or {

    eprintln(err)

    println(fp.usage())

    return

  }

  println('Fetching last stories...')

  stories := fetch\_top\_stories(top\_num)

  term.cursor\_up(1)

  term.erase\_toend()

  // Print stories

  for i, story in stories {

    len := '${i + 1}'.len

    indent := ' '.repeat(2 + len)

    println('${i + 1}. ${term.bold(story.title)}')

    println('${indent}score: ${story.score}    comments: ${story.descendants}    user: ${story.by}')

    url := 'url: https://news.ycombinator.com/item?id=${story.id}'

    println('${indent}${term.dim(url)}')

    if source\_urls {

      source\_url := 'source: ${story.url}'

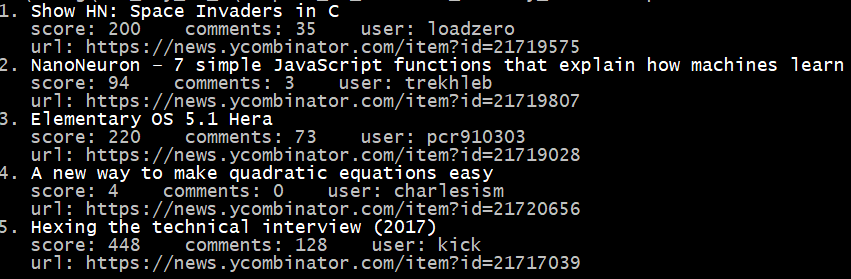
      println('${indent}${term.dim(source\_url)}')

    }

  }

}

Output:



## 13.8 V and databases

### A - sqlite module

First download sqlite from <https://sqlite.org/download.html>

Download the source code sqlite-amalgamation (contains the header files) and the precompiled binary for your platform.

Example 1: Working with an in-memory sqlite database: *ex1\_sqlite.v*

#flag -lsqlite3 // not needed on Linux

import sqlite

fn main() {

  db := sqlite.connect(':memory:')

  db.exec("create table users (id integer primary key, name text default '');")

  db.exec("insert into users (name) values ('Sam')")

  db.exec("insert into users (name) values ('Peter')")

  db.exec("insert into users (name) values ('Kate')")

  nr\_users := db.q\_int('select count(\*) from users')

  println('nr users = $nr\_users')

  name := db.q\_string('select name from users where id = 1')

  assert name == 'Sam'

  users := db.exec('select \* from users')

  for row in users {

    println(row.vals)

  }

}

This program works on Windows and Linux, and also in the test form sqlite\_test.v

On Windows: OK!

**Solution:**

**1) sqlite installed in e:\sqlite, this location is in PATH variable, folder contains sqlite3.dll and sqlite3.h**

**2) copy sqlite3.h in folder C:\Users\CVO\AppData\Local\Temp\v**

**3) place all sqlite files from sqlite installation in C:\mingw-w64\bin\mingw64\x86\_64-w64-mingw32\lib**

Compilation errors:

1) fatal error: sqlite3.h: No such file or directory  #include "sqlite3.h"

Solution: #flag -lsqlite3

But then the import sqlite does not happen! Without the flag, it does.

-verbose:

flags=

\* -ldbghelp

\* -lsqlite3

cc() isprod=0 outname=ex1\_sqlite

==========

gcc -std=gnu11 -Wall -Wextra -Wno-unused-variable -Wno-unused-parameter -Wno-unused-result -Wno-missing-braces -Wno-unused-label -Werror=implicit-function-declaration -o "ex1\_sqlite" "C:\Users\CVO\AppData\Local\Temp\v\ex1\_sqlite.tmp.c" -ldbghelp -lsqlite3

**C:\Users\CVO\AppData\Local\Temp\v\ex1\_sqlite.tmp.c:191:10: fatal error: sqlite3.h: No such file or directory**

#include "sqlite3.h"

^~~~~~~~~~~

compilation terminated.

V error: C error. This should never happen.

2) undefined: `sqlite.connect` (in module `sqlite`)

🡨 function connect is present and pub in c:\v\vlib\sqlite\sqlite.v

But: c:\v\vlib\sqlite>*v test sqlite\_test.v*

Testing...

