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The Lessons of Log4shell

Preparing for the Next Zero-Day

Hello World

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Agenda

00 The Silver Bullet

01 Lesson 1

02 Lesson 2

03 Lesson 3

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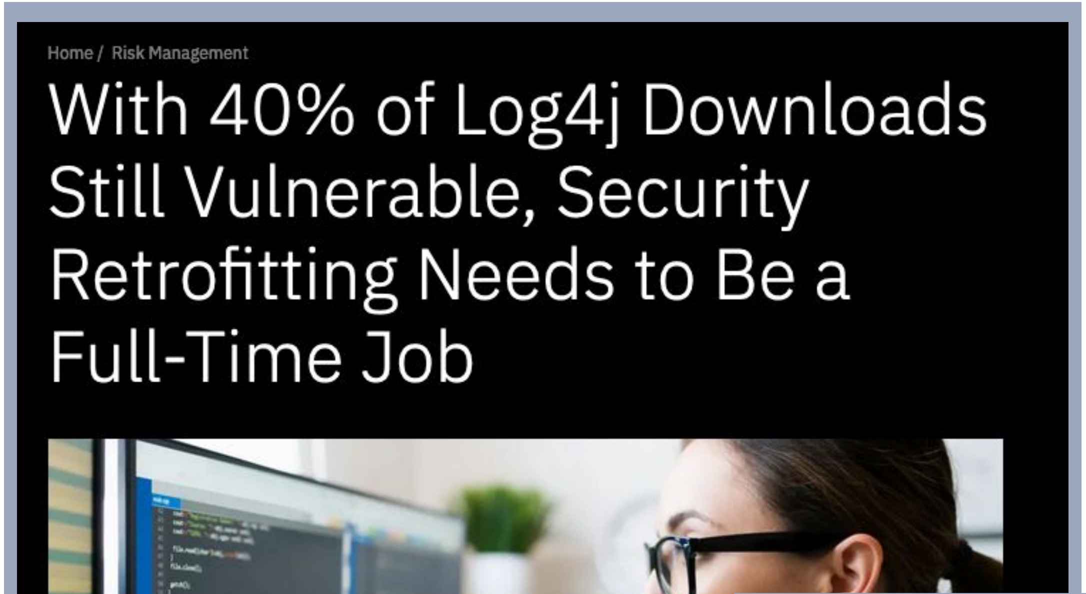
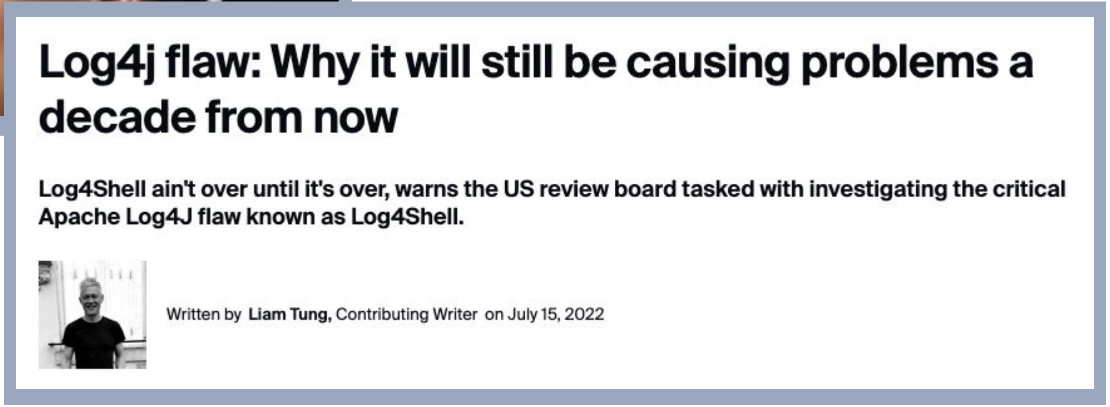
This is not a utopian talk with magic solutions

