

# Go Basics

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## Why Go

- C-like syntax
- rapid developing & high performance [benchmark](#)
- easy deploying: statically linked when building executable binaries
- standard library support: db/net/encoding/test
- goroutine: write parallel programs in serial thinking
- "Google" brand

## Milestones

- 2007.9 Rob Pike、Ken Thompson、Robert Griesemer started designing go
- 2009.11 Birth
- 2017.8 Go 1.9 released

## Installation & Configuration

- Fetch go installer of your platform(unix/linux/windows supported)
- Define your GOROOT(where go installed) & GOPATH(workspace) environment variables
- Test `go` command, you should get:

Go is a tool for managing Go source code.

Usage:

```
go command [arguments]
```

The commands are:

```
build      compile packages and dependencies
clean      remove object files
doc        show documentation for package or symbol
env        print Go environment information
bug        start a bug report
fix        run go tool fix on packages
fmt        run gofmt on package sources
generate   generate Go files by processing source
get        download and install packages and dependencies
.....
```

- Examples

```
go fmt // format source code
go get "github.com/lwldcr/hbase1" // get a package from github
```

## Syntax & Go basics

- Hello world

```
package main // must have this line

import "fmt"

func main() {
    fmt.Println("Hello, World! This is a Go program.")
}
```

- package

- "main": must contain a function: `func main() {}`, compiled as a binary
- other: library package providing function for reuse and deliver

- import

- import anything you need, here "fmt" is a built-in package, with frequently used text formatting functions, like the `fmt.Println` above
- import more than one packages could be written as follows:

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

- func

- stating of function, followed by a function name, parameters list inside parentheses, returning values (optional)

```
func function1() { // a function with no parameters return
nothing
}

func function2(i int, s string) { // a function with
parameters, return nothing
}

func function3(i int, s string) int { // returns an int
}

func function4(i int, s string) (int, error) { // returns an
int and an error
}
```

- Variables definition

- Complicated way

```
var i int // state a new variable i whose type is int
i = 10 // assign 10 to i
fmt.Println(i)
```

- Easy way

```
i := 10 // state an int type variable i and assign it to 10
```

- Flow control

- for

```
for i := 0; i < 10; i++ { // C & Java style usage
    fmt.Printf("i = %d\n", i)
}

for { // same as "while"
}

for i, v := range integer_slice { // typical usage in Go: looping
an array-like object
}
```

- if else
- switch
  - no fallthrough

```
i := 1
switch i {
  case 1:
    fmt.Println("1") // we dont have to add an "break" here
                    // the following "default" will never be
    printed
  default:
    fmt.Println("default") // won't be called
}
```

- goto

```
var odd_sum, even_sum int
for i := 0; i < 10; i++ {
  if i % 2 == 0 {
    goto EVEN
  } else {
    goto ODD
  }
EVEN:
  even_sum += i
  continue
ODD:
  odd_sum += i
  continue
}
fmt.Println("odd_sum:", odd_sum, "even_sum:", even_sum)

>>> odd_sum: 25 even_sum: 20
```

- type definition

```

type DataType struct {
    Visible int // will be seen out of the original package
    invisible int // invisible out of the original package
    SubData SubDataType // nesting definition
}

type SubDataType struct {
    Data string
}

```

- defer, panic and recover

- defer: call before function returns

```

func Query(query Query) ([]Data) {
    conn := getDbConn() // assume getDbConn() returns a db connection
    defer conn.Close() // close db connection before function returns
    // do your job here
    .....
}

```

- panic & recover

- panic: raise error
- recover: got panic error, and try handling error

```

package main

import "fmt"

func main() {
    fmt.Printf("hello world")
    defer func() {
        if err := recover(); err != nil {
            fmt.Println("got panic error: ", err)
        }
    }()
    myPainc()
    fmt.Printf("This will not show")
}

func myPainc() {
    var x = 30
    var y = 0
    panic("Panic error") // raising an error
    var c = x / y
    fmt.Println(c) // this will not show
}

```

hello world got panic error: Panic error

Process finished with exit code 0

## Significant features

- Slice

- definition

```

intslice := make([]int, 10, 15) // make an int slice, with 10
elements, capacity 15

