Securing the software supply chain

Filippo Valsorda

Google

We all use

other people's code


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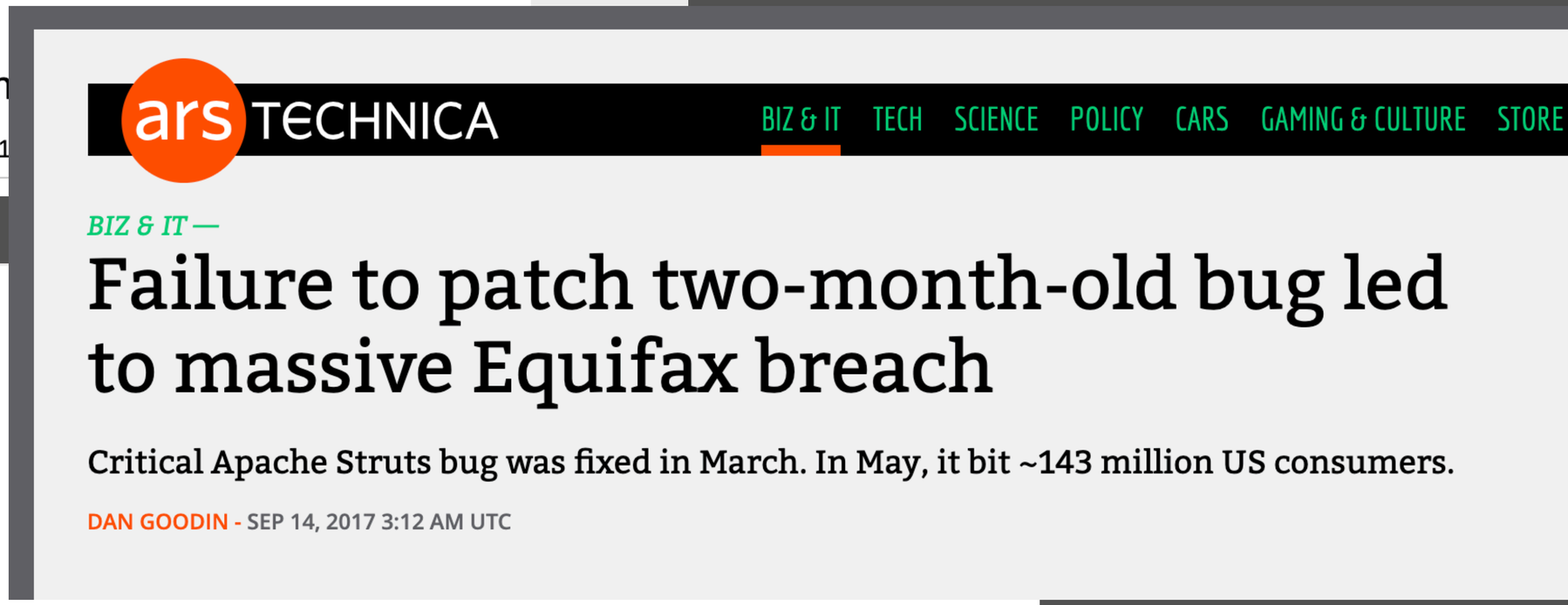
How one developer just broke Node, Babel and thousands of projects in 11 lines of JavaScript
Code pulled from NPM – wh
By Chris Williams, Editor in Chief 23 Mar 201
MOST REA
1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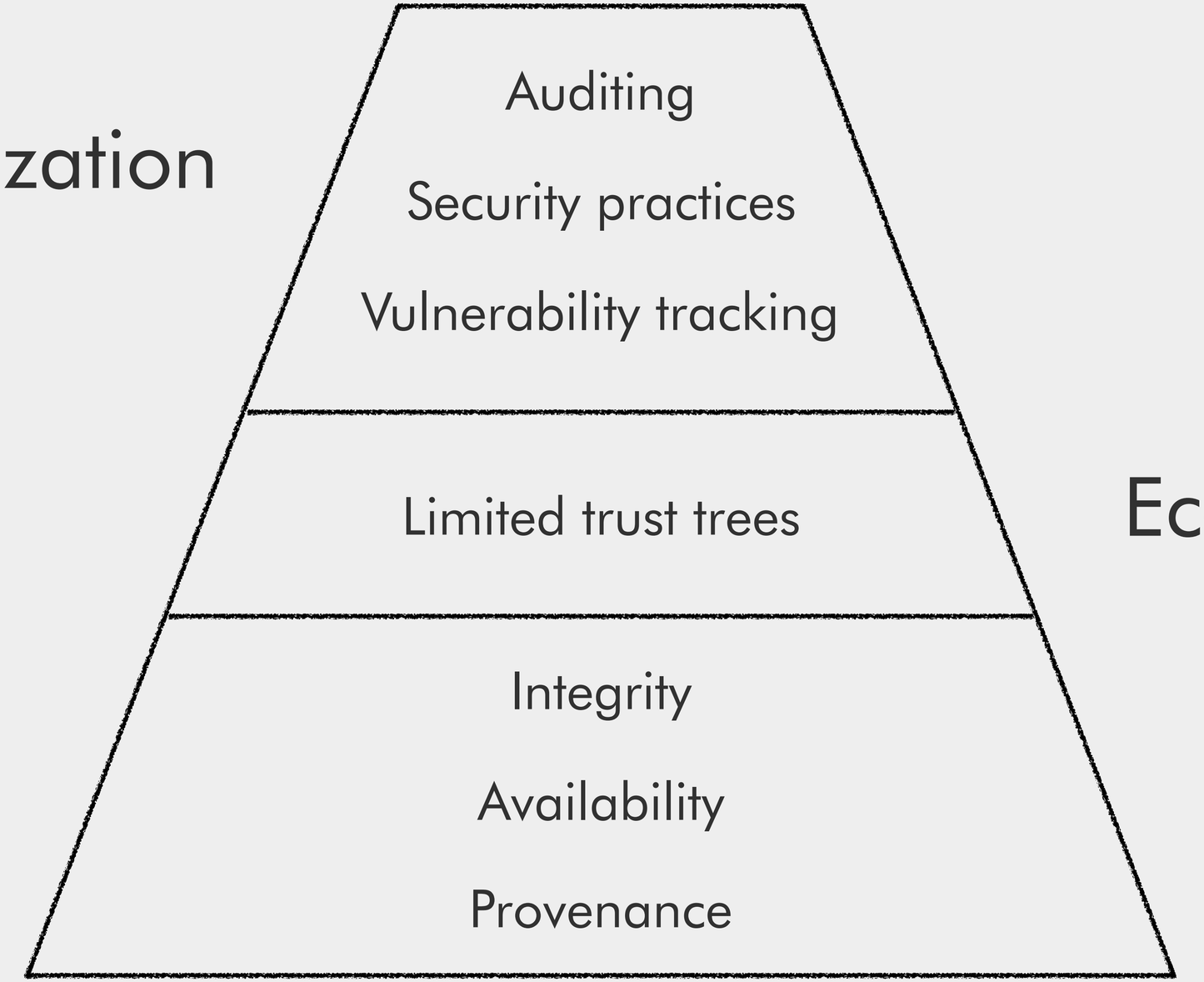
BIZ & IT —
Failure to patch two-month-old bug led to massive Equifax breach
Critical Apache Struts bug was fixed in March. In May, it bit ~143 million US consumers.
DAN GOODIN - SEP 14, 2017 3:12 AM UTC