Lesson 1:
The Bad News



Home / Risk Management

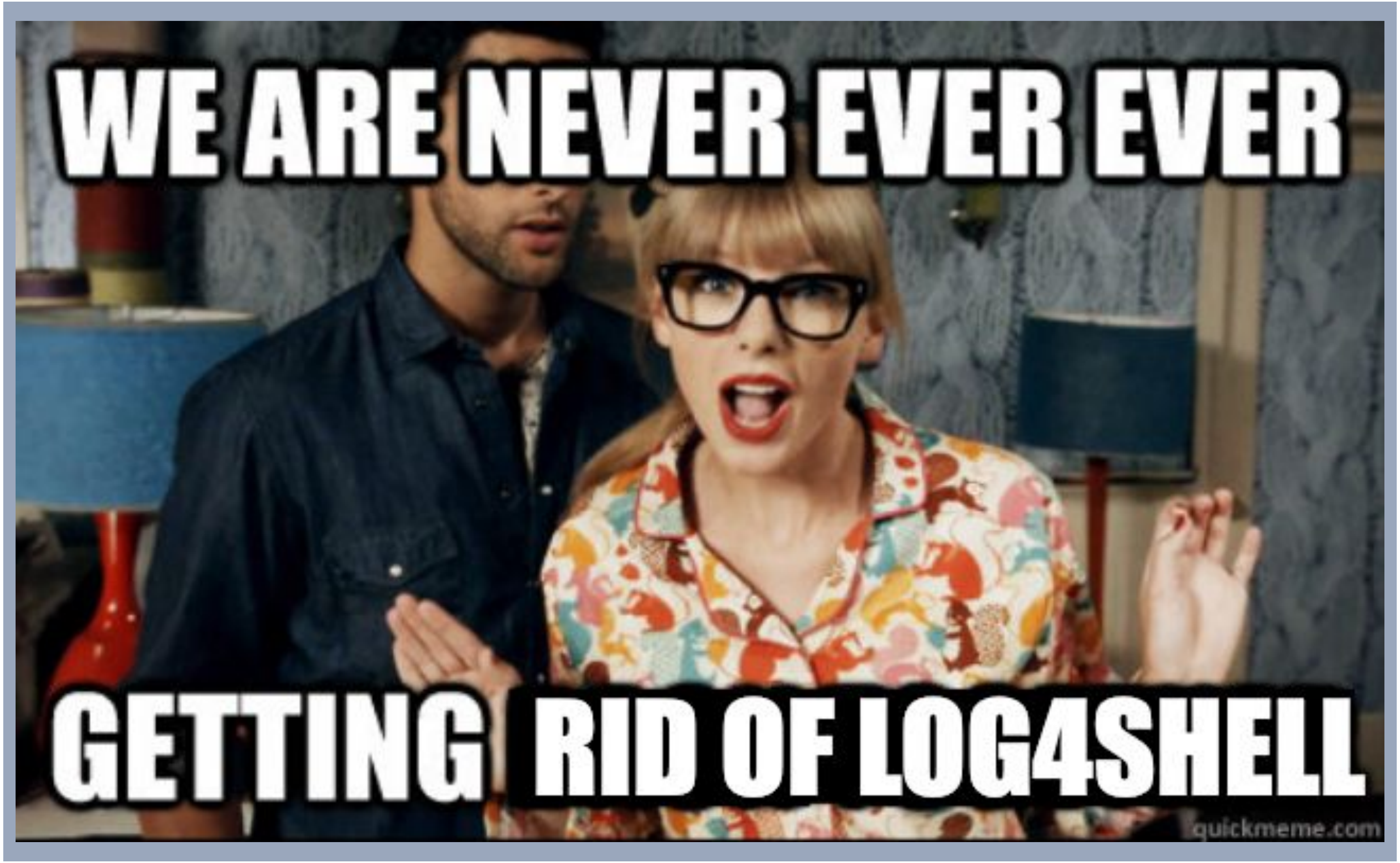
With 40% of Log4j Downloads Still Vulnerable, Security Retrofitting Needs to Be a Full-Time Job



Log4j flaw: Why it will still be causing problems a decade from now

Log4Shell ain't over until it's over, warns the US review board tasked with investigating the critical Apache Log4J flaw known as Log4Shell.

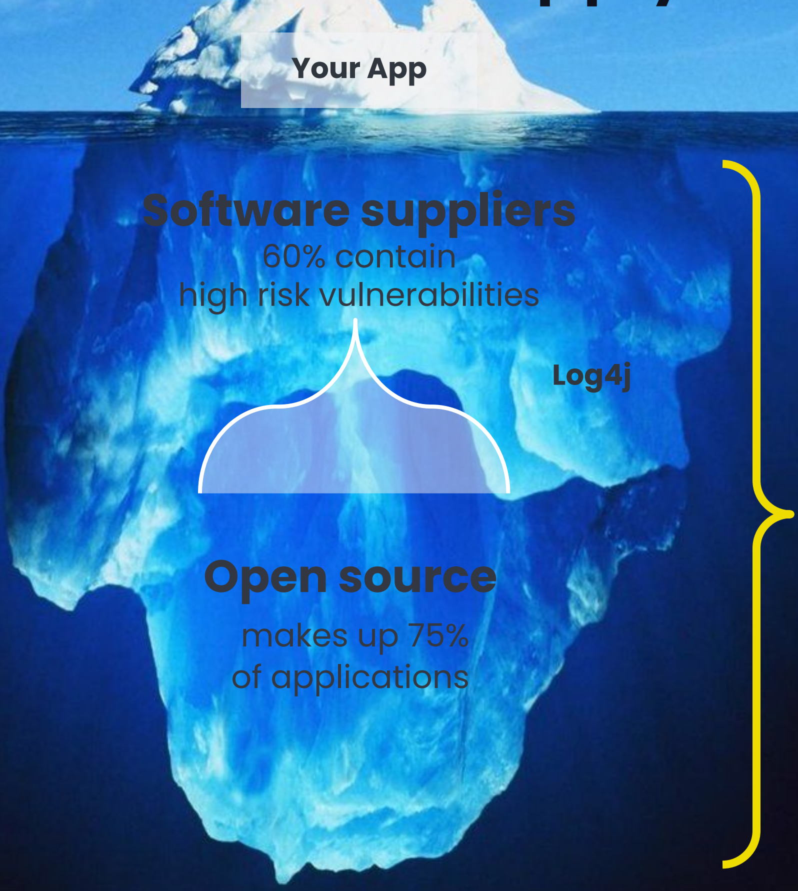
Written by **Liam Tung,** Contributing Writer on July 15, 2022


