Introducing **piladb** to the Gopher

by Fernando Álvarez

GoMad — Madrid Go UG — 16/02/2017

Summary

- `whoami`

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- Introduction to **piladb**

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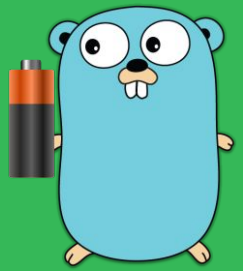
- Internals in Go
- Demo
- Future plans
- Help!

`whoami`

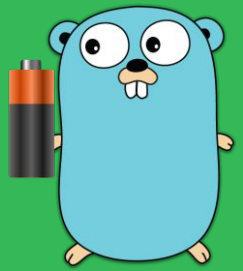
Fernando Álvarez

- Software Engineer from Madrid
- Infrastructure at BeBanjo
- Gopher since 2013
- Open Source through ≅oscillatingworks
- Author of **piladb**
- @fern4lvarez

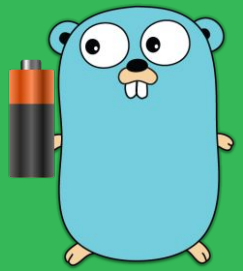
piladb *[pee-lah-dee-bee].*



piladb



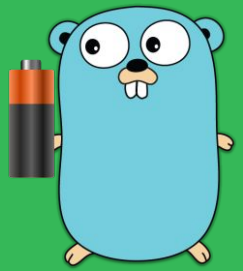
piladb



battery

piladb

charge



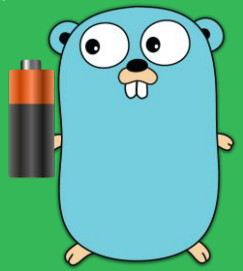
battery

piladb

energy

battery

charge

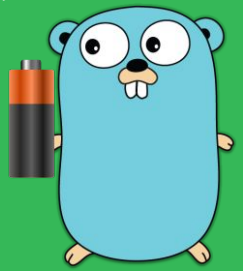


piladb

energy

battery

charge



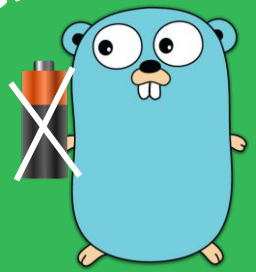
superpowers

piladb

~~energy~~

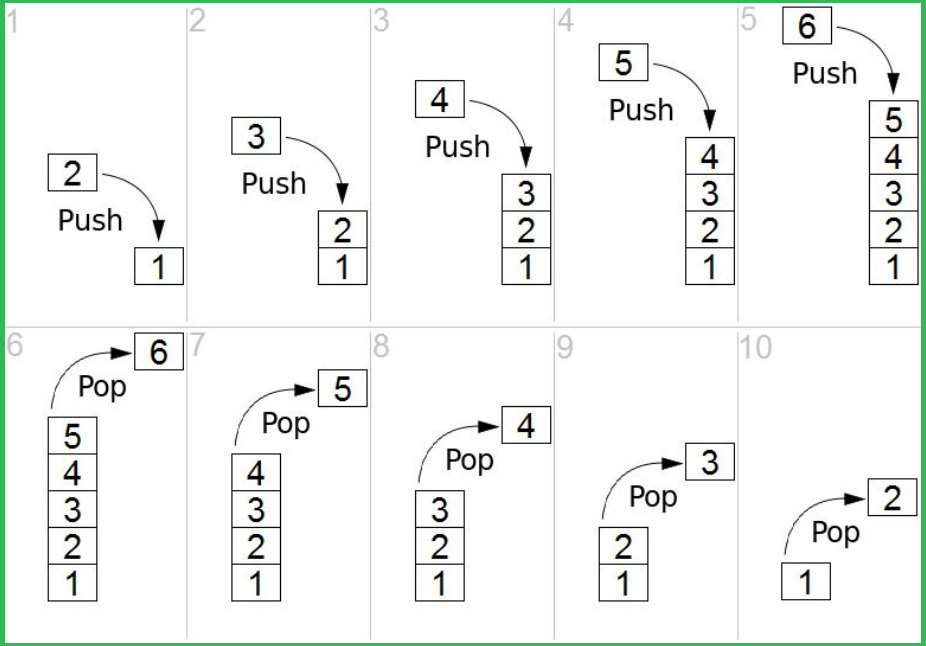
~~battery~~

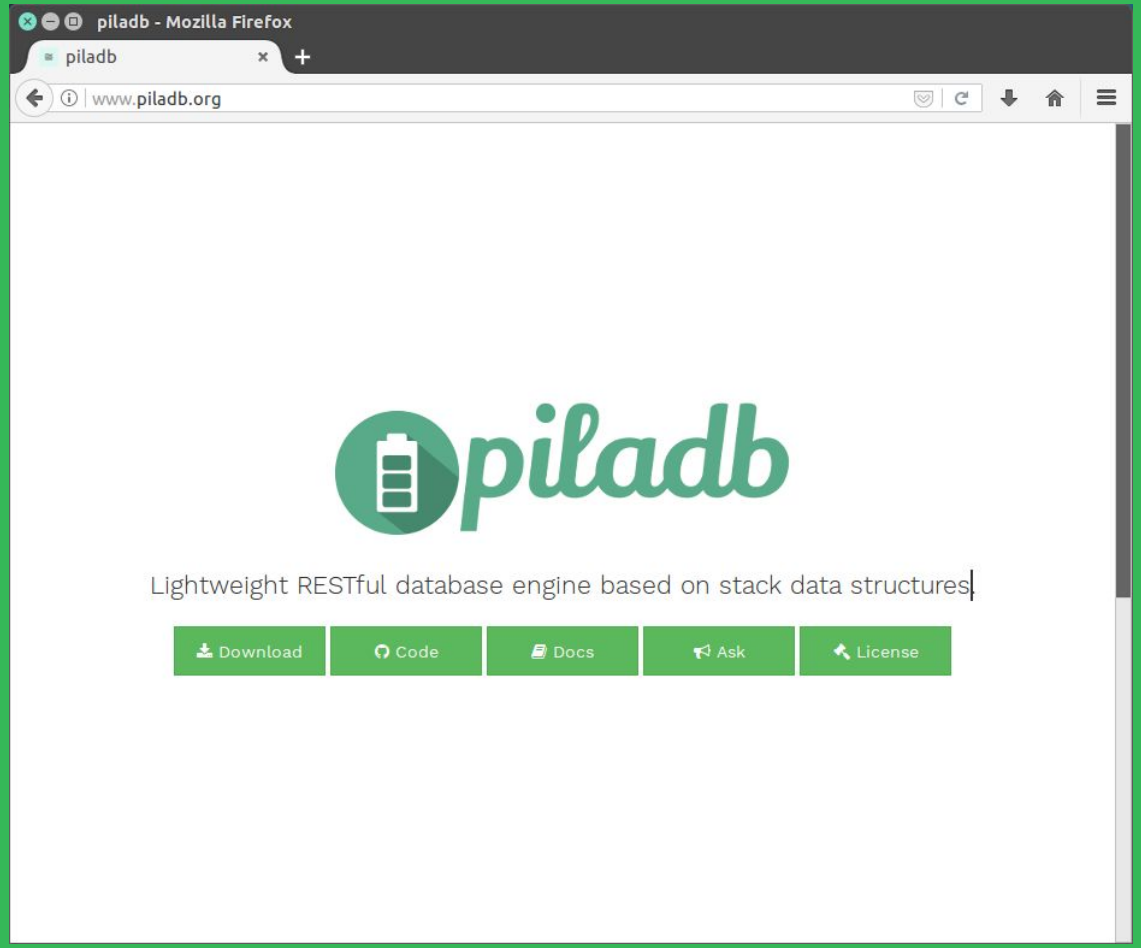
~~charge~~



~~superpowers~~

stack data structure


1
2
Push
1
2
3
Push
2
1
3
4
Push
3
2
1
4
5
Push
4
3
2
1
5
6
Push
5
4
3
2
1
6
6
Pop
5
4
3
2
1
7
5
Pop
4
3
2
1
8
4
Pop
3
2
1
9
3
Pop
2
1
10
2
Pop
1


piladb - Mozilla Firefox
piladb
www.piladb.org
piladb
Lightweight RESTful database engine based on stack data structures
Download
Code
Docs
Ask
License

database engine written in Go

lightweight and fast*

* no benchmarks yet, but feels fast!

```
piladb|master ⇒ find . -name '*.go'| grep -v vendor/ | grep -v "_test.go" | xargs wc -l
   17 ./pkg/stack/stacker.go
   83 ./pkg/stack/stack.go
   35 ./pkg/version/version.go
    8 ./pkg/date/date.go
   31 ./pkg/uuid/uuid.go
  107 ./pila/pila.go
  149 ./pila/stack.go
  138 ./pila/database.go
   65 ./pila/stack_status.go
    9 ./main.go
  395 ./pilad/conn.go
   57 ./pilad/router.go
   24 ./pilad/logo.go
  148 ./pilad/config.go
   68 ./pilad/utils.go
   30 ./pilad/main.go
   57 ./pilad/status.go
   65 ./config/value.go
   53 ./config/config.go
   57 ./config/vars/vars.go
 1596 total
```

Latest release

v0.1.0

0fd38ce

Version 0.1.0

Edit

fern4lvarez released this on 20 Dec 2016 · **12 commits** to master since this release

First release! 🎉

Downloads