the npm blog
Blog about npm things.
Details about the event-stream incident

Three supply chain security players

1. Language — enables trust
2. Ecosystem — propagates and limits trust
3. Organization — manages and mitigates trust

Organization



Ecosystem

Language

Three supply chain security players

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Three supply chain security players

1. Language — enables trust
    1. Provenance — what code do we depend on?
    2. Availability — where do we get it?
    3. Integrity — has it been tampered with?

Provenance

Trying to establish:

- a universal name
- a permanent version

Python: PyPi and pipenv

Rust: crates.io and cargo

Node: NPM

Ruby: rubygems.org and Bundler

Go Modules

```
module github.com/FiloSottile/mostly-harmless/dcbot

require (
   crawshaw.io/sqlite v0.1.1
   github.com/pkg/errors v0.8.0
   github.com/sirupsen/logrus v1.2.0
   golang.org/x/sync v0.0.0-20181108010431-42b317875d0f
)

go 1.14
```

Availability

Making sure the code is still available in the future.

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BIZ & IT —

Rage-quit: Coder unpublished 17 lines of JavaScript and “broke the Internet”

Dispute over module name in npm registry became giant headache for developers.

SEAN GALLAGHER - MAR 25, 2016 2:10 AM UTC

Go Module Proxies and Mirror

```
GOPROXY=https://proxy.golang.org

https://proxy.golang.org/
github.com/sirupsen/logrus/@v/
v1.4.2.zip
```

Integrity

Protecting code from tampering.

No trust in proxies.

No trust in a central entity.

No trust on first use.