WE ARE NEVER EVER EVER
GETTING RID OF LOG4SHELL
quickmeme.com

Lesson 2:
What We Don’t Know

Hidden Risk in the Software Supply Chain

Risk in the Software Supply Chain



Your App

Software suppliers

60% contain
high risk vulnerabilities

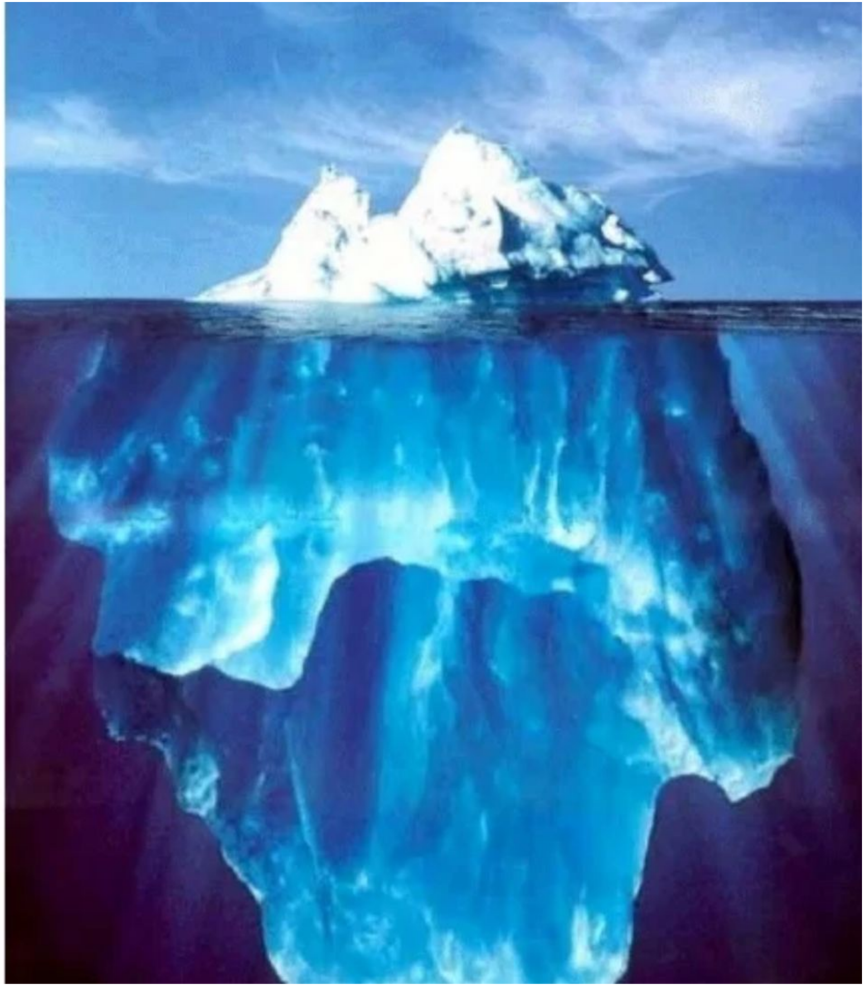
Log4j

Open source

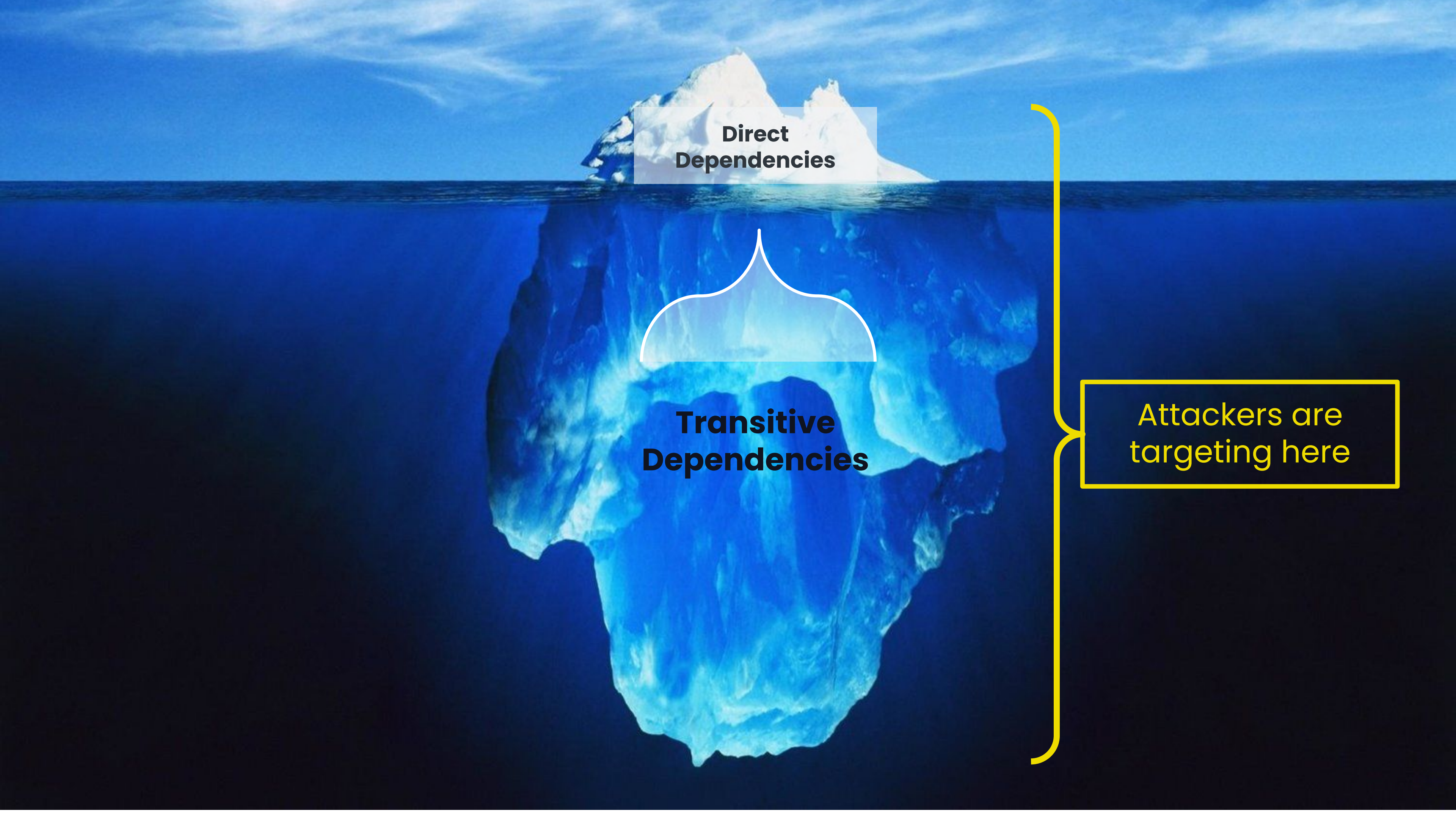
makes up 75%
of applications

Attackers are
targeting here

Free is Just the Tip of the Iceberg: Open Source Library System Software



Lori Bowen Ayre
lori.ayre@galecia.com
METRO Webinar
October 6, 2009



Direct Dependencies

Transitive Dependencies

Attackers are targeting here

This metaphor…