piladb0.1.0.darwin-amd64.tar.gz	2.51 MB
piladb0.1.0.darwin-amd64.zip	2.51 MB
piladb0.1.0.linux-amd64.tar.gz	2.54 MB
piladb0.1.0.linux-amd64.zip	2.54 MB
Source code (zip)	
Source code (tar.gz)	

RESTful communication

PUSH, POP, PEEK, SIZE, FLUSH

JSON compatible elements

strings, numbers, objects, arrays, booleans, *null* [1]

[1] https://www.w3schools.com/js/js_json_datatypes.asp

no configuration files

no configuration files

environment variables

CLI parameters

inject via REST API

100% test coverage [1]

[1] https://codecov.io/gh/fern4lvarez/piladb

in-memory store

context and use cases

context

- Project started in October 2015
- More a Proof of Concept, less a solution to a problem
- Solo, side project
- First release in December 2016 (0.1.0)
- Main influences: Redis, Elasticsearch, CouchDB, BoltDB
- Not persistent, not distributed, *yet*

use cases

- Caching system
  - Invalidation using dates
  - All read and write ops are O(1)

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  - Key: name of a Stack, Value: elements of the Stack

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use cases

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  - Invalidation using dates
  - All read and write ops are O(1)
- Key-Value store with version history
  - Key: name of a Stack, Value: elements of the Stack
- Undo/Redo mechanism
- Message processing

functionality and main components

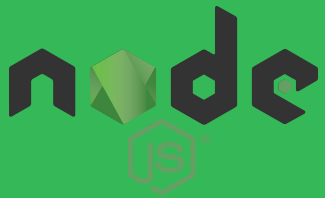
```
~|⇒
~|⇒ pilad
2017/02/15 03:11:25
2017/02/15 03:11:25          d8b 888                888 888
2017/02/15 03:11:25          Y8P 888                888 888
2017/02/15 03:11:25              888                888 888
2017/02/15 03:11:25 88888b.  888 888  8888b.   .d88888 88888b.
2017/02/15 03:11:25 888 "88b 888 888    "88b  d88" 888 888 "88b
2017/02/15 03:11:25 888  888 888 888 .d888888 888  888 888  888
2017/02/15 03:11:25 888 d88P 888 888 888  888 Y88b 888 888 d88P
2017/02/15 03:11:25 88888P"  888 888 "Y888888  "Y88888 88888P"
2017/02/15 03:11:25 888
2017/02/15 03:11:25 888
2017/02/15 03:11:25 888
2017/02/15 03:11:25
2017/02/15 03:11:25 Version: master
2017/02/15 03:11:25 Host:    linux_amd64
2017/02/15 03:11:25 Port:    1205
2017/02/15 03:11:25 PID:     13918
2017/02/15 03:11:25
```

with your favourite HTTP client...


