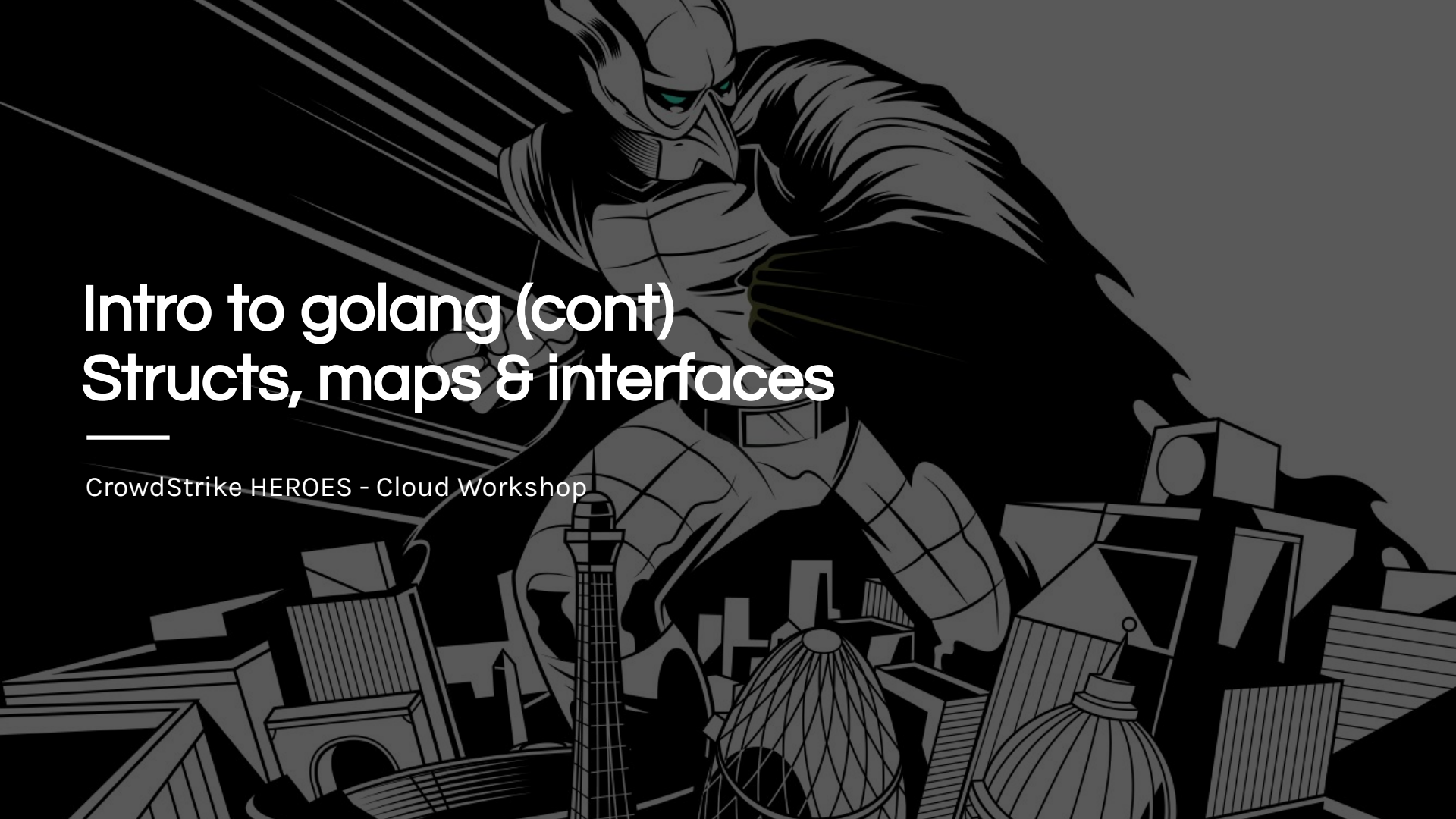
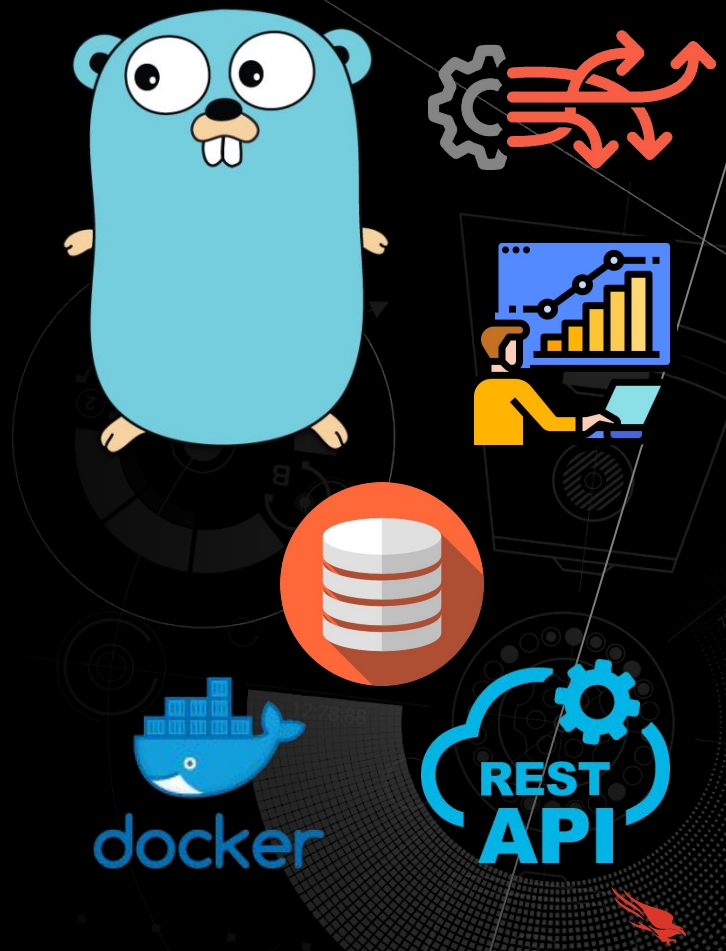