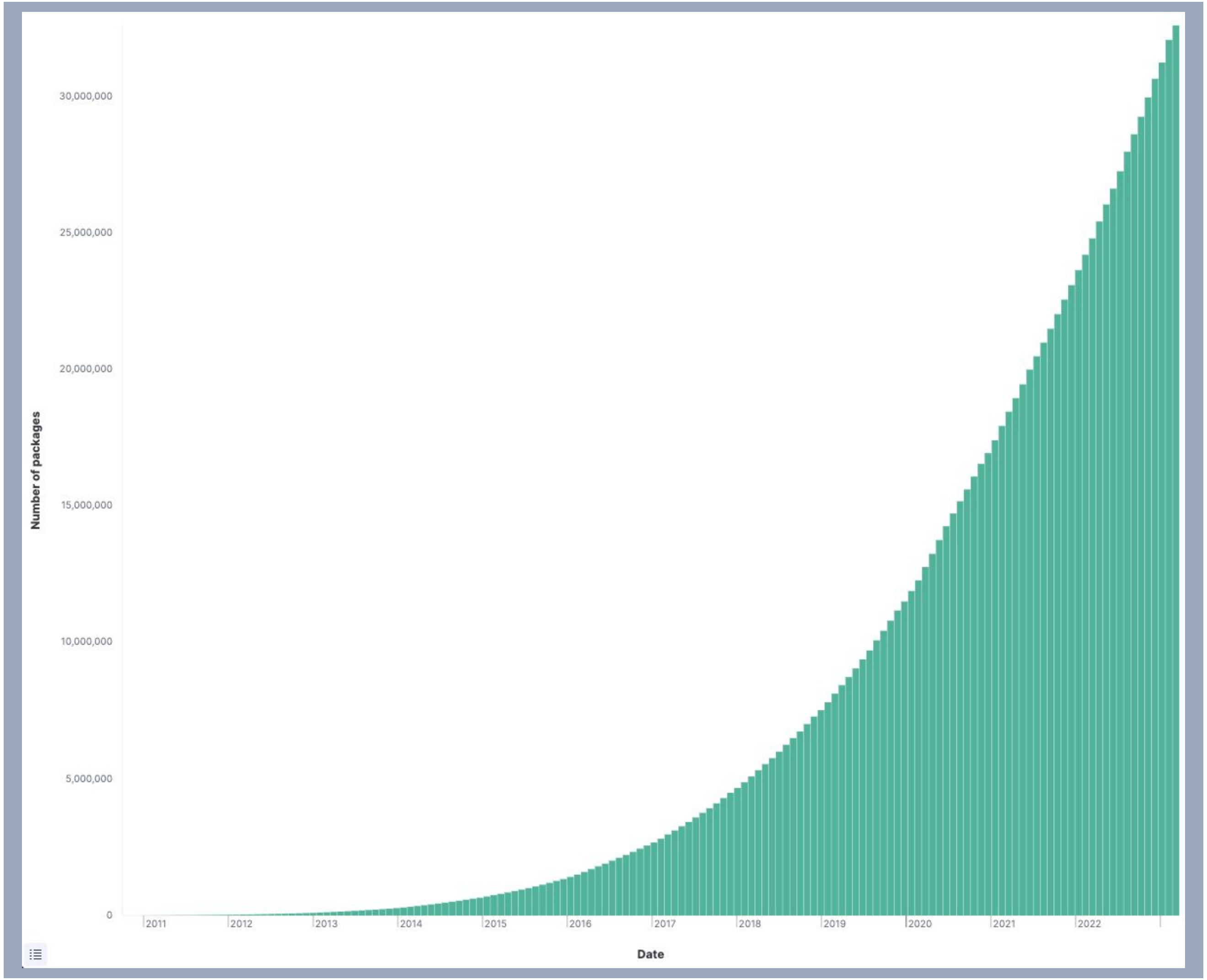
- You’ve seen this iceberg metaphor. I’ve used this metaphor 100 times, I’ve criticized this metaphor.
- This is an OLD metaphor
- Things have changed a lot but we’re still thinking about old systems
- https://www.slideshare.net/loriayre/open-source-library-system-software-free-is-just-the-tip-of-the-iceberg
- They’re attacking the bottom now - that’s a supply chain attack
- But really, the top isn’t “your code” - the top is your direct dependencies, bottom is transitive
- You can only directly control what’s at the top
- They’re attacking the whole iceberg, but you probably only know about the stuff at the top

WHY Don't We Know?