curl://


Insomnia


POSTMAN


node
JS


php

CREATE DATABASE: `PUT /databases?name=MYDATABASE`

```
{
  "id": "22ffa4116b38da7988ebe505f9e129ba",
  "name": "MYDATABASE",
  "number_of_stacks": 0
}
```

CREATE STACK: `PUT /databases/MYDATABASE/stacks?name=MYSTACK`


```
{
  "id": "0c39814bad28d8b2ec5b4d697701c125",
  "name": "MYSTACK",
  "peek": null,
  "size": 0,
  "created_at": "2017-02-15T03:35:22.446530542+01:00",
  "updated_at": "2017-02-15T03:35:22.446530542+01:00",
  "read_at": "2017-02-15T03:35:22.446530542+01:00"
}
```

PUSH: POST /databases/MYDATABASE/stacks/MYSTACK {"element":"this is an element"}


```
{
  "id": "0c39814bad28d8b2ec5b4d697701c125",
  "name": "MYSTACK",
  "peek": "this is an element",
  "size": 1,
  "created_at": "2017-02-15T03:35:22.446530542+01:00",
  "updated_at": "2017-02-15T03:45:30.264123933+01:00",
  "read_at": "2017-02-15T03:46:18.060685036+01:00"
}
```

PUSH x 3: POST /databases/MYDATABASE/stacks/MYSTACK {"element":"this is the 4th element"}


```
{
  "id": "0c39814bad28d8b2ec5b4d697701c125",
  "name": "MYSTACK",
  "peek": "this is the 4th element",
  "size": 4,
  "created_at": "2017-02-15T03:35:22.446530542+01:00",
  "updated_at": "2017-02-15T03:48:47.699231061+01:00",
  "read_at": "2017-02-15T03:48:50.109298271+01:00"
}
```

POP: DELETE /databases/MYDATABASE/stacks/MYSTACK


```
{
  "id": "0c39814bad28d8b2ec5b4d697701c125",
  "name": "MYSTACK",
  "peek": "this is the 3rd element",
  "size": 3,
  "created_at": "2017-02-15T03:35:22.446530542+01:00",
  "updated_at": "2017-02-15T03:50:02.882637946+01:00",
  "read_at": "2017-02-15T03:50:34.287258581+01:00"
}
```

PEEK: GET /databases/MYDATABASE/stacks/MYSTACK?peek

```
{
  "element": "this is the 3rd element"
}
```

FLUSH: `DELETE /databases/MYDATABASE/stacks/MYSTACK?flush`


```
{
  "id": "0c39814bad28d8b2ec5b4d697701c125",
  "name": "MYSTACK",
  "peek": null,
  "size": 0,
  "created_at": "2017-02-15T03:35:22.446530542+01:00",
  "updated_at": "2017-02-15T03:52:27.494852286+01:00",
  "read_at": "2017-02-15T03:52:27.494852286+01:00"
}
```

stack

- LIFO: Last in, First out
- Stores JSON-compatible elements
- Unique name and identifier
- Created by user

database

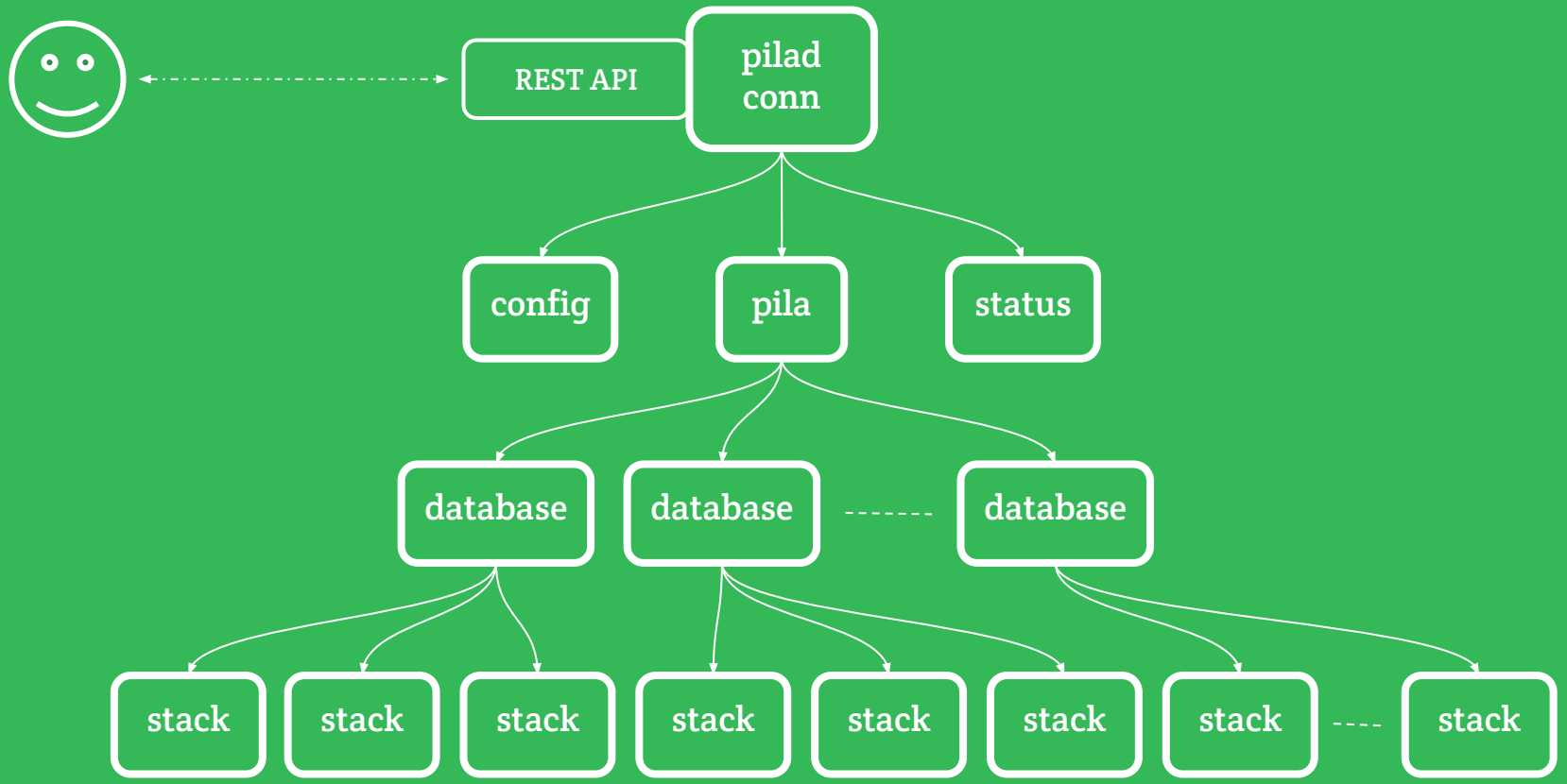
- Contains Stacks
- Unique name and identifier
- Created by user

