
V = lwh
10+n-9=3
n = 3-10+9
n = -7+9
n = 2
sin(a/2) = ±√((1-cosa)/2)
A = πr²
C = 2πr
1+3=4
c² = a²+b²
Aaah...
A = ½ bh

Formal methods

Formal methods

Channels, memory, and

Synchronization via message passing

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Department of informatics
University of Oslo, Norway

Before then, I lived in the US
and was an engineer at...

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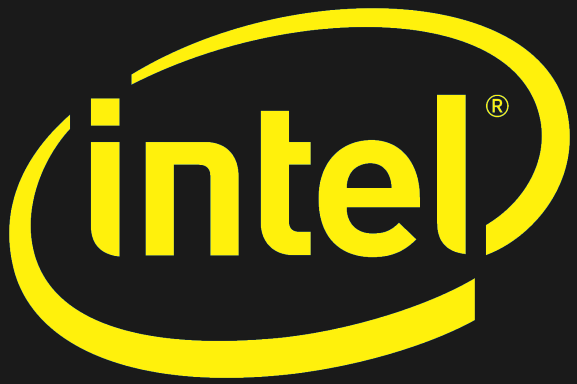
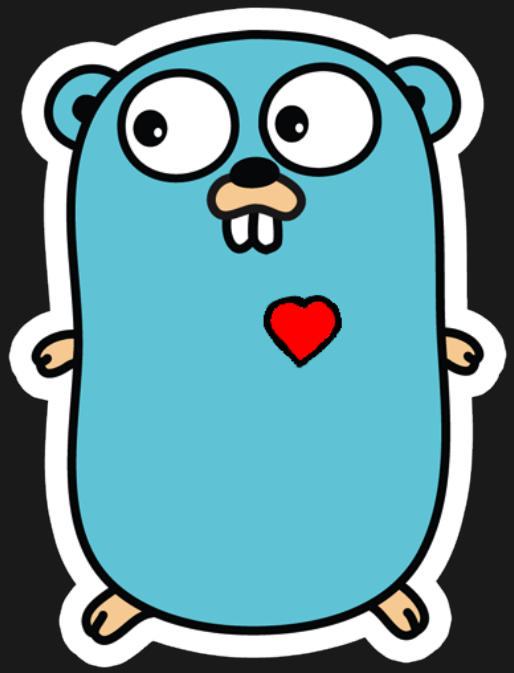
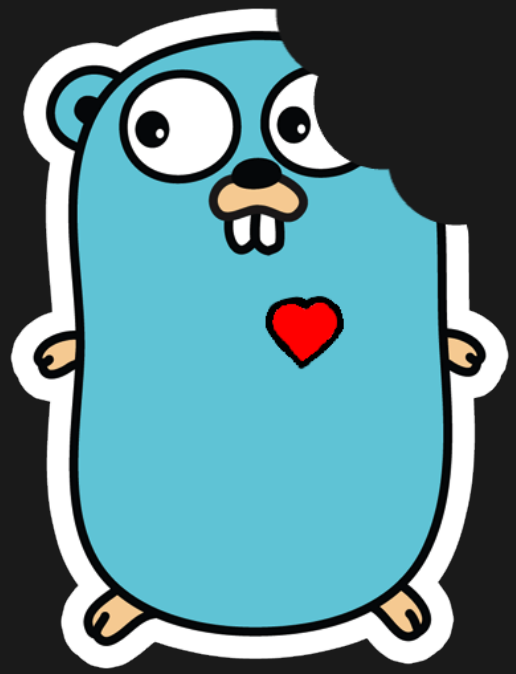


What I would like to get out

What is in for you





without interfaces

without interfaces
or packages

without interfaces
or packages
or pointers

without interfaces
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or pointers
or arrays, maps...

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or arrays, maps...

Goroutines

without interfaces
or packages
or pointers
or arrays, maps...

Goroutines

Concurrency

without interfaces
or packages
or pointers
or arrays, maps...

Goroutines & Channels

Concurrency

without interfaces
or packages
or pointers
or arrays, maps...

Goroutines & Channels

Concurrency Synchronization

without interfaces
or packages
or pointers
or arrays, maps...