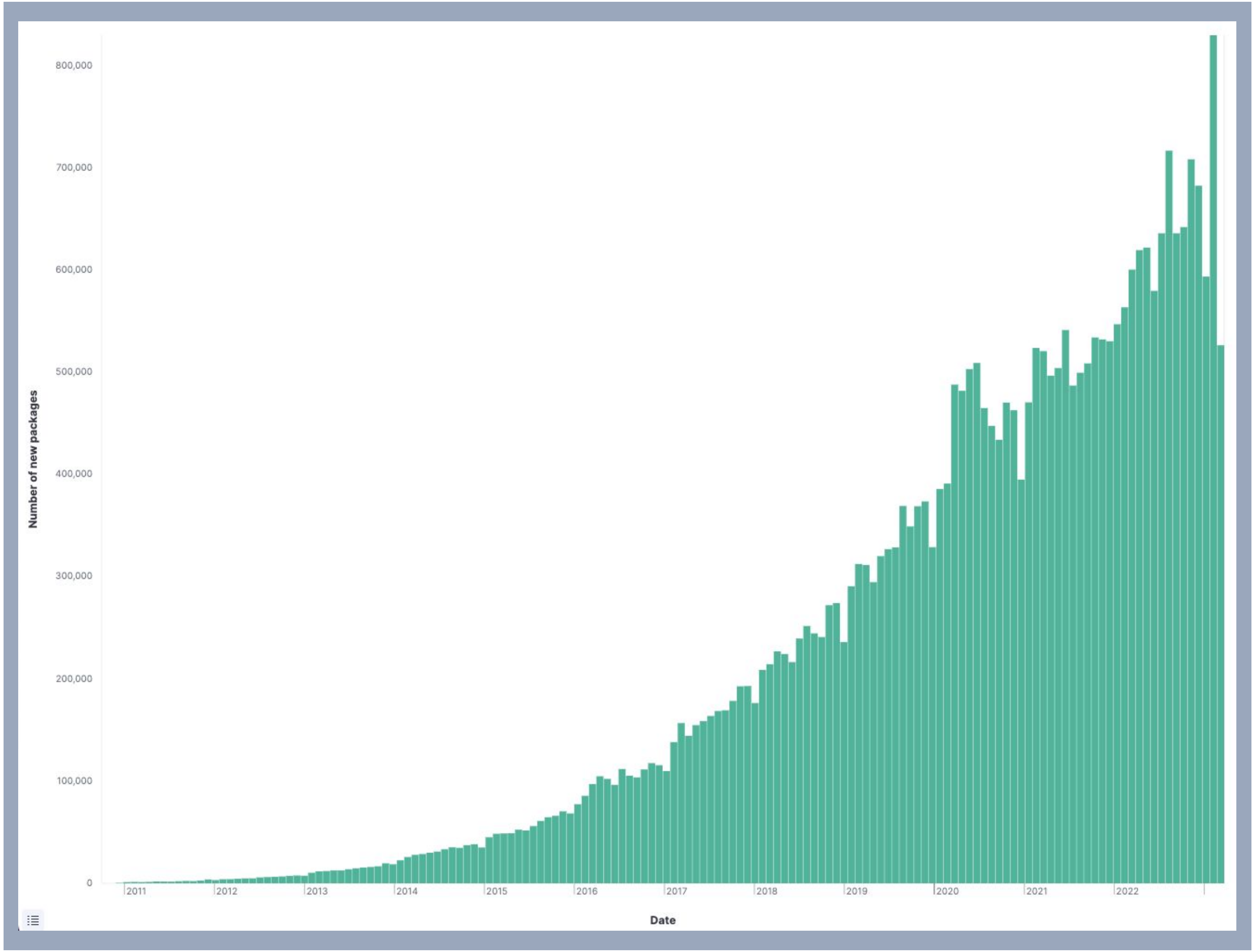
- Explosion of Open Source
- Transitive Dependencies

The Result:

Number of NPM packages



Number of NEW packages

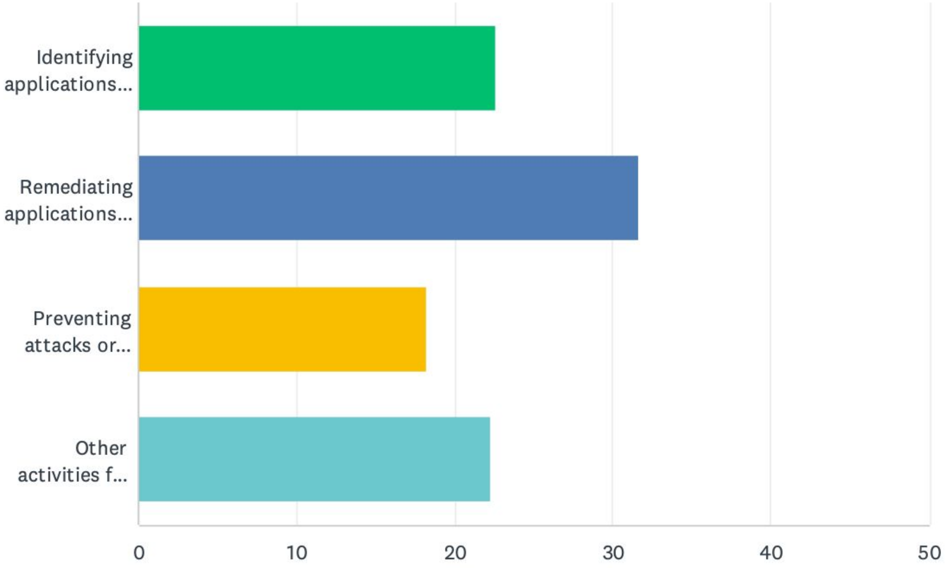


Open source is huge

- NPM introduced 2010
- 32 million packages (as of March 2023)
- Approx. 1,000,000 new packages **per month**
- That’s just NPM!