Intro to golang (cont)
Structs, maps & interfaces

CrowdStrike HEROES - Cloud Workshop

CROWDSTRIKE

Date	Topic
July 25 - 16:00	Intro to golang
July 26 - 16:00	Intro to golang (continuation)
July 27 - 16:00	Multithreading
July 28 - 16:00	Rest API
July 29 - 16:00	Unit testing, logging and monitoring
August 1 - 16:00	Workshop and Q&A
August 2 - 16:00	Deployments/Docker
August 3 - 16:00	Databases
August 4 - 16:00	Databases extended
August 5 - 13:00	Microservices contest (4h with Awards)



Structs

- Collections of fields
- Keyword `struct`

```
type Vertex struct {
    X int
    Y int
}
```

- Keyword `type` can be used to define any new type

```
type myfunc func(int,int) int
```

- Accessing fields

```
v := Vertex{1, 2}
v.X = 4
```

- Access by '`.`' regardless of pointer type or simple object

```
v := Vertex{1, 2}
p := &v
p.X = 1e9
```

Initialising structs

```
type Vertex struct {
    X, Y int
    z bool
}
```

- `X, Y` are fields that can be used by other packages
- `z` can only be used inside the same package

```
var (
    v1 = Vertex{1, 2, true} // type Vertex
    v2 = Vertex{Z: true, X: 1}  // Y:0 is implicit
    v3 = Vertex{}      // X:0 and Y:0 and Z:false
    p  = &Vertex{1, 2, true} // has type *Vertex
)
```

- Declaring structs without field names:
  - all fields must be specified
  - field order must be respected

Zero values for structs

- There are two formatting options for printing structs ‘%v’ and ‘%+v’

```
var v1 Vertex
fmt.Printf("%v\n", v1)
> {0 0 false}
fmt.Printf("%+v\n", v1)
> {X:0 Y:0 z:false}
```

- ‘%+v’ also prints fields names

```
var p1 *Vertex
fmt.Printf("%v\n", p1)
> <nil>
```

- When defining a new pointer to a struct we get a empty pointer NOT an empty struct

```
x := p1.X
> panic...
```

- Initialising a pointer

```
p1 = new(Vertex)
```

Maps

- Declaring maps
  - `var m map[keyType]valueType`
  - Initial value is `nil`
- Initialised with the same keyword as arrays, `make`
  - `m := make(map[keyType]valueType)`
  - The initial size of a map is always zero
- To add values to a map there isn't a built-in function
  - `m[newKey] = newValue`
- We can create a map with values already inserted (map literals)

```
temperatures := map[string]int{
    "Bucharest": 33,
    "Cluj": 28,
    "Iasi" 29,
}
```

