# Go Basics

WASA: Web and Software Architecture

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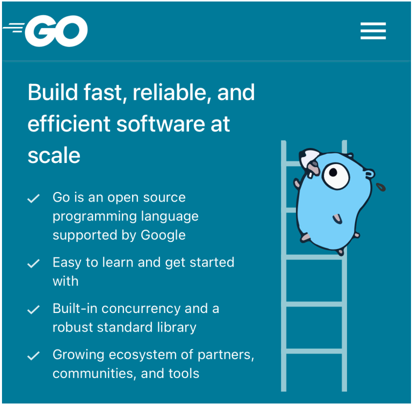
# GO Language



## Build fast, reliable, and efficient software at scale

- ✓ Go is an open source programming language supported by Google
- ✓ Easy to learn and get started with
- ✓ Built-in concurrency and a robust standard library
- ✓ Growing ecosystem of partners, communities, and tools

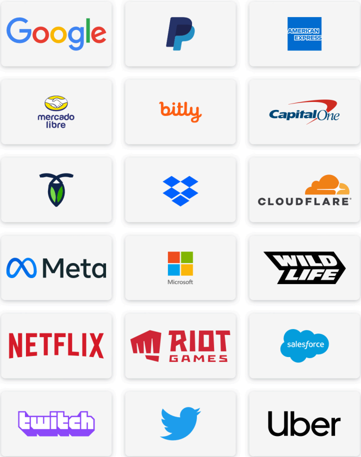
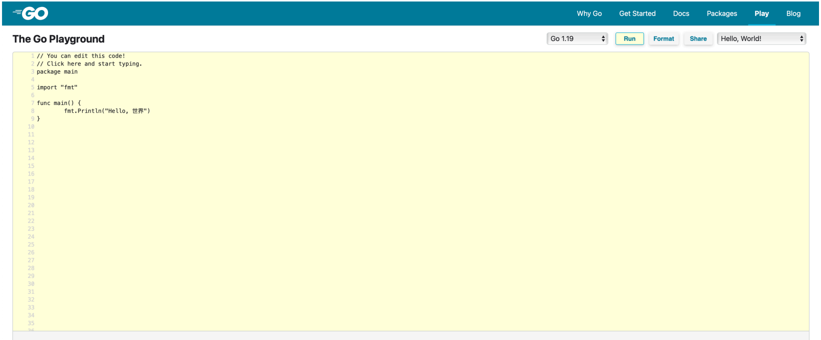


**Figure 1:** Companies using Go

# Go Playground



```go
// You can edit this code!
// Click here and start typing.
package main

import "fmt"

func main() {
	fmt.Println("Hello, 世界")
}
```

**Figure 2:** https://go.dev/play/

# Packages

- Go functions are grouped into packages.
- Each package is made of one or more files in the same directory
- The package is declared at the beginning of the file, e.g.: *`package main`* below

```
package main
//...
```

# Import

- A file can import other packages, e.g.:

```go
import (
    "fmt"
    "math/rand"
)
```

# Hello World

- Let's import the *fmt* package, which contains functions for formatting and printing text

```go
package main

import "fmt"

func main() {
    fmt.Println("Hello, world!")
}
```

- You can use the functions of the imported package if their name begins with a capital letter
- same for variables (e.g., *math.Pi*)

# Go basic types

```
bool

string

int  int8  int16  int32  int64
uint uint8 uint16 uint32 uint64 uintptr

byte // alias for uint8

rune // alias for int32, represents a Unicode code point

float32 float64

complex64 complex128
```

# Variables

```go
package main
import "fmt"

// these are visible in the package
var b bool
var s string
var x, y float32

func main() {
    var i int // this is local in this function
    fmt.Println(i, b, s, x, y)
}
```

- Note that type is after the variable name(s)

# Initial values

```go
var i int = 10
var b = true // takes the type of the initializer
var x, y = 1.5, 2.5
```

*Zero values* are used when there is no explicit initial value:

- `0` for numeric types,
- `false` for the boolean type, and
- `""` (the empty string) for strings.

# Short declaration with initialization inside functions

```go
package main
import "fmt"

func main() {
    k := 3
    fmt.Println(k)
}
```

# Constants

```go
// ...
const k = 10
const zero = -273.15
// ...
```

# Arrays

```go
package main
import "fmt"

func main() {
  var v [10]int
  odds := [5]int{1, 3, 5, 7, 9}
  i := 4
  v[0] = odds[i] // 9
  fmt.Println(v)
}
//[9 0 0 0 0 0 0 0 0 0]
```

# Slices

```go
package main
import "fmt"

func main() {
  vowels := [5]string{"a","e","i","o","u"}
  var s []string = vowels[1:3] // [e, i] (half-open range)
  fmt.Println(s)
}
```

- default is zero for the slice's low bound and the length of the array for the high bound
- `vowels[0:5]`, `vowels[:5]`, `vowels[0:]`, and `vowels[:]` are the same

# Slices (contd)

- A slice does not store any data, it just describes a section of an underlying array.

```go
package main
import "fmt"

func main() {
  vowels := [5]string{"a","e","i","o","u"}
  var s []string = vowels[1:3]
  t := vowels[1:3]
  fmt.Println(t) // [e i]
  s[0] = "x"
  fmt.Println(vowels) // [a x i o u]
  fmt.Println(t) // [x i]
}
```

# Literals

- Array Literal

```
[3]bool{true, true, false}
```

- Slice Literal

```
[]bool{true, true, false}
```

it creates an array and then a slice that references it

# Slices (contd)

- length: number of elements in the slice
- capacity: number of elements from low bound to end of array
- e.g.: `var s []string = vowels[1:3]`: len(s) = 3, cap(s) = 4
- builtin `make()` function:

```go
package main
import "fmt"

func main() {
  b := make([]int, 0, 5)
  fmt.Println(len(b)) // 0
  fmt.Println(cap(b)) // 5
  fmt.Println(b) // [] or nil
}
```

# Maps

```go
package main
import "fmt"

var temperatures map[string]int

func main() {
  temperatures = make(map[string]int)
  // must use make() to initialize a map
  temperatures["Rome"] = 27
  temperatures["London"] = 18
  temperatures["San Francisco"] = 21
  fmt.Println(temperatures)
}
```

# Maps (contd)

```go
package main
import "fmt"

func main() {
  // with map literals
  var temp = map[string]int{
    "r": 27,
    "l": 18,
    "s": 21,
  }
  fmt.Println(temp) // map[l:18 r:27 s:21]
}
```

# Maps (contd)

- `delete(m, key)` to delete an element
- e.g. `delete(temperatures,"Rome")`
- `elem, ok := m[key]` to test that a key is present
- e.g.

```
//...
elem, ok := temperatures["London"] // 18 true
elem, ok = temperatures["Paris"]   // 0 false
//...
```

- (this is *two-value assignment*)

# Pointers

- The type *T is a pointer to a T value. Its zero value is nil.
- e.g., `var p *int`
- The & operator generates a pointer to its operand, e.g.:

```go
i := 42
p = &i
```

- Dereferencing

```go
fmt.Println(*p) // read i through the pointer p
*p = 21         // set i through the pointer p
```