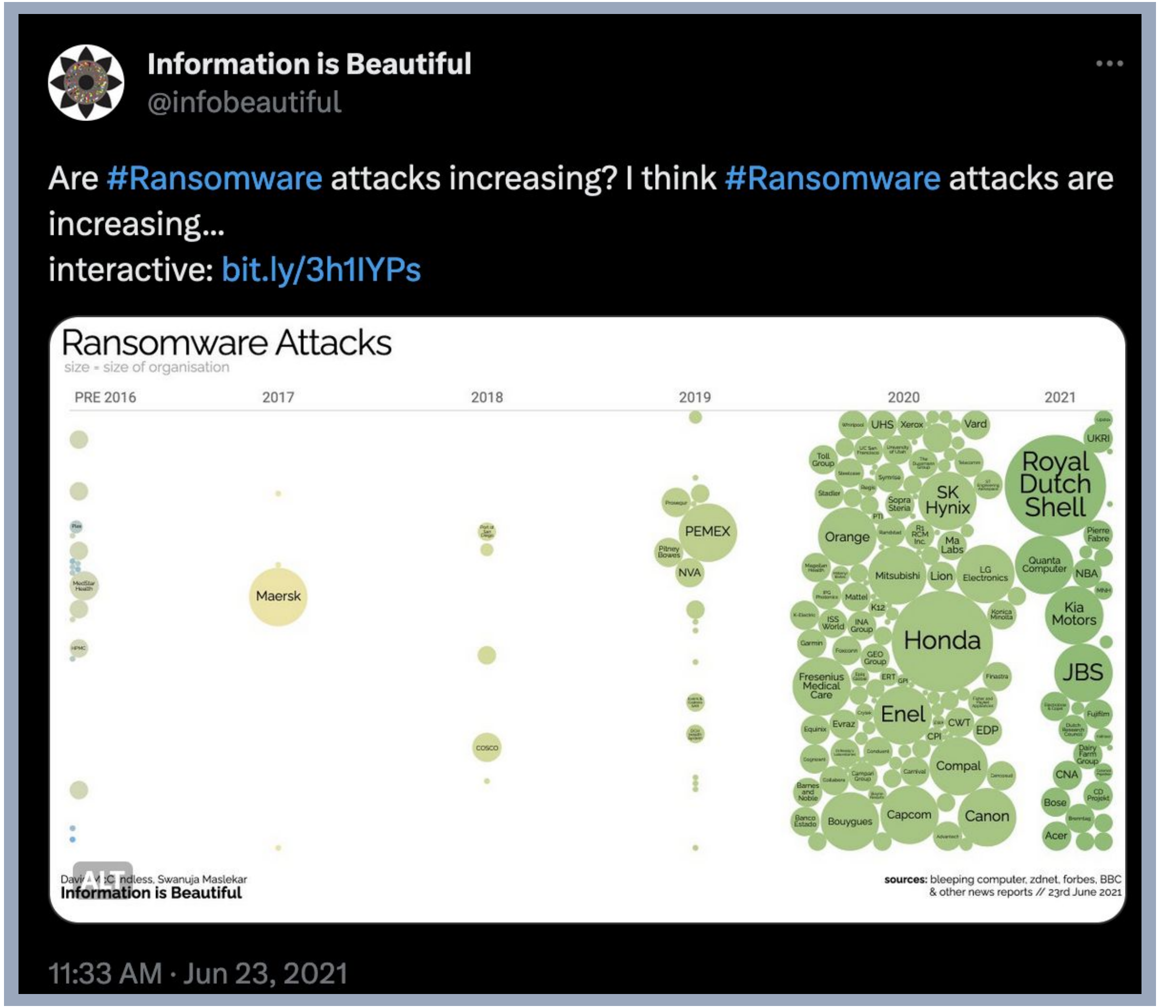
Q12 Estimate how many hours you personally have spent to date on each of the following activities.

Answered: 195 Skipped: 15



If We Knew…

- People spent insane amounts of time just finding log4j, because nobody knew where (or even if) it was hiding
- Knowing = Faster Remediation
- SBOMs help, a LOT, but…
  - They aren't a silver bullet
  - Scanners aren't perfect (e.g. can't penetrate binary blobs, cf. OpenSSL3.)
  - Not all SBOMs are equal
  - SBOMs aren't ubiquitous (yet) (producers aren't reliably supplying them)
  - SBOMs are more accurate and useful when producers/maintainers generate them BUT something is better than nothing
  - SBOM management is hard
  - Any SBOM generated before an actual build is suspect (transitive deps)
  - SBOM Everywhere: https://github.com/ossf/sbom-everywhere
  - I don't know what the end game is but generating them is better than nothing, figure out the details later



Information is Beautiful
@infobeautiful

Are #Ransomware attacks increasing? I think #Ransomware attacks are increasing...
interactive: bit.ly/3h1IYPs

Ransomware Attacks

size = size of organisation

David McCandless, Swanuja Maslekar
Information is Beautiful

sources: bleeping computer, zdnet, forbes, BBC & other news reports // 23rd June 2021

11:33 AM · Jun 23, 2021

The predictable consequence

- Ransomware has exploded along with transitive dependencies and open source in general
- I don’t believe in coincidences