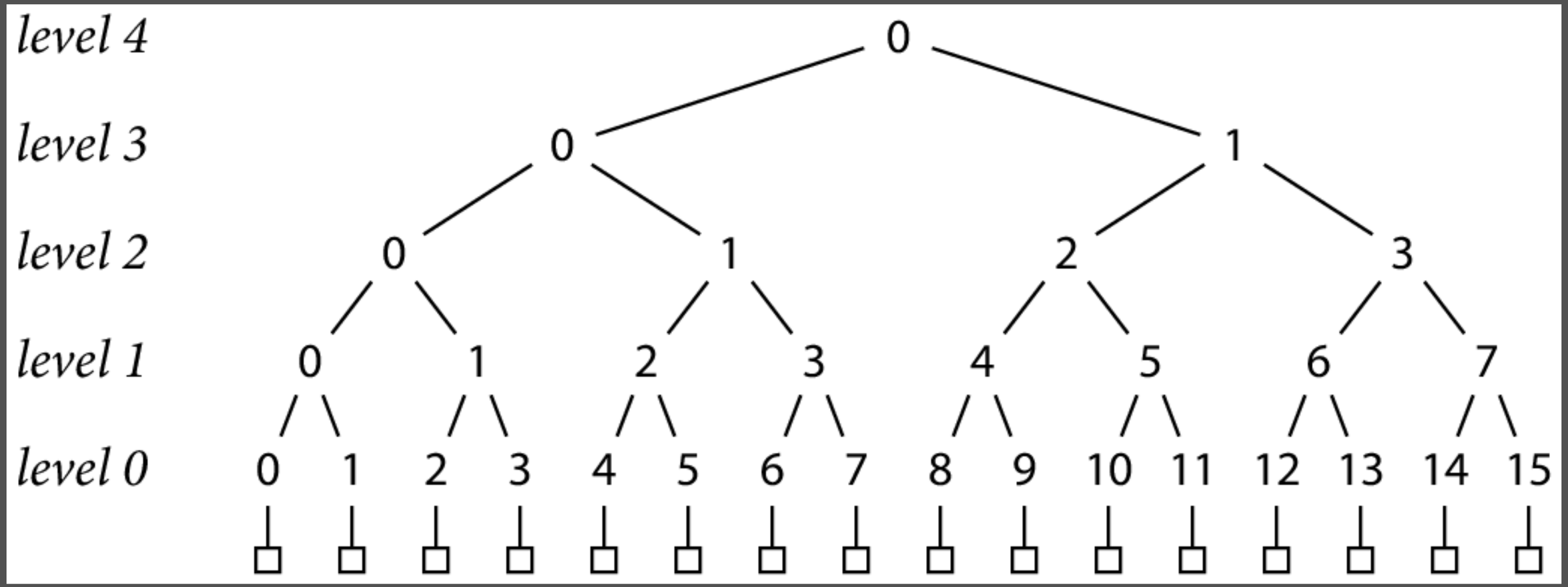
No key management for authors.

