

Golang for Sysadmins - A Practical Introduction

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Introduction

- workshop that gets you started with Go in a practical manner
- first workshop, be gentle!
- follow along:
 - <https://francis.begyn.be/talk/intro-to-go-workshop.pdf>
 - [https://gitlab.inuits.io/o11y/o11y-presentations -> presentations/intro-to-go-workshop.md](https://gitlab.inuits.io/o11y/o11y-presentations->presentations/intro-to-go-workshop.md)



- through the system packager:
 - `apt install golang`
 - `yay go`
 - `pacman -Syu go`
 - ...
- from the website:
 1. Download the tarball from <https://go.dev/dl/>
 2. Run `tar -C /usr/local -xzf go1.20.3.linux-amd64.tar.gz`
 3. Add the path to PATH: `export PATH=$PATH:/usr/local/go/bin`
 4. Test by running `go version`

- initialize a go module `go mod init workshop`
 - Go module is a collection of packages in a file tree
- running go programs without building `go run main.go`
- building go programs `go build main.go`
 - `go build -o workshop main.go`
 - `./workshop`

```
package main

import "fmt"

func main() {
    fmt.Println("hello world")
}
```

- variables can be explicitly declared `var X int`
- but the types can also be inferred from the variable `var a = "test"`

```
var a string
```

```
a = "test"
```

```
var b, c int
```

```
c = 2
```

```
var d = "initial"
```

```
var e = true
```

- := is shorthand for declaring and initializing a variable

```
var a = "apple"  
var b, c int = 1, 2  
var d = true
```

is equivalent

```
a := "apple"  
b, c := 1, 2  
d := true
```

- keyword `const`

```
const n = "test"
```

```
const a = 1
```


- string
- int, int16, int32, int64
- uint, uint16, uint32, uint64
- float32, float64
- string
- bool
- rune (this is basically the Go equivalent of char)

- array:
 - `[2]string`
 - declare and initialize `[2]string{"hello","world"}`
 - defined by type AND size
- slice:
 - `[]string`
 - defined by type
 - has append function
- map:
 - `map[string]int`
 - accessing the map `var[key]` returns the value
 - check if key exists `exist, val := map[key]`

```
if a == b {  
    fmt.Println("hello world")  
}
```

```
if a == b {  
    fmt.Println("hello world")  
} else {  
    fmt.Println("foo bar")  
}
```

```
if a == b {  
    fmt.Println("hello world")  
} else if a == c {  
    fmt.Println("foo bar")  
} else {  
    fmt.Println("oopss")  
}
```

- Go only has `for` as a loop keyword

```
for i:=0;i++;i<=10 {  
    fmt.Println("hello world")  
}
```

- `for each` is implemented by using the `range` keyword

```
words := []string{"hello", "world", "test", "oops"}  
for ind, val := range words {  
    fmt.Printf("%s - %s"/n, ind, val)  
}
```

- The `for` keyword also accepts a condition (turning it into a `while`)

```
search := true
for search {
    fmt.Println("searching...")
    if var == "looking for" {
        search = false
    }
}
```

- An infinite loop is very short in Go

```
for {
    fmt.Println("going forever!")
}
```

```
func hello(name string) string {  
    return "hello " + name  
}
```

```
func main() {  
    fmt.Println(hello("francis"))  
}
```

- functions can return error as a data type

```
func hello(name string) (string, error) {  
    if name != "francis" {  
        return "", fmt.Errorf("woops, you're not the right person")  
    }  
    return "hello " + name, nil  
}
```

```
func main() {  
    fmt.Println(hello("francis"))  
    fmt.Println(hello("tom"))  
}
```


basics - error handling

```
func hello(name string) (string, error) {  
    if name != "francis" {  
        return "", fmt.Errorf("woops, you're not the right person")  
    }  
    return "hello " + name, nil  
}
```

```
func main() {  
    welcome, err := hello("tom")  
    if err != nil {  
        fmt.Println("hey, you don't seem to have access to this")  
        os.Exit(0)  
    }  
}
```

- very extensive
- holds almost anything you want for simple programs

```
import (  
    "fmt"  
    "io"  
    "os"  
    "net/http"  
)
```

- get dependencies with `go get <dependency path>`
- a module can contain multiple packages
- tracked in `go.mod` and `go.sum` files

1. Install Go

- through the system packager:
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- from the website:
 - 1.1 Download the tarball from <https://go.dev/dl/>
 - 1.2 Run `tar -C /usr/local -xzf go1.20.3.linux-amd64.tar.gz`
 - 1.3 Add the path to PATH: `export PATH=$PATH:/usr/local/go/bin`
 - 1.4 Test by running `go version`