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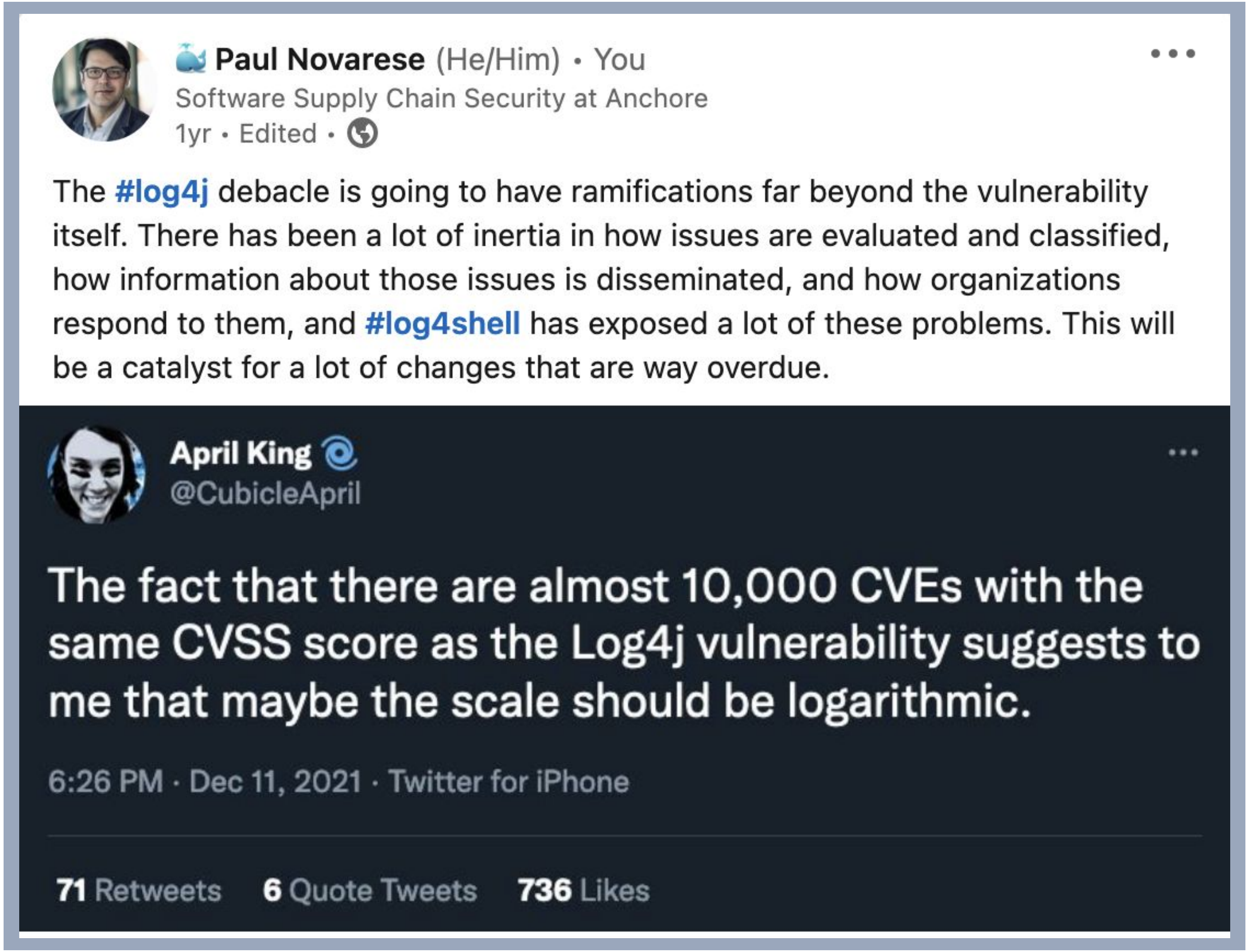
Lesson 3: The Other Thing We Don’t Know



🐳 **Paul Novarese** (He/Him) • You

Software Supply Chain Security at Anchore

1yr • Edited • 🌐

The #log4j debacle is going to have ramifications far beyond the vulnerability itself. There has been a lot of inertia in how issues are evaluated and classified, how information about those issues is disseminated, and how organizations respond to them, and #log4shell has exposed a lot of these problems. This will be a catalyst for a lot of changes that are way overdue.

April King

@CubicleApril

The fact that there are almost 10,000 CVEs with the same CVSS score as the Log4j vulnerability suggests to me that maybe the scale should be logarithmic.