The Go Checksum Database

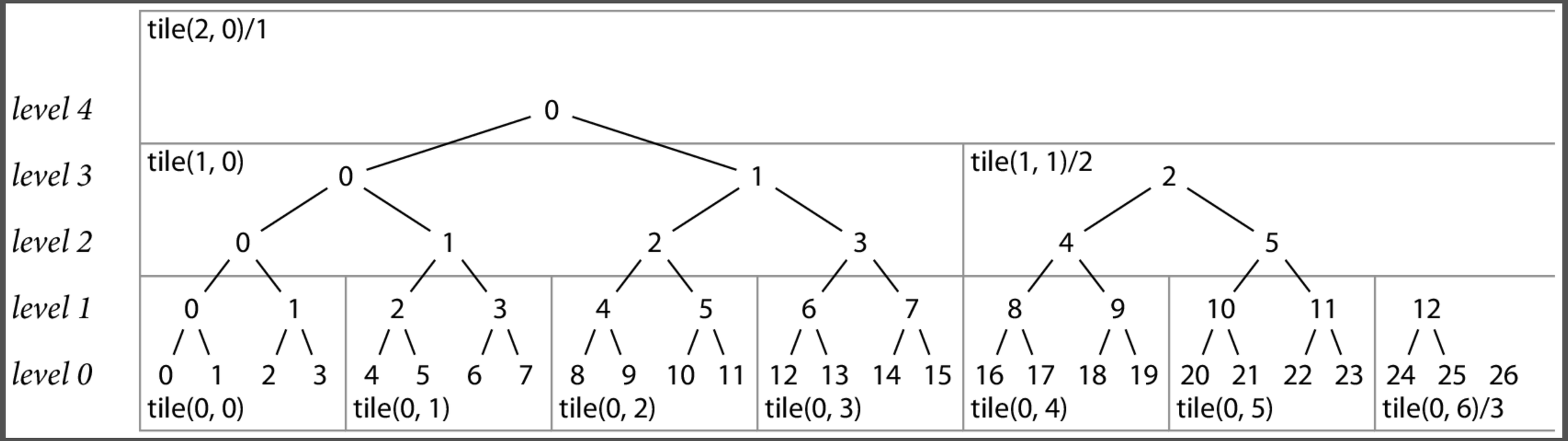
Solve
"is everyone looking at the same code"
as a proxy for
"is this the right code"

```
$ curl https://sum.golang.org/lookup/github.com/sirupsen/logrus@v1.4.2

15937
github.com/sirupsen/logrus v1.4.2
h1:SPIRibHv4MatM3XXNO2BJeFLZwZ2LvZgfQ5+UNI2im4=
github.com/sirupsen/logrus v1.4.2/go.mod
h1:tLMulIdttU9McNUspp0xgXVQah82FyeX6MwdIuYE2rE=

go.sum database tree
737311
a6tjmEcOB7ayb8j3fTHRrOcZ8DMe+iNsWpp8CJMFoqY=

— sum.golang.org Az3gro/R/8oqJRyMC3biFoTrXFFr+nJ6PAhkGIqnsVUbnBNA3vOPxm/
RPGUIm+ejFqe37G9IrT0z+F2hPaYMvaaYSgo=
```

Merkle trees for accountability



Tiles for caching



The Go Checksum Database

- A public append-only log of module version checksums
- kept accountable by Merkle tree proofs verified on the client
- served as cacheable efficient tiles.

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Importing a dependency delegates a degree of trust to it and to its transitive dependencies.

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A healthy ecosystem fights this like technical debt.

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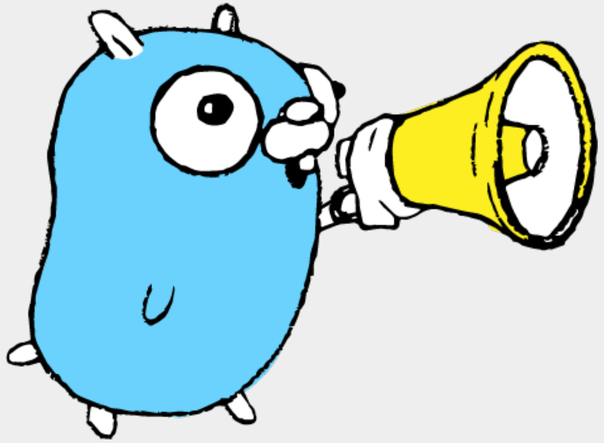
POISONING THE WELL —

Widely used open source software contained bitcoin-stealing backdoor

Malicious code that crept into event-stream JavaScript library went undetected for weeks.

DAN GOODIN - NOV 26, 2018 10:55 PM UTC



Go proverb #8

A little copying is better
than a little dependency.

Go build dependencies

```
$ go list -m all
github.com/FiloSottile/mostly-harmless/dcbot
crawshaw.io/iox v0.0.0-20181124134642-c51c3df30797
crawshaw.io/sqlite v0.1.1-0.20181106130822-19c189e3c5ce
github.com/davecgh/go-spew v1.1.1
github.com/konsorten/go-windows-terminal-sequences v1.0.1
github.com/pkg/errors v0.8.0
github.com/pmezard/go-difflib v1.0.0
github.com/sirupsen/logrus v1.2.0
github.com/stretchr/objx v0.1.1
github.com/stretchr/testify v1.2.2
golang.org/x/crypto v0.0.0-20181203042331-505ab145d0a9
golang.org/x/sync v0.0.0-20181108010431-42b317875d0f
golang.org/x/sys v0.0.0-20181213200352-4d1cda033e06
```

Go build dependencies

```
$ go list -deps -f "{{if not .Standard}}{{.ImportPath}}{{end}}"
crawshaw.io/sqlite
crawshaw.io/sqlite/sqliteutil
github.com/pkg/errors
golang.org/x/sys/unix
golang.org/x/crypto/ssh/terminal
github.com/sirupsen/logrus
github.com/sirupsen/logrus/hooks/syslog
golang.org/x/sync/errgroup
github.com/FiloSottile/mostly-harmless/dcbot
```

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Three supply chain security players

3. Organization — manages and mitigates trust
    1. Vulnerability tracking — past vulnerabilities
    2. Security practices — future vulnerabilities
    3. Auditing — current vulnerabilities

Vulnerability tracking

Identify and patch public vulnerabilities.