2. Write a small program that will check if the passed `name` is in an array of strings and greet the person when they are. If they are not, kindly inform them of this and handle the error.
 - check if `name` is in array
 - return error when they are not
 - greet them when they are
- 20 min time box
- links:
 - <https://gobyexample.com/>
 - <https://pkg.go.dev/>
 - <https://gobyexample.com/if-else>
 - <https://gobyexample.com/slices>
 - <https://gobyexample.com/maps>
 - <https://gobyexample.com/functions>

```
func authenticate(name string, auth map[string]bool) error {
    ok, val := auth[name]
    if !ok {
        return fmt.Errorf("you are not in the authenticated")
    }
    if !val {
        return fmt.Errorf("you don't have permission to acc")
    }
    return nil
}
```

```
func main() {  
    users := make(map[string]bool)  
    users["francis"] = true  
    users["vince"] = true  
    users["tom"] = false  
    users["kerre"] = true  
  
    attempt := "francis"  
    err := authenticate(attempt, users)  
    if err != nil {  
        fmt.Printf("we had an error when authenticating: %v", err)  
    }  
    fmt.Printf("welcome %s!\n", attempt)  
}
```

```
func main() {
    users := make(map[string]bool)
    users["francis"] = true
    users["vince"] = true
    users["tom"] = false
    users["kerre"] = true

    attempt = "leeroy"
    err = authenticate(attempt, users)
    if err != nil {
        fmt.Printf("we had an error when authenticating: %v\n", err)
        os.Exit(0)
    }
    fmt.Printf("welcome %s!\n", attempt)
}
```


- 15 minutes

- reading/writing file is spread over a selection of packages
- helper functions to easily parse complete files or write files
- can also “open” the file and then manually handle the parsing

```
import (  
    "bufio"  
    "fmt"  
    "io"  
    "os"  
)
```

- option to just read the file into memory `os.ReadFile`
- same for writing `os.WriteFile`

```
dat, err := os.ReadFile("/tmp/dat")  
fmt.Print(string(dat))
```

```
d1 := []byte("hello\ngo\n")  
err := os.WriteFile("/tmp/dat1", d1, 0644)
```

- handle the files manually
 - open()
 - create()
 - read()
 - ...

```
func main() {  
    f, err := os.Open("/tmp/dat")  
    b1 := make([]byte, 5)  
    n1, err := f.Read(b1)  
    r4 := bufio.NewReader(f)  
    b4, err := r4.Peek(5)  
    f.Close()  
  
    f, err := os.Create("/tmp/dat2")  
    d2 := []byte{115, 111, 109, 101, 10}
```

- standard library “net/http”

```
import (  
    "bufio"  
    "fmt"  
    "net/http"  
)
```

- standard request helper functions
 - .Get(url string)
 - .Post(url string, body io.Reader)
 - ...

Simple HTTP client

```
func main() {  
    resp, err := http.Get("https://gobyexample.com")  
    if err != nil {  
        panic(err)  
    }  
    defer resp.Body.Close()  
  
    fmt.Println("Response status:", resp.Status)  
    ... handle body parsing ...  
}
```

- standard library “net/http”
- standard request helper functions
 - `.Get(url string)`
 - `.Post(url string, body io.Reader)`
- complex queries:
 1. Create client with the right config: `client := http.Client{}`
 2. Create the request: `http.NewRequest(method, url string, body io.Reader)`
 3. Let the client execute the request: `client.Do(request)`

Slightly more complex HTTP client

```
func (bw *BitwardenClient) CreateItem(item Item) error {
    jsonItem, err := json.Marshal(item)
    req, err := http.NewRequest("POST",
        bw.BaseURL+"/object/item",
        bytes.NewBuffer(jsonItem)
    )
    req.Header.Add("Content-Type", "application/json")
    resp, err := bw.Client.Do(req)
    defer resp.Body.Close()
    var createResp ItemCreateResp
    json.NewDecoder(resp.Body).Decode(&createResp)
    ...
}
```


- HTTP server using `net/http` is relatively easy
- based on the “handler” concept

- HTTP server using `net/http` is relatively easy
- based on the “handler” concept
- server started with `http.ListenAndServe(":8080", nil)`

- handlers implement the `http.Handler` interface
- handler functions take `http.ResponseWriter` & `http.Request` arguments
 - `ResponseWriter` can be used to answer

```
func hello(w http.ResponseWriter, req *http.Request) {  
    fmt.Fprintf(w, "hello\n") # just send "hello" back  
}
```

HTTP server - handlers

- handlers implement the `http.Handler` interface
- handler functions take `http.ResponseWriter` & `http.Request` arguments
 - `ResponseWriter` can be used to answer
 - `Request` holds the request data

```
# This handler does something a little more sophisticated by  
# reading all the HTTP request headers and echoing them into  
# the response body.
```

```
func headers(w http.ResponseWriter, req *http.Request) {  
    for name, headers := range req.Header {  
        for _, h := range headers {  
            fmt.Fprintf(w, "%v: %v\n", name, h)  
        }  
    }  
}
```

HTTP server - starting the server

```
func main() {  
    http.HandleFunc("/hello", hello)  
    http.HandleFunc("/headers", headers)  
    http.ListenAndServe(":8090", nil)  
}
```

1. Create a little program that uses HTTP client to talk with you're favorite API! No ideas, see the API's below
 2. Create HTTP server that combines the code from before (the authentication exercise) and only answers if a correct user is mentioned in the headers.
- remainder of the workshop
 - links:
 - <https://gobyexample.com/>
 - <https://pkg.go.dev/net/http>
 - <https://pkg.go.dev/encoding/json>
 - <https://gobyexample.com/json>
 - <https://gobyexample.com/http-client>
 - <https://gobyexample.com/http-server>