Goroutines & Channels $\rightsquigarrow$ Memory Model

Concurrency Synchronization

If you must read the rest of this document to understand the behavior of your program, you are being too clever.

Don't be clever.

[https://golang.org/ref/mem]

Initially `z = 0; done = false;`

```
      T1                    |        T2
z     = 42                  |
done = true                 |   if (done)
                            |      fmt.Println("t2", z)
```

Initially `z = 0; done = false;`

```
      T1                        |         T2
z     = 42                      |
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                                |       fmt.Println("t2", z)
```

Will `T2` print anything?

Initially `z = 0; done = false;`

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What values can `T2` print?

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```
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z     = 42                  |
c     <- true               |   if (done)
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c     <- true               |      <- c
                            |      fmt.Println("t2", z)
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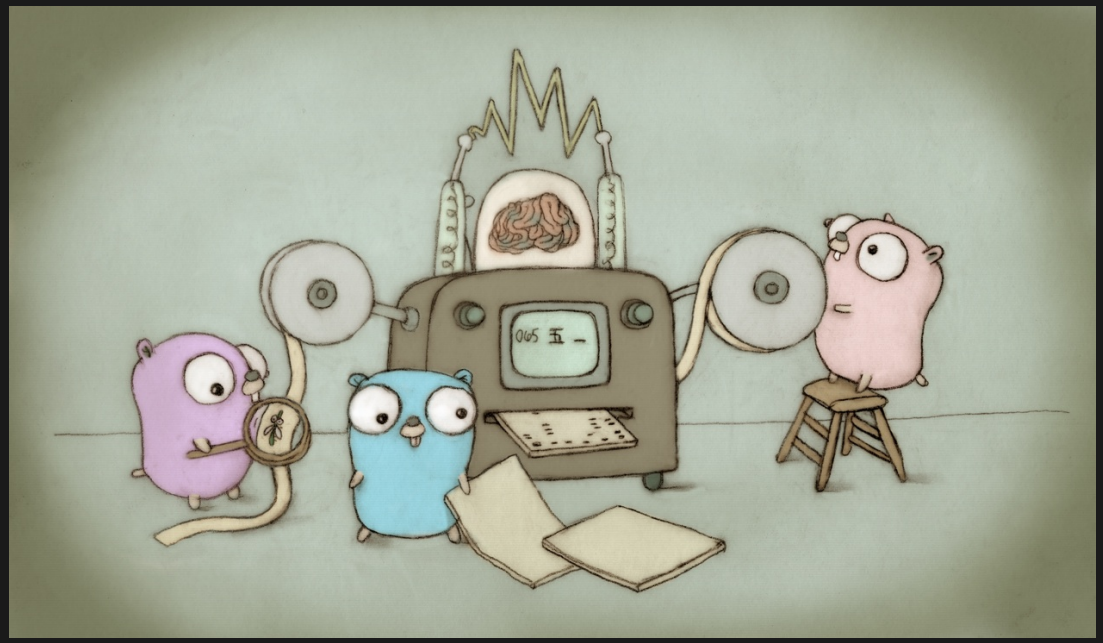
Will `T2` print anything?
What values can `T2` print?

Gave a formal description of a memory model inspired by Go.

You can think of it as a translation from English to Math.

Operational semantics of a weak memory model with channel synchronization
Journal of logical and algebraic methods in programming, 2018
International Symposium on Formal Methods, Oxford, 2018

Now I am working on finding concurrency bugs in Go programs
Specifically, finding data races in the execution of a program