pila

- Main entity of the engine
- Contains Databases
- Created by pilad on startup
- github.com/fern4lvarez/piladb/pila

pilad

- Daemon that starts piladb engine
- Implements REST API + configuration
- Creates a single instance of the Pila entity


REST API
pilad
conn
config
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stack
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stack
stack

internals in Go

Fernando Álvarez

implementation of a Stack

implementation is decoupled from the type

```go
// Stack represents a stack entity in piladb.
type Stack struct {
	// ID is a unique identifier of the Stack
	ID fmt.Stringer

	// Name of the Stack
	Name string

	// Database associated to the Stack
	Database *Database

	// CreatedAt represents the date when the Stack was created
	CreatedAt time.Time

	// UpdatedAt represents the date when the Stack was updated for the last time.
	// This date must be updated when a Stack is created, and when receives a PUSH,
	// POP, or FLUSH operation.
	// Note that unlike CreatedAt, UpdatedAt is not triggered automatically
	// when one of these events happens, but it needs to be set by hand.
	UpdatedAt time.Time

	// ReadAt represents the date when the Stack was read for the last time.
	// This date must be updated when a Stack is created, accessed, and when it
	// receives a PUSH, POP, or FLUSH operation.
	// Note that unlike CreatedAt, ReadAt is not triggered automatically
	// when one of these events happens, but it needs to be set by hand.
	ReadAt time.Time

	// base represents the Stack data structure
	base stack.Stacker
}
```

./pila/stack.go

interface that contains all Stack operations

```go
package stack

// Stacker represents an interface that contains all the
// required methods to implement a Stack that can be
// used in piladb.
type Stacker interface {
        // Push an element into a Stack
        Push(element interface{})
        // Pop the topmost element of a stack
        Pop() (interface{}, bool)
        // Size returns the size of the Stack
        Size() int
        // Peek returns the topmost element of the Stack
        Peek() interface{}
        // Flush flushes a Stack
        Flush()
}
```

./pkg/stack/stacker.go

use another Stack implementation by touching one line

```go
// NewStack creates a new Stack given a name and a creation date,
// without an association to any Database.
func NewStack(name string, t time.Time) *Stack {
	s := &Stack{}
	s.Name = name
	s.SetID()
	s.CreatedAt = t
	s.base = stack.NewStack()
	return s
}
```

./pila/stack.go

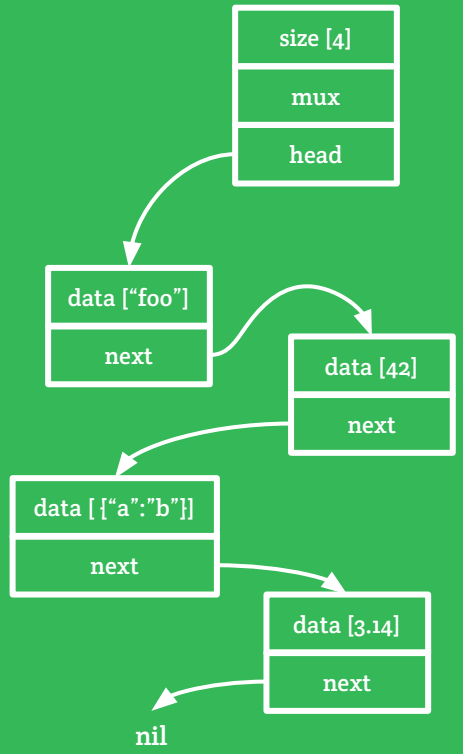
current implementation uses linked lists

implementation using linked lists

```go
// Stack implements the Stacker interface, and represents the stack
// data structure as a linked list, containing a pointer
// to the first Frame as a head and the size of the stack.
// It also contain a mutex to lock and unlock
// the access to the stack at I/O operations.
type Stack struct {
        head *frame
        size int
        mux  sync.Mutex
}

// frame represents an element of the stack. It contains
// data and the link to the next Frame as a pointer.
type frame struct {
        data interface{}
        next *frame
}
```

./pkg/stack/stack.go



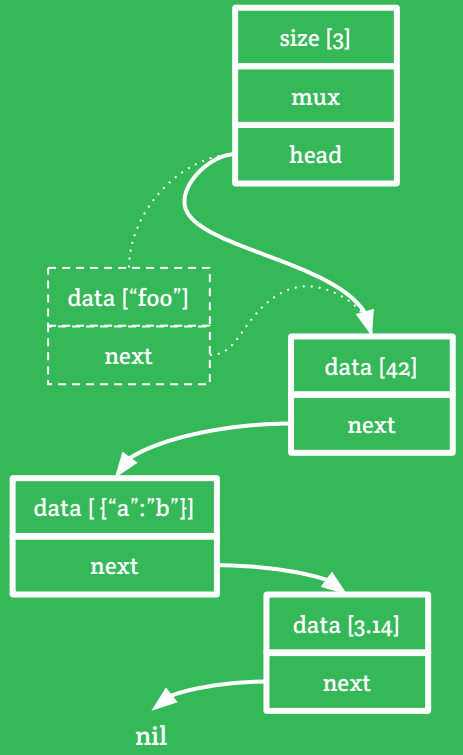
implementation using linked lists

```go
// Pop removes and returns the element on top of the stack,
// updating its head to the next Frame. If the stack was empty,
// it returns false.
func (s *Stack) Pop() (interface{}, bool) {
	s.mux.Lock()
	defer s.mux.Unlock()

	if s.head == nil {
		return nil, false
	}

	element := s.head.data
	s.head = s.head.next
	s.size--
	return element, true
}
```