----------------------------------------------------------------------------

0 ms | <=== total time spent running V \_test.v files

ok, fail, total = 0, 0, 0

This works also in the folder: E:\Vlang\The\_Way\_to\_V\Chapter\_13\_Standard\_Library\_vlib\databases\sqlite

* The test mode loads the sqlite module correctly, but the compile mode does not !

?? Collect all the sqlite files in a folder with that name and put it in C:\v\thirdparty\sqlite : doesn’t work

?? place module sqlite locally with program: no

?? copy sqlite3.h in folder vlib\sqlite: no

🡪 **copy sqlite3.h in folder** **C:\Users\CVO\AppData\Local\Temp\v:**

This helps for error 1)

Now error:

C:\Users\CVO\AppData\Local\Temp\v\ex1\_sqlite.tmp.c: In function 'sqlite\_\_DB\_q\_string':

C:\Users\CVO\AppData\Local\Temp\v\ex1\_sqlite.tmp.c:3390:10: warning: initialization discards 'const' qualifier fr...

*v –g –verbose ex1\_sqlite.v*

c:\v\vlib\sqlite\sqlite.v: In function 'sqlite\_\_DB\_q\_string':

c:\v\vlib\sqlite\sqlite.v:47:10: warning: initialization discards 'const' qualifier from pointer target type [-Wdiscarded-qualifiers]

f := C.sqlite3\_column\_text(stmt, 0)

^~~~~~~~~~~~~~~~~~~

c:\v\vlib\sqlite\sqlite.v:48:25: warning: passing argument 1 of 'tos\_clone' discards 'const' qualifier from pointer target type [-Wdiscarded-qualifiers]

res := tos\_clone(C.sqlite3\_column\_text(stmt, 0))

^~~~~~~~~~~~~~~~~~~~~~~~~

c:\v\vlib\builtin\string.v:79:26: note: expected 'byte \*' {aka 'unsigned char \*'} but argument is of type 'const unsigned char \*'

pub fn tos\_clone(s byteptr) string {

~~~~~~^

c:\v\vlib\sqlite\sqlite.v: In function 'sqlite\_\_DB\_exec':

c:\v\vlib\sqlite\sqlite.v:68:25: warning: passing argument 1 of 'tos\_clone' discards 'const' qualifier from pointer target type [-Wdiscarded-qualifiers]

val := tos\_clone(C.sqlite3\_column\_text(stmt, i))

^~~~~~~~~~~~~~~~~~~~~~~~~~~

c:\v\vlib\builtin\string.v:79:26: note: expected 'byte \*' {aka 'unsigned char \*'} but argument is of type 'const unsigned char \*'

pub fn tos\_clone(s byteptr) string {

~~~~~~^

C:/mingw-w64/bin/mingw64/bin/../lib/gcc/x86\_64-w64-mingw32/8.1.0/../../../../x86\_64-w64-mingw32/bin/**ld.exe: cannot find -lsqlite3**

collect2.exe: error: ld returned 1 exit status

* Place all sqlite files from installation in C:\Users\CVO\AppData\Local\Temp\v : no
* Place all sqlite files from installation in C:\mingw-w64\bin\mingw64\x86\_64-w64-mingw32\bin : no
* **Place all sqlite files from installation in** **C:\mingw-w64\bin\mingw64\x86\_64-w64-mingw32\lib : YES!!**

On Linux: OK !

alternative install:

sudo apt-get install libsqlite3-dev

?? concrete examples of B,C?D

### B – mysql module

### C – postgress module

Install PostgreSQL by downloading the latest version for your OS from <https://www.postgresql.org/download/>

Start the pgAdmin4 tool and create a database customerdb

From the command-line, go to the folder with the script mydb.sql.

Execute the script mydb.sql with the command:

psql -f mydb.sql -U postgres -d customerdb

This creates a Customer table in this db and inserts some records, which you can view in pgAdmin4.