```

- data structure: a pointer to an array, a length, a capacity
  - as function parameters: go functions always copy data, so pass a full huge array cost much, use slice instead
  - related reading: [\[Go slices are not dynamic arrays\]\(https://appliedgo.net/slices/\)](https://appliedgo.net/slices/), [译文](#)

- Channel

- definition

```

ch1 := make(chan int, 10) // make a new channel with buffer size of
10
ch2 := make(chan int) // make a new channel without buffer, block
read & write
for i := 0; i < 10; i++ {
    ch1 <- i // you cannot continuously write into a channel with no
buffer
    ch2 <- i // this will cause error
}

```

- in & out

```

for i := 0; i < 10; i++ { // in function1
    ch1 <- i
}

```

```

for {
    select {
        case i := <- ch1:
            fm.Println("got:", i)
        default:
            fmt.Println("got nothing")
            time.Sleep(1 * time.Microsecond)
    }
}

```

- Interface

```

type Person interface { // define an interface
    SayHello()
}

type Man struct {
    Name string
    Birthday string
}

func (m Man) SayHello() { // type Man implements SayHello() function
    // Man could be used as Person type
    fmt.Println("hello, this is", m.Name)
}

type Woman struct {
    Name string
    Married bool
}

func (w Woman) SayHello() {
    fmt.Println("hi, i'm", w.Name)
}

func Greeting(p Person) {
    p.SayHello() // call SayHello()
}

func main() {
    m := Man{Name:"Bruce"}
    w := Woman{Name:"Alice", Married:false}
    Greeting(m)
    Greeting(w)
}

```

hello, this is Bruce hi, i'm Alice

- Pointers



```

func swap(i *int, j *int) {
    temp := *i
    *i = *j
    *j = temp
}

func main() {
    i, j := 1, 10
    fmt.Printf("i = %d, j = %d\n", i, j)

    swap(&i, &j)
    fmt.Printf("i = %d, j = %d\n", i, j)
}

```

i = 1, j = 10 i = 10, j = 1

- Goroutine

```

// "net/http" server.go
// http.ListenAndServe()
func (srv *Server) Serve(l net.Listener) error {
    .....
    for {
        rw, e := l.Accept()
        .....
        go c.serve(ctx) // for every request, starts a new Goroutine
    }
}

```

- Sync

```

func produce(ch chan int, wg *sync.WaitGroup) {
    for i := 0; i < 10; i++ {
        ch <- i
        fmt.Println("append:", i)
    }
    fmt.Println("appending done")
    wg.Done()
}

func consume(ch chan int, wg *sync.WaitGroup) {
    fmt.Println("start consuming..")
    for {
        select {
        case i, ok := <- ch:
            if !ok {
                fmt.Println("error")
            }
        }
    }
}

```

```

        wg.Done()
        return
    }
    fmt.Println("got:", i)
    if i == 9 {
        fmt.Println(" consuming done")
        wg.Done()
        return
    }
    default:
        time.Sleep(1*time.Microsecond)
    }
}
wg.Done()
}

func main() {
    ch := make(chan int) // make a new channel
    var wg sync.WaitGroup // state a WaitGroup variable
    wg.Add(2) // add 2

    go consume(ch, &wg) // start consuming goroutine
    go produce(ch, &wg) // start produce

    wg.Wait() // wait until all goroutines done
    close(ch) // close channel
}

```

- Powerful built-in Libraries
  - net
  - encoding
  - glog

## Downsides

- Notorious "stop the world" (fixed in Go 1.5)
- Fixed coding style(easy to read others' code)
- No classes(struct), no inheritance(nested struct), no generic type(interface{})
- Error handling, someone feels elegant, most users think ugly

```
if a, err := function1(); err != nil { // call function1 and check
error
    handle_error()
    return
}

if b, err := function2(); err != nil { // call function2 and check
error
    handle_error()
    return
}
```

## Typical occasions

- High performance HTTP server
- A powerful game server
- API service
- Data processing
- My projects
  - [hf-themis](#) - service for monitoring and sending alert messages
  - [hf-dataservice](#) - API services, have data communicating with Redis/Hbase/Impala

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