./pkg/stack/stack.go

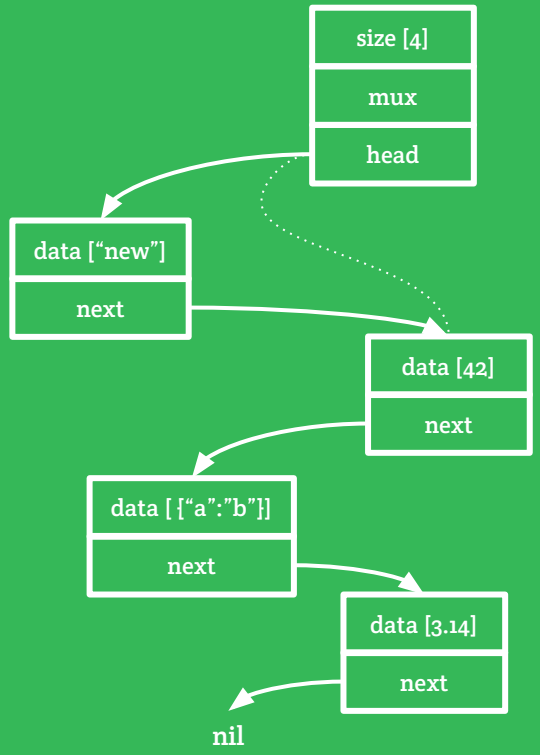


implementation using linked lists

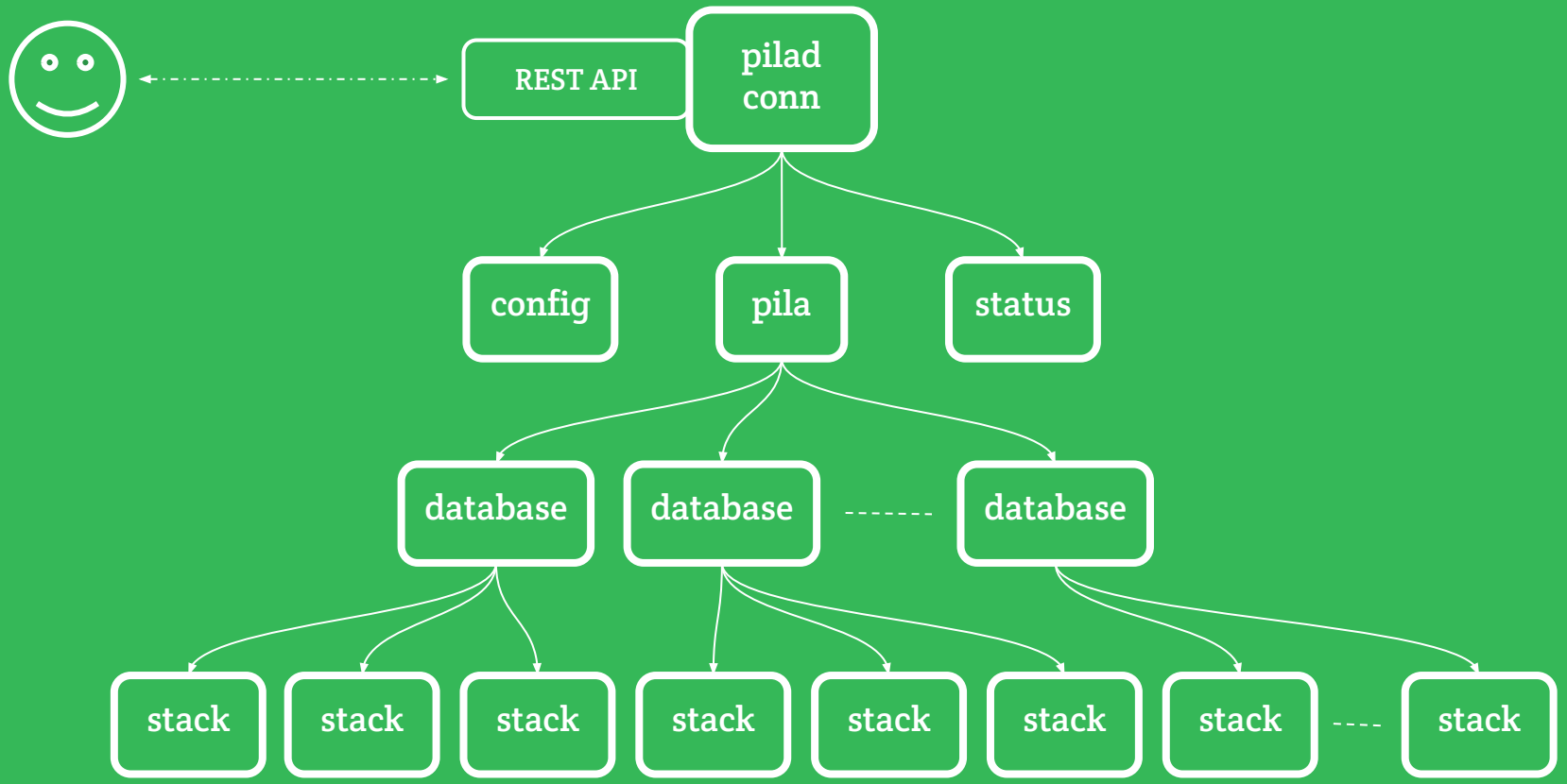
```go
// Push adds a new element on top of the stack, creating
// a new head holding this data and updating its head to
// the previous stack's head.
func (s *Stack) Push(element interface{}) {
	s.mux.Lock()
	defer s.mux.Unlock()

	head := &frame{
		data: element,
		next: s.head,
	}
	s.head = head
	s.size++
}
```