Now try to execute *customer.v*:

module main

import pg

struct Customer {

  id int

  name string

  nr\_orders int

  country string

}

fn main() {

  db := pg.connect(pg.Config{

    host: 'localhost' //'127.0.0.1'

    user: 'postgres'

    dbname: 'customerdb'

  }) or {

    println('failed to connect')

    println(err)

    return

  }

  nr\_customers := db.select count from Customer

  println('Total customers: $nr\_customers')

  // V syntax can be used to build queries

  println('----------------------------------------------------------------')

  bg\_customers := db.select from Customer where country == 'Bulgaria' && id != 2

  for customer in bg\_customers {

    println('$customer.country | $customer.id - $customer.name')

  }

  println('----------------------------------------------------------------')

  ru\_customers := db.select from Customer where country == 'Russia'

  for customer in ru\_customers {

    println('$customer.country | $customer.id - $customer.name')

  }

  // by adding `limit 1` we tell V that there will be only one object

  println('----------------------------------------------------------------')

  existing := db.select from Customer where id == 1 limit 1 or { panic(err) }

  println('Existing customer name: $existing.name')

  println('Existing customer full information:')

  println(existing)

  println('------------------------------------------------------------------------')

  q := Customer{}

  // It's easy to handle queries that don't return any data

  if anon := db.select from Customer where id == 12345 && name == q.name &&

      nr\_orders > q.nr\_orders limit 1 {

    println('Non existing customer name: $anon.name')

  }

  // Insert a new customer

  nc := Customer{

    name: 'John Doe'

    nr\_orders: 10

  }

  db.insert(nc)

}

?? On Windows:

Compile: v customer.v:

C:\Users\CVO\AppData\Local\Temp\v\customer.tmp.c:191:10: fatal error: libpq-fe.h: No such file or directory

?? Copy libpq-fe.h from E:\PostgreSQL\include to C:\Users\CVO\AppData\Local\Temp\v

Still same error!

?? Add E:\PostgreSQL\include to PATH: idem \lib: idem

?? copy libpq-fe.h near customer.v: idem

?? copy libpq-fe.h to C:\mingw-w64\bin\mingw64\x86\_64-w64-mingw32\lib: idem

?? copy libpq.dll near customer.v and in local\temp\v : idem

**Solution: ??**

On Linux-Ubuntu: OK

Installed by default, check with: sudo apt-get install postgresql-11

Start pgadmin3. Execute sql from mydb.sql in SQL Editor, change COPY into insert statements.

INSERT INTO public.customer(

id, name, nr\_orders, country, created\_at)

VALUES (4,'Krusmynta Efraimsdotter',5,'Bulgaria','2019-08-19 09:40:31.396807');

Compiling OK, but in the translated SQL statements an s is added to the tbale name: Customer -> Customers !!

After renaming the table in the db to Customers, everything ok:

status=0

Total customers: 7

----------------------------------------------------------------

Bulgaria | 1 - Bilbo Begins

Bulgaria | 3 - Viktualia Rullgardina

Bulgaria | 4 - Krusmynta Efraimsdotter

----------------------------------------------------------------

Russia | 5 - Ana Karenina

Russia | 6 - Viktor Savashkin

----------------------------------------------------------------

Existing customer name: Bilbo Begins

Existing customer full information:

{

id: 1

name: Bilbo Begins

nr\_orders: 11

country: Bulgaria

}

------------------------------------------------------------------------

?? insert and if anon := did not work

### D – ORM module

## 13.9 Graphical modules.

See \graphical

Of special importance for the success of V are the graphical libraries, which make it easy to make apps with native UI capabilities: you no longer need to embed a browser to develop cross-platform apps quickly.

A - V ui: *native cross platform GUI drawing library* (uses Cocoa on macOSX, winAPI/GDI+ on Windows, GTK+ on Linux); this uses native controls, for example, for a TextBox: NSTextView on macOS, edit HWND on Windows.

V UI is a cross-platform UI toolkit for Windows, macOS, Linux, and soon Android, iOS and the web (JS/WASM). V UI uses native widgets on Windows and macOS, on all other platforms the widgets are drawn by V UI. Right now only the non-native widgets are available.

The API is declarative, and there will be hot reloading, similar to SwiftUI and Flutter.