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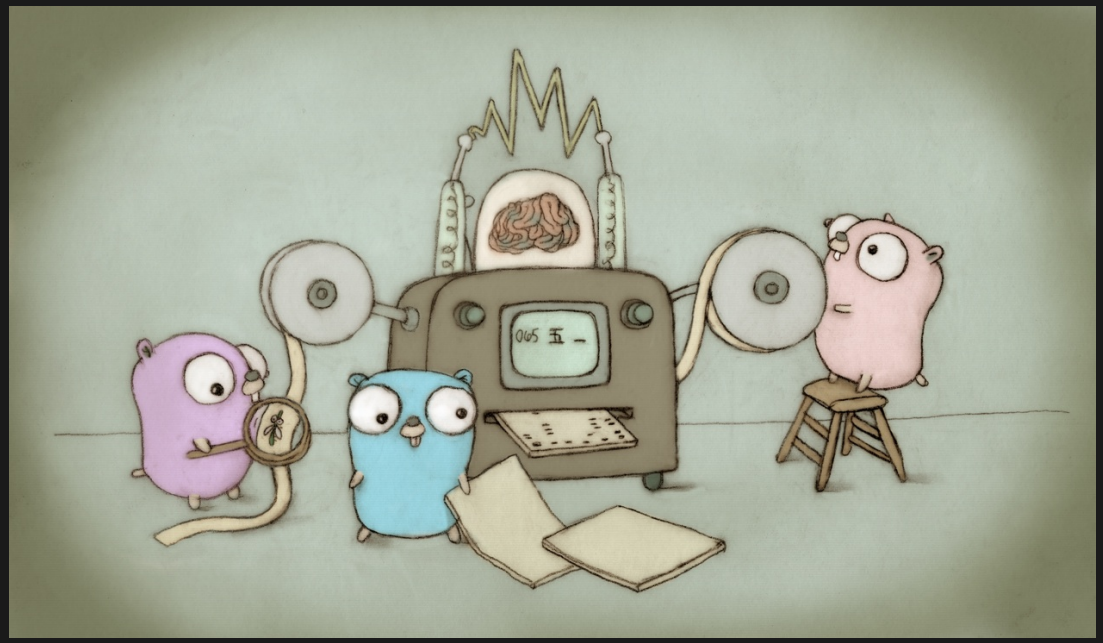

Understanding Google's thread sanitizer library

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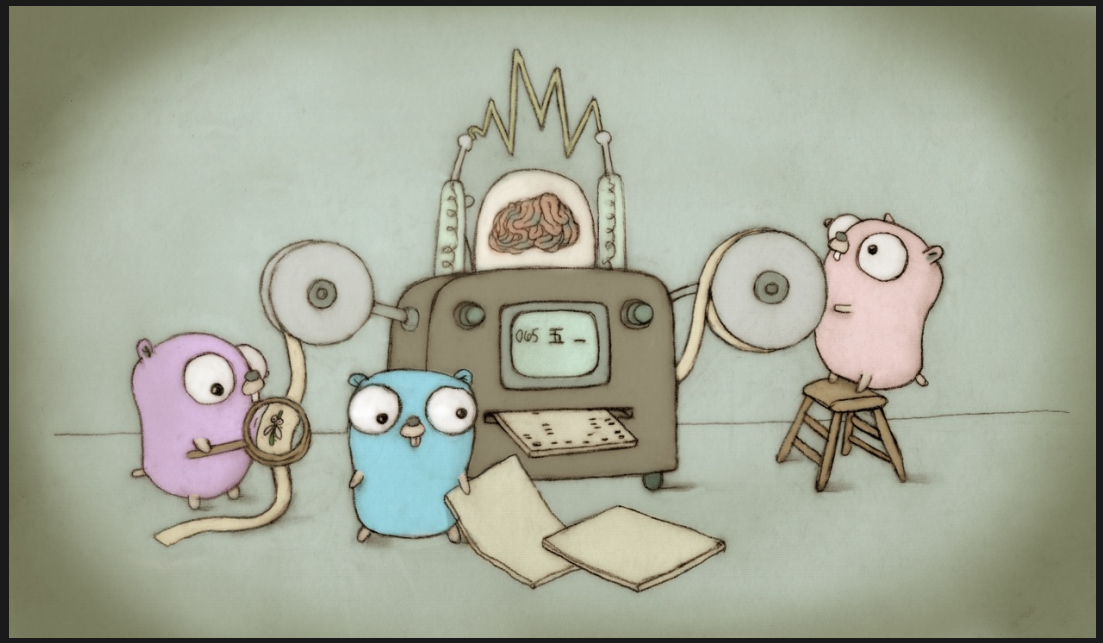

Understanding Google's thread sanitizer library
Hacking the Go compiler

Academia + Industry

Academia + Industry

Questions?