go-ing for an evening stroll

golang beasts & where to find them

`$ who`

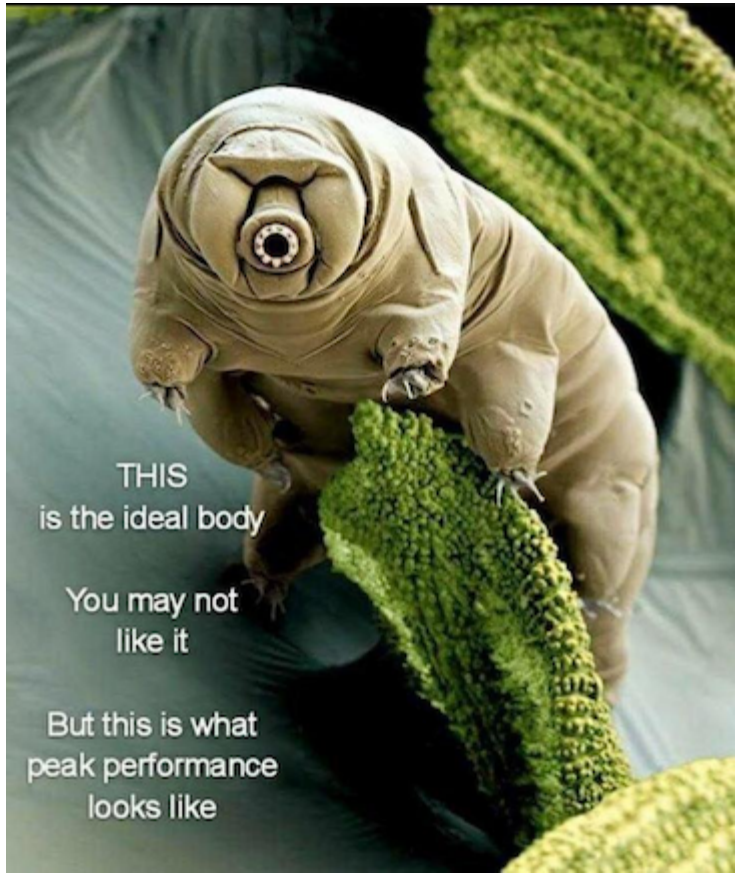
- Stefan Edwards, Practice Lead ComServ
  - GitHub/Twitter/Lobste.rs: lojikil
- Bobby Tonic, Senior AppSec Engineer
  - Twitter: b0bbytabl3s
  - GitHub: btonic
- Trail of Bits

`$ what presentation.md`

- Common Go vulnerabilities we see
  - Integers/Numerics
  - Standard Library Issues
  - Error checking & type assertions
  - Defer semantics
- How to find them
- How to fix them

$ what takeaway.md

- Go has some edge cases
- Luckily, most are easily uncovered
- Tooling can help... if you know how to use them



Integers/Numerics

- Go's integer semantics are interesting...

```
        v, err := strconv.Atoi("4294967377")
        g := int32(v)
        fmt.Printf("v: %v, g: %v\n", v, g);
```

- on 32bit: `v` is an `int`, 32bits wide, and truncated before conversion in `g`
- on 64bit: `v` is an `int`, 64bits wide, and only `g` is truncated: `v: 4294967377, g: 81`

Integers/Numerics

- that may seem obvious, but we see it often
  - CNCF projects, blockchains, &c
- Finding it is *mostly* manual:
  - Any uses of `strconv.Atoi` is likely wrong
  - Flows with `ParseInt/ParseUint` and down casts
  - Nico has done some great hunts with CodeQL

Integers/Numerics

an aside

```
if len(s) > 1 && (s[0] == 'E' || s[0] == 'e') {
parsed, err := strconv.ParseInt(string(s[1:]), 10, 64)
        if err != nil {
                return 0, 0, DecimalExponent, false
        }
        return 10, int32(parsed), DecimalExponent, true
}
```

Integers/Numerics

- always check for things that return 'naked' `int`
- ensure what build platform you're using (amd64, &c)
- check dataflows from `strconv.ParseInt` and assume `strconv.Atoi` is wrong
- Tooling? CodeQL, two fists

Standard Library

- Standard libraries: the building blocks of most software.
- In theory, libraries should avoid exposing abusable behavior.
- This doesn't always happen, even in standard libraries.

Standard Library

- An example:

```
os.MkdirAll("/some/path/i/want/to/make", 0600)
ioutil.WriteFile("/some/file/i/want/to/make/here.txt",
":)", 0600)
```

- `os.MkdirAll` will populate the directories specified if they do not already exist, with the specified permissions.
- `ioutil.WriteFile` will create a file at a specified path (if it doesn't already exist) with the specified permissions, and write to it.

Standard Library

- *enhance*: ...**populate the directories specified if they do not already exist**...
  - What happens if some directories in the path exist, but with different permissions?
- *enhance*: ...**create a file at a specified path (if it doesn't already exist)**...
  - What happens if the file exists, but with different permissions?
- Both cases: No error or warning. Existing directories/files will be used and retain original permissions.
- Attacker: Pre-population attacks. Create a directory/file path with open permissions before the program does, then let the program write sensitive information there!

Errors & Assertions

- Go errors are great...
  - assuming you pay attention
- Type assertions fit in here too
- Four major issues:

```
v, err := SomeFunc(...)
g, err := SomeFunc(...)
h := someval.(int)
err == nil || err != nil
```

Errors & Assertions

- We see *a lot* of type assertion panics & missed error checks
- Luckily easier to catch
  - use `errcheck -asserts` for both error checks & type assertions
  - use `ineffassign`
  - *maybe* use `errcheck -assert -blank`
- Fuzz... **everything**

Errors & Assertions

- Check your error results rigorously
- Understand your flows as much as possible
  - Compiler won't save you
  - Can continue on... but is that ok?
- Avoid type assertions, and always check `ok`
  - `if h, ok := someval.(int); ok { ...`
  - always check `ok` is true

Defer Semantics

- `defer` is central to error handling, and often used for finalizing operations. You might:
  - `defer` a function that handles a `panic` through `recover`, which might be raised during a function's execution.
  - `defer` a `resource.Close()` or `resource.Finish()` to finalize a resource.

Defer Semantics

- Unfortunately, using `defer` can be unintuitive.
- When `defer`ing a function, the values returned by the `defer`ed function are ignored, including `error` values.
  - When opening a file for writing and using `defer file.Close()`, errors could be produced but execution will continue.

Defer Semantics

- When `defer`ing a function which handles a panic, the `defer` FILO stack order matters.
  - A `panic` in a `defer`ed function can be `recover`ed by deferred function earlier in the `defer` stack.
  - An un-`recover`ed `panic` in a `defer`ed function will bubble up to the function's caller.
- *tangentially related*: In what cases would the following fail to process a `panic`?

```
defer func() {
    if e := recover(); e != nil {
        /* my error handling */
    }
}()
```

Defer Semantics

- Avoid `defer`ing a function that returns an error value.
- Enumerate the values passed to `panic`.
  - `panic` will pass `nil` to `recover`! (Hint: on the last toy example)
- Ensure you are `defer`ing functions that `recover` from a `panic` in the proper order.
- Review the specification to understand scoping rules for `defer`ed inline functions, pass-by-copy vs pass-by-reference, and when a `defer` executes in the context of a function's body and the `return` of a function.

Thanks!

https://github.com/lojikil/kyoto-go-nihilism