On Linux, V UI will be a full-featured lightweight alternative to GTK and Qt.

Jan 29 20 - Doesn’t work on Windows:

v run temperature.v

warning: temperature.v:18:21: reference field `App\*.lbl\_fahrenheit` must be initialized

warning: temperature.v:18:21: reference field `App\*.lbl\_celsius` must be initialized

warning: temperature.v:18:21: reference field `App\*.window` must be initialized

warning: temperature.v:33:13: reference field `ui.LabelConfig.ref` must be initialized

warning: temperature.v:42:13: reference field `ui.LabelConfig.ref` must be initialized

c:\v\thirdparty\stb\_image\stbi.obj already built.

c:\v\thirdparty\glad\glad.obj already built.

V error: Microsoft (R) C/C++ Optimizing Compiler Version 19.23.28106.4 for x64

Copyright (C) Microsoft Corporation. All rights reserved.

temperature.tmp.c

C:\Users\CVO\AppData\Local\Temp\v\temperature.tmp.c(313): fatal error C1083: Cannot open include file: **'ft2build.h'**: No such file or directory

Solved by installing freetype:

git clone --depth=1 <https://github.com/ubawurinna/freetype-windows-binaries> c:\v\thirdparty\freetype\

Then:

V run users.v

warning: users.v:51:2: reference field `App\*.window` must be initialized

warning: users.v:145:5: reference field `ui.PictureConfig.ref` must be initialized

c:\v\thirdparty\stb\_image\stbi.obj already built.

c:\v\thirdparty\glad\glad.obj already built.

V error: Microsoft (R) C/C++ Optimizing Compiler Version 19.23.28106.4 for x64

Copyright (C) Microsoft Corporation. All rights reserved.

users.tmp.c

C:\Users\CVO\AppData\Local\Temp\v\users.tmp.c(11499): error C2440: 'type cast': cannot convert from 'ui\_\_IWidgeter' to 'ui\_\_IWidgeter'

🡨 reported in #39 - <https://github.com/vlang/ui/issues>

?? Coming: a Delphi-like visual editor for building native GUI apps.

For more complex 2D/3D applications:

### B) Open GL-access:

gg: a small hardware accelerated graphics library that takes care of drawing primitives in modern OpenGL: writing shaders, compile them, initialize vertex buffer objects, working with text, etc.

It has built in camera logic.

DirectX, Metal, and Vulkan are going to be supported in the future (2019?), so you will be able to write cross platform graphical applications without worrying about implementation details.

It will allow loading and rendering complex 3D objects. By the end of this summer I’m hoping to implement skeletal animation as well. So it’ll be super easy to develop 3D games without any engines or complex IDEs.

*vid* uses gg for rendering

gl: an OpenGL wrapper

gx: Constants and helpers for drawing; used in time\_table.v / tetris.v

* Tetris works on Linux and Windows
* The Color struct is defined in the standard-library module gx, so by importing gx, you can write:

const (

red = gx.Color{r: 255, g: 0, b: 0}

blue = gx.rgb(0, 0, 255)

)

glfw (??): uses the OpenGL libraries

Right now this is desktop only, but mobile support is planned.

Examples:

1) see ch12\hot\_reload/bounce.v

2) see ch12\hot\_reload/graph.v

For 3)-5) on Windows:

works if freetype.dll and glfw3.dll and RobotoMono-Regular.ttf are copied into the folder where the exe is.

3) *tetris/tetris.v*: works on Windows and Linux

To compile on Windows: see document: How to compile tetris

4) *empty\_gg\_freetype.v*

Compiles and runs (shows empty window) on Linux and Windows

5) *v-pong*:

Compile s and runs on Linux and Windows

Push SPACE to start, use LEFT and RIGHT arrow to move the paddles; sound doesn’t work yet (Dec 29)

v run pong.v

v build pong.v

6) A version of the game\_of\_life using the graphical modules: (see graphical/*game\_of\_life/life\_gg.v*):

This still uses the automaton module (see § 11.4), but instead of a terminal output, it produces a graphical output using the modules gg, glfw and gx. For Windows: copy glfw3.dll to folder game\_of\_life.