./pkg/stack/stack.go



implementation of Config


REST API
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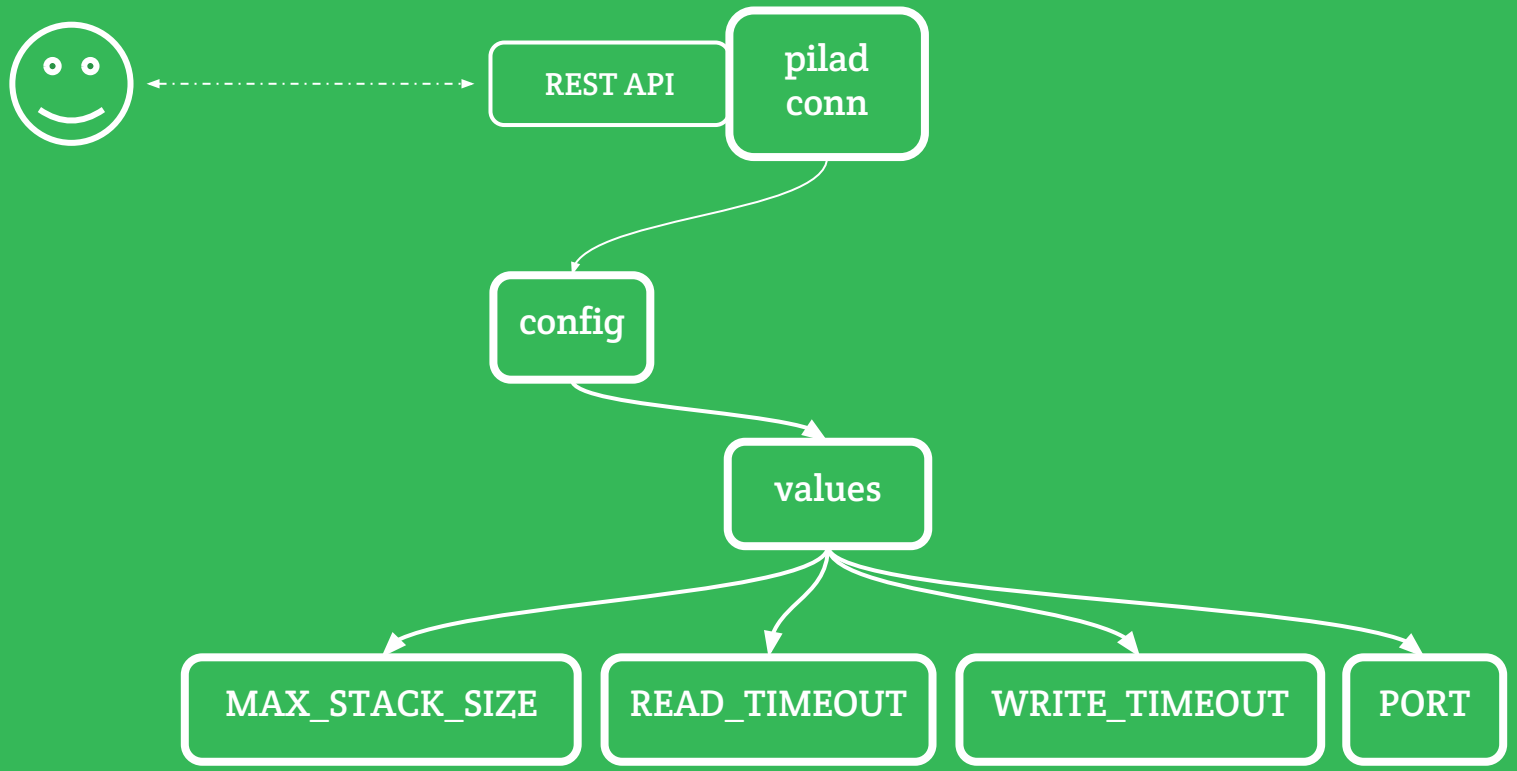

REST API
pilad conn
config
values
MAX_STACK_SIZE
READ_TIMEOUT
WRITE_TIMEOUT
PORT

config is like a Pila with a single Database

```go
// Config represents a Database containing all
// configuration values that will be
// updated and consumed by piladb.
type Config struct {
	Values *pila.Database
}
```

```go
// Get gets a config value from a key.
func (c *Config) Get(key string) interface{} {
	s, ok := c.Values.Stacks[uuid.New(CONFIG+key)]
	if !ok {
		return nil
	}
	return s.Peek()
}

// Set sets a config value having a key and the value.
func (c *Config) Set(key string, value interface{}) {
	s, ok := c.Values.Stacks[uuid.New(CONFIG+key)]
	if !ok {
		sID := c.Values.CreateStack(key, time.Now().UTC())
		s, _ = c.Values.Stacks[sID]
	}

	s.Push(value)
}
```

./config/config.go

export a func per config value

```go
// WriteTimeout returns the value of WRITE_TIMEOUT.
// Type: time.Duration, Default: 45
func (c *Config) WriteTimeout() time.Duration {
	writeTimeout := c.Get(vars.WriteTimeout)
	t := intValue(writeTimeout, vars.WriteTimeoutDefault)
	return time.Duration(t)
}

// Port returns the value of PORT.
// Type: int, Default: 1205
func (c *Config) Port() int {
	port := c.Get(vars.Port)
	t := intValue(port, vars.PortDefault)

	if t < 1025 || t > 65536 {
		return vars.PortDefault
	}
	return t
}
```

./config/value.go

set or modify a config var on runtime:

POST /_config/READ_TIMEOUT {"element":15}

```
104                 if r.Method == "POST" {
105                         if r.Body == nil {
106                                 log.Println(r.Method, r.URL, http.StatusBadRequest,
107                                         "no element provided")
108                                 w.WriteHeader(http.StatusBadRequest)
109                                 return
110                         }
111                         err := element.Decode(r.Body)
112                         if err != nil {
113                                 log.Println(r.Method, r.URL, http.StatusBadRequest,
114                                         "error on decoding element:", err)
115                                 w.WriteHeader(http.StatusBadRequest)
116                                 return
117                         }
118
119                         c.Config.Set(vars["key"], element.Value)
120                 }
```