CROWDSTRIKE

Maps - Retrieving and deleting values

- Adding a new value to the same key overwrites the value
  - `m[oldKey] = newValue`
- Retrieving an element
  - `value := m[key]`
- Checking if an element exists
  - `value, exists := m[key]`
  - `exists` is a `bool` that is `true` if the element is present, `false` otherwise
  - If `key` is not in the map, then `value` is the zero value for `valueType`
  - We can just check existence without getting the value: `_ , exists := m[key]`
- Deleting an element
  - `delete(m, key)`

CROWDSTRIKE

Methods

- Go does not have classes
- A method is a function with a special *receiver* argument

```
func (v Vertex) Abs() float64 {
    return math.Sqrt(v.X*v.X + v.Y*v.Y)
}
```

- The *receiver* is the object on which the function is called

```
v := Vertex{3, 4}
v.Abs()
```

- Methods can also be defined on non-struct types

Pointer receivers

With a value receiver, the Abs method operates on a copy of the original Vertex value

```
func (v Vertex) Abs() float64 {
    return math.Sqrt(v.X*v.X + v.Y*v.Y)
}
```

Methods with pointer receivers can modify the value to which the receiver points

```
func (v *Vertex) Scale(f float64) {
    v.X = v.X * f
    v.Y = v.Y * f
}
```

We can call methods with either receiver type on any type, pointer or value.

CROWDSTRIKE

Interfaces

An *interface* type is defined as a set of method signatures.

```
type MyInterface interface {
    f1()
    f2(int, string) int
    f3(a int, b int)
}
```

Go figures it out at assigning an object to a interface if the object type implements it.

Until we write `var i MyInterface ; i = new(Vertex)` go does not care if Vertex is a MyInterface or not.

A solution would be to add a variable declaration to the package where `Vertex` is defined

```
var _ MyInterface = (*Vertex)(nil)
```


CROWDSTRIKE

Implementing interfaces

There is no explicit declaration that we implement an interface, we just define the methods.

```
type I interface {
     M()
}

type T struct {
     S string
}

// This method means type T implements the interface I, but we don't need to explicitly declare that it does so.
func (t T) M() {
     fmt.Println(t.S)
}
```

CROWDSTRIKE

The empty interface

The interface type that specifies zero methods is known as the empty interface:

```
interface{}
```

Empty interfaces are used by code that handles values of unknown type

```
var i interface{}
describe(i)

func describe(i interface{}) {
    fmt.Printf("(%v, %T)\n", i, i)
}
```

The %T format returns the underlying type of a value. The empty interface has the type `nil`

Type assertions

- A type assertion provides access to an interface value's underlying concrete value.

  `t := i.(T)`

  - If the conversion can't be done it triggers a panic
- We can avoid it by adding a check
  - `t, ok := i.(T)`
  - `ok` is a bool value that is `true` if the conversion succeeds
  - `t` will be the zero value for the `T` type otherwise

Type switches

```
var i interface{}
switch v := i.(type) {
case int:
   fmt.Printf("Twice %v is %v\n", v, v*2)
case string:
   fmt.Printf("%q is %v bytes long\n", v, len(v))
default:
   fmt.Printf("I don't know about type %T!\n", v)
}
```

- We can combine a series of conversion checks into a switch
- Inside the `case` branches the `v` variable has the type of the `case` for the branch
- The conversion does not take into account fields in a struct, but the go type of the object

CROWDSTRIKE

Built-in interfaces
Stringers

- A `Stringer` is a type that can describe itself as a string.

```
type Stringer interface {
    String() string
}
```

- The result can be seen by calling

```
fmt.Println(instanceOfStringerObj)
fmt.Printf("%v\n",instanceOfStringerObj)
```

Built-in interfaces
Errors

The `error` type is a built-in interface similar to `fmt.Stringer`:

```
type error interface {
    Error() string
}
```

Functions often return an `error` value, and calling code should handle errors by testing whether the error equals `nil`.

```
i, err := strconv.Atoi("42")
if err != nil {
    fmt.Printf("couldn't convert number: %v\n", err)
    return
}
fmt.Println("Converted integer:", i)
```

CROWDSTRIKE

Any questions?