It works in Windows and Linux.

?? See also: C:\v\vlib\ui\examples\users\_gui.v (Nov 20: not present)

See also: code\_examples\3D shooter (size +- 100 Kb): (*3dshooter.v + v2*)

### C) SDL:

see: <https://en.wikipedia.org/wiki/Simple_DirectMedia_Layer>

vlib/sdl/examples

Works on Linux:

After installation of SDL (see Readme.md)

1) basic sdl window

2) tvintris: tetris with sound

Doesn’t work on Windows:

Dec 29: c:\v\vlib\sdl\examples\basic\_window>v -g main.v

C compiler=gcc

c:\v\vlib\sdl\examples\basic\_window\main.v:135: warning: "UNICODE" redefined

<command-line>: note: this is the location of the previous definition

c:\v\vlib\sdl\examples\basic\_window\main.v:59:10: **fatal error: SDL.h: No such file or directory**

compilation terminated.

V error: C error. This should never happen.

Please create a GitHub issue: https://github.com/vlang/v/issues/new/choose

## 13.10 vweb

<https://github.com/vlang/v/tree/master/vlib/vweb>

See module vweb (= GitHub source)

See examples/vweb in distribution

This modules uses the other vlib modules os, net, http and net.urllib.

It provides a MVC like web framework, like Rails or ASP.NET MVC, with an emphasis on simplicity.

It works with HTML templates, and it has a built-in V template language, which uses @ to indicate code. For example *index.html*:

@for post in posts

<div class=post>

<a class=topic href="@post.url">@post.title</a>

<img class=comment-img>

<span class=nr-comments>@post.nr\_comments</span>

<span class=time>@post.time</span>

</div>

@end

To this corresponds a method *index()* in a V source file, which invokes as its last line:

$vweb.html()

This compiles an HTML template into V during compilation, and embeds the resulting code in the current action. That means that the template automatically has access to that action's entire environment.

Deploying vweb apps:

Everything, including HTML templates, is **contained** in one binary file. That's all you need to deploy.

A simple example can be found at: vweb\vweb\_example

On Windows: it compiles and runs, an http-server responds on <http://localhost:8082/>

With this url in the browser-windows, the following is shown:



Here is the output on the server’s terminal:

*Running vweb app on http://localhost:8082 …*

firstline="GET / HTTP/1.1

"

firstline="GET /favicon.ico HTTP/1.1

"

firstline=""

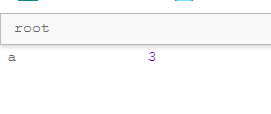
no vals for http

The webserver continues to run until it is ended with CTRL+C

The url [http://localhost:8082/index](http://localhost:8082/text) also shows the same output.

The url <http://localhost:8082/text> outputs the text: Hello world

The url <http://localhost:8082/json_endpoint> shows the following screen:



On Linux: it works also.

Tutorial web blog: see web\_blog\blog:

<https://github.com/vlang/v/blob/master/tutorials/building-a-simple-web-blog-with-vweb.md>

Dec 14: 4) When the index() method is changed to $vweb.html()

On both Ubuntu and Windows 10, I get the error message: blog.v:10:22: `app` is declared as mutable, but it was never changed

8| pub fn (app &App) init() {}

9|

10| fn (app mut App) index() {

With table Articles in Postgress: same error when connecting to pg: fatal error: libpq-fe.h: No such file or directory

On Linux: a bunch of other errors coming from the C pg driver.

sql query="select id, title, text from Articles"

/tmp/v/blog\_orm.tmp.c: In function â€˜pg\_\_connectâ€™:

/tmp/v/blog\_orm.tmp.c:3960:18: warning: pointer targets in initialization of â€˜byte \*â€™ {aka â€˜unsigned char \*â€™} from â€˜char \*â€™ differ in signedness [-Wpo...

(Use `v -g` to print the entire error message)

V error: C error. This should never happen.

Other web frameworks:

**Vex**: <https://github.com/nedpals/vex>

inspired by Express and Sinatra

?? try out