./pilad/config.go

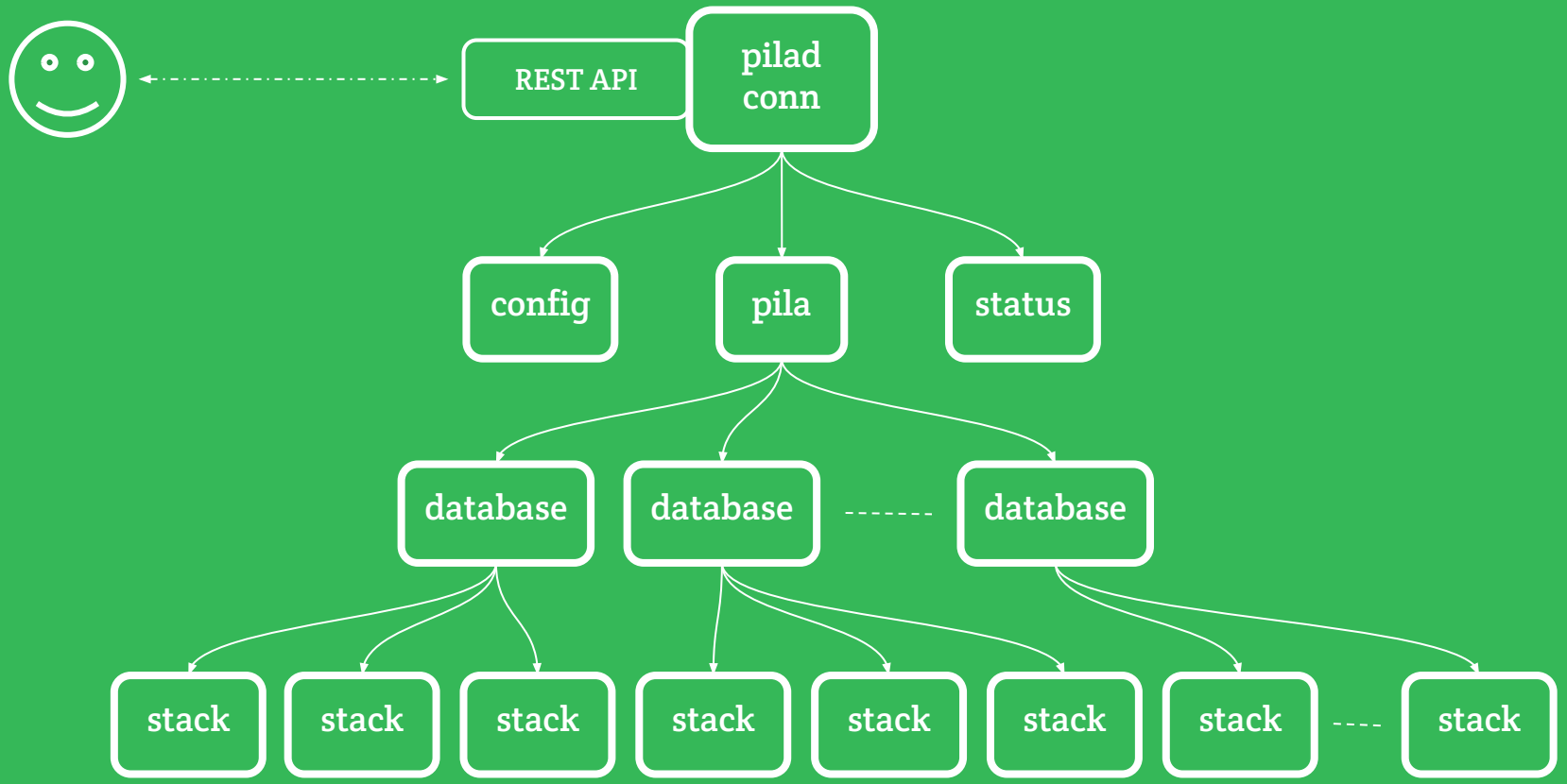
read config values on runtime: PUSH

```
246                 case r.Method == "POST":
247                         c.checkMaxStackSize(c.pushStackHandler)(w, r, stack)
248                         return
```

```
136 // checkMaxStackSize checks config value for MaxStackSize and execute the
137 // wrapped handler if check is validated.
138 func (c *Conn) checkMaxStackSize(handler stackHandlerFunc) stackHandlerFunc {
139         return func(w http.ResponseWriter, r *http.Request, stack *pila.Stack) {
140                 if s := c.Config.MaxStackSize(); stack.Size() >= s && s != -1 {
141                         log.Println(r.Method, r.URL, http.StatusNotAcceptable, vars.MaxStackSize, "value reached")
142                         w.WriteHeader(http.StatusNotAcceptable)
143                         return
144                 }
145
146                 handler(w, r, stack)
147         }
148 }
```

./pilad/config.go

implementation of Status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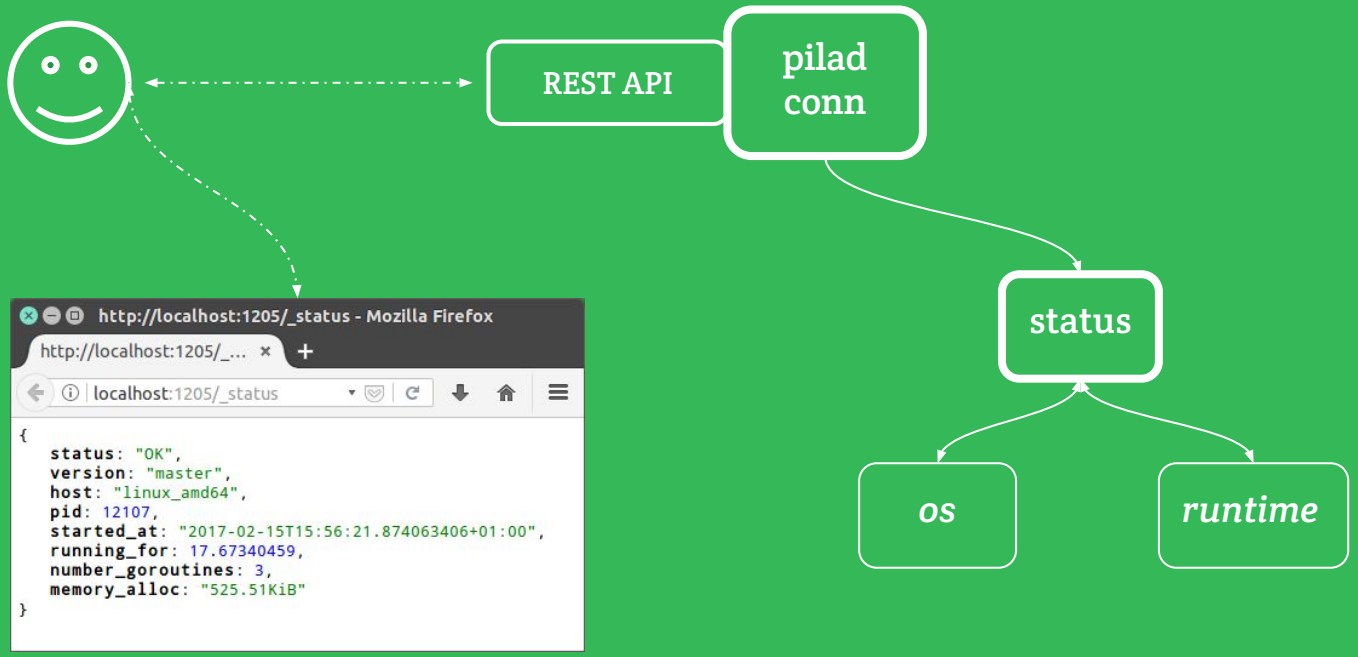
REST API
pilad
conn
status
os
runtime
http://localhost:1205/_status - Mozilla Firefox
http://localhost:1205/_...
localhost:1205/_status
{
status: "OK",
version: "master",
host: "linux_amd64",
pid: 12107,
started_at: "2017-02-15T15:56:21.874063406+01:00",
running_for: 17.67340459,
number_goroutines: 3,
memory_alloc: "525.51KiB"
}