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Security practices

How are new vulnerabilities going to get introduced, discovered, and handled?

Tests, fuzzing and CI

Security reporting

Maintenance status

Sustainability

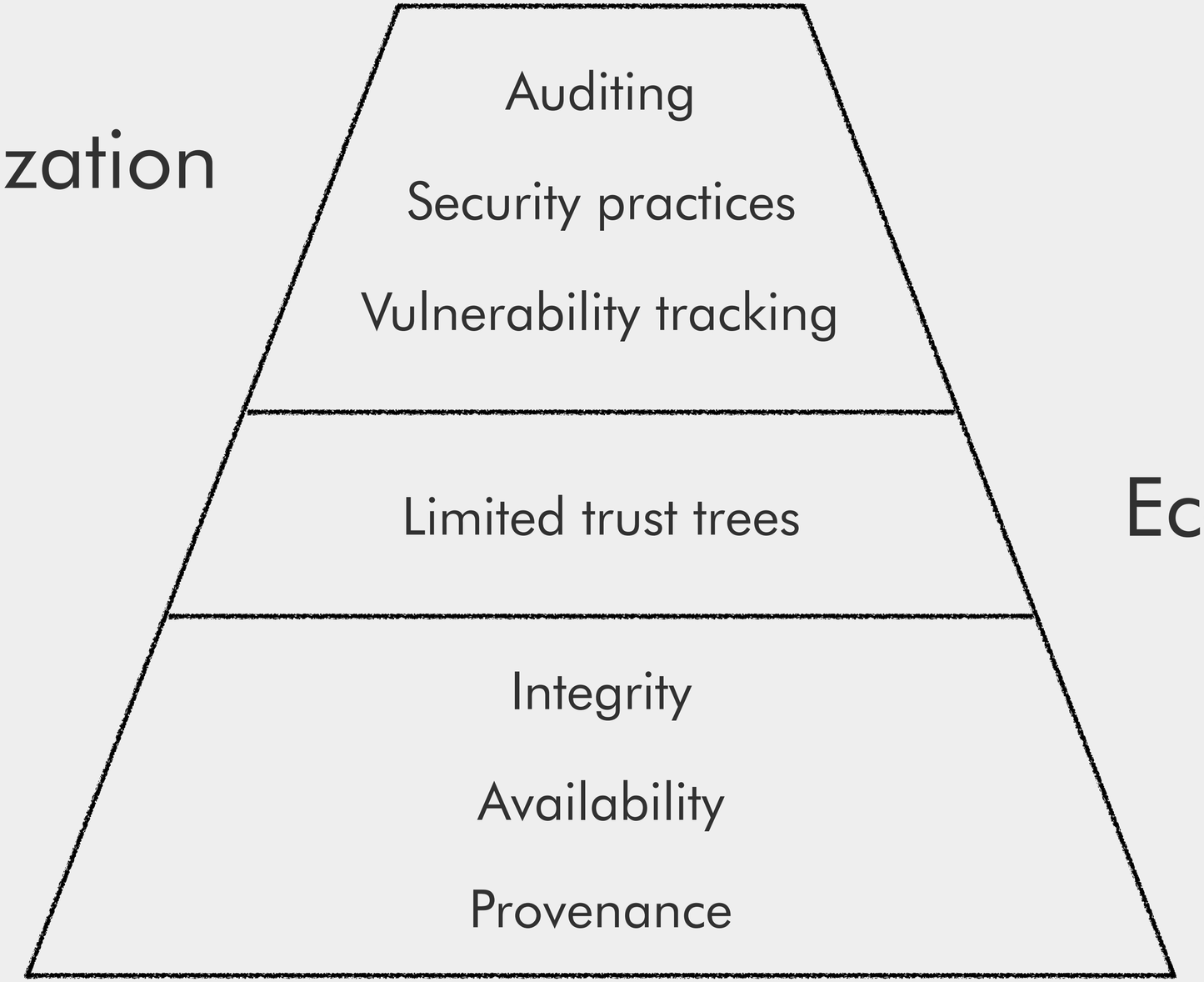
pkg.go.dev

Search for a package

Auditing

Actively looking for malicious code and vulnerabilities.

Organization



Ecosystem

Language

Questions?

The Go Checksum Database
https://golang.org/design/25530-sumdb

"Our Software Dependency Problem" by Russ Cox
https://research.swtch.com/deps

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