os

- `os.Getpid()`: piladb process ID

runtime

- `runtime.GOOS`: Host operating system
- `runtime.GOARCH`: Host architecture
- `runtime.NumGoroutine()`: Number of existing goroutines
- `runtime.MemStats`: Statistics about memory allocator

```go
// A MemStats records statistics about the memory allocator.
type MemStats struct {
	// General statistics.
	Alloc      uint64 // bytes allocated and not yet freed
	TotalAlloc uint64 // bytes allocated (even if freed)
	Sys        uint64 // bytes obtained from system (sum of XxxSys below)
	Lookups    uint64 // number of pointer lookups
	Mallocs    uint64 // number of mallocs
	Frees      uint64 // number of frees

	// Main allocation heap statistics.
	HeapAlloc    uint64 // bytes allocated and not yet freed (same as Alloc above)
	HeapSys      uint64 // bytes obtained from system
	HeapIdle     uint64 // bytes in idle spans
	HeapInuse    uint64 // bytes in non-idle span
	HeapReleased uint64 // bytes released to the OS
	HeapObjects  uint64 // total number of allocated objects

	// Low-level fixed-size structure allocator statistics.
	//	Inuse is bytes used now.
	//	Sys is bytes obtained from system.
	StackInuse  uint64 // bytes used by stack allocator
	StackSys    uint64
	MSpanInuse  uint64 // mspan structures
	MSpanSys    uint64
	MCacheInuse uint64 // mcache structures
	MCacheSys   uint64
	BuckHashSys uint64 // profiling bucket hash table
	GCSys       uint64 // GC metadata
	OtherSys    uint64 // other system allocations

	// Garbage collector statistics.
	NextGC        uint64 // next collection will happen when HeapAlloc ≥ this amount
	LastGC        uint64 // end time of last collection (nanoseconds since 1970)
	PauseTotalNs  uint64
	PauseNs       [256]uint64 // circular buffer of recent GC pause durations, most recent at [(NumGC+255)%256]
	PauseEnd      [256]uint64 // circular buffer of recent GC pause end times
	NumGC         uint32
	GCCPUFraction float64 // fraction of CPU time used by GC
	EnableGC      bool
	DebugGC       bool

	// Per-size allocation statistics.
	// 61 is NumSizeClasses in the C code.
	BySize [61]struct {
		Size    uint32
		Mallocs uint64
		Frees   uint64
	}
}
```

go/src/runtime/memstats.go

pull MemStats on each request

```go
// Update updates the Status given a current time and memory
// stats.
func (s *Status) Update(now time.Time, mem *runtime.MemStats) {
	s.RunningFor = now.Sub(s.StartedAt).Seconds()
	s.NumberGoroutines = runtime.NumGoroutine()
	s.MemoryAlloc = MemOutput(mem.Alloc)
}
```

./pilad/status.go

```go
// statusHandler writes the piladb status into the response.
func (c *Conn) statusHandler(w http.ResponseWriter, r *http.Request) {
	c.Status.Update(time.Now().UTC(), MemStats())

	w.Header().Set("Content-Type", "application/json")
	log.Println(r.Method, r.URL, http.StatusOK)
	w.Write(c.Status.ToJSON())
}
```

./pilad/conn.go

```go
// MemStats fetches the memory statistics provided
// by the Go stdlib.
func MemStats() *runtime.MemStats {
	var mem runtime.MemStats
	runtime.ReadMemStats(&mem)
	return &mem
}
```

./pilad/utils.go

demo

future plans

0.1.x

- Update to Go 1.8
- More docs!
  - Internals
  - Configuration
  - Go package
- Go client library

0.2.x

- New Stack operations
  - ROTATE, BASE, BLOCK, CONCAT
  - Spoiler! Stacks will be Queues too
- Option to allow pushing to Stack when it is full
  - Bottommost element will be removed
- More clients libraries?
  - Ruby, JS, Python, PHP, Java...

0.3.x

- Version control
  - Using activity logs
- Restore from any point in time
  - Persistence!
- New logo
  - Bye battery!

Future

- Replication
- pilaql (query language)
- Authentication
- TLS
- JSON API
- ... and more!

help!

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Official piladb client library in Go https://www.piladb.org

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.gitignore	Initial commit	2 days ago
LICENSE	Initial commit	2 days ago
README.md	Update README.md	2 days ago

README.md

piladb-go

Official piladb client library in Go

all it takes to get started

```
go get -u github.com/fern4lvarez/piladb/...
cd $GOPATH/src/github.com/fern4lvarez/piladb
make
```

https://www.piladb.org

https://github.com/fern4lvarez/piladb

https://docs.piladb.org

https://www.reddit.com/r/piladb/

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thank you!
questions?