6:26 PM · Dec 11, 2021 · Twitter for iPhone

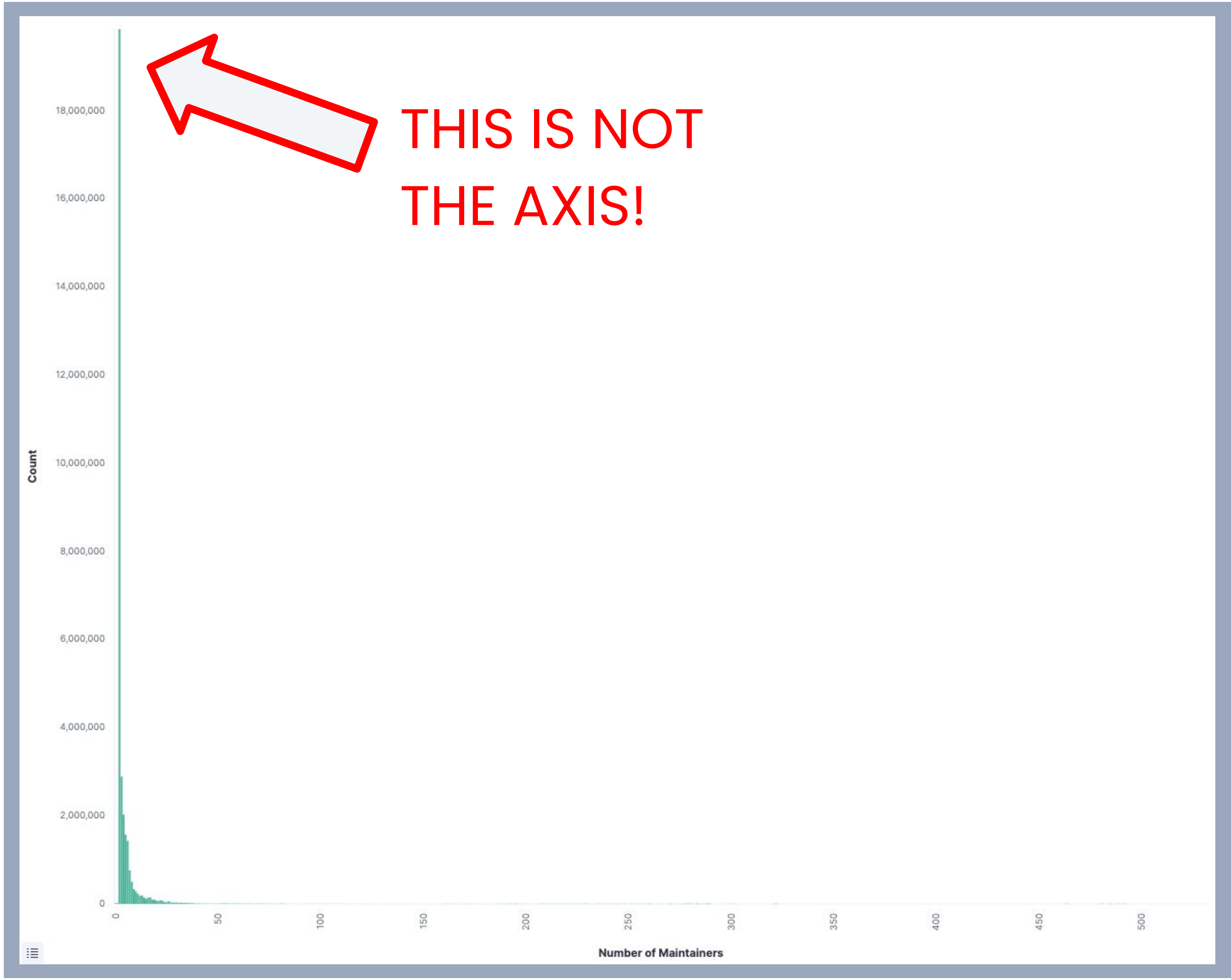
71 Retweets **6** Quote Tweets **736** Likes

OK, If Not CVSS, Then What?

- GHSAs (more transparent than CVEs)
- CISA KEV
- EPSS
- GitHub Insights and other project health metrics
  - This is (currently) a very manual process
  - But it’s getting a lot easier
  - Project health isn’t **directly** about safety
  - What happens when it hits the fan?

An Example Project Health Metric:

Number of Maintainers



THIS IS NOT THE AXIS!

Recap, Notes, &c.

Recap

- Log4Shell is Radioactive, Immortal
- We Don’t Know What’s In Our Own Software
- We Must Get Better Guidance
- How Software Gets Made is Different Now
- We Have a Lot of Eggs in GitHub’s Basket
- Think about Risk in the General Case

Footnotes

Slide 6 (Log4Shell will still be causing problems a decade from now):
https://www.zdnet.com/article/log4j-flaw-why-it-will-still-be-causing-problems-a-decade-from-now/

Slide 6 (40% of Log4j downloads still vulnerable):
https://securityintelligence.com/articles/log4j-downloads-vulnerable/

Slide 10 (possible origin of the iceberg):
https://www.slideshare.net/loriayre/open-source-library-system-software-free-is-just-the-tip-of-the-iceberg

Slides 12,13, 22 (Open Source is Bigger Than You Can Imagine):
https://anchore.com/blog/open-source-is-bigger-than-you-imagine/

Slide 14 (log4j survey etc):
https://anchore.com/log4j/

Slide 18:
https://twitter.com/CubicleApril/status/1469825942684160004
https://www.linkedin.com/posts/novarese_log4j-log4shell-activity-6876206319238463488-8bEA

Reading List

GitHub Advisory Database:
https://github.com/advisories

GitHub Insights:
https://docs.github.com/en/issues/planning-and-tracking-with-projects/viewing-insights-from-your-project/about-insights-for-projects

SBOM Everywhere:
https://github.com/ossf/sbom-everywhere

My previous DevOpsDays 2022 talk (Learn From Log4Shell):
https://www.youtube.com/watch?v=PINtIL_oN0k
https://github.com/pvnovarese/2022-devopsdays

CVEs CWEs CVSS and It's Discontents
https://www.linkedin.com/pulse/cves-cwes-cvss-its-discontents-sherif-mansour

Open Source Security Podcast Episode 392 – Curl and the calamity of CVE
https://opensourcesecurity.io/2023/09/10/episode-392-curl-and-the-calamity-of-cve/

Probably Don’t Rely on EPSS Yet
https://insights.sei.cmu.edu/blog/probably-dont-rely-on-epss-yet/

CVE-2020-19909 is everything that is wrong with CVEs
https://daniel.haxx.se/blog/2023/08/26/cve-2020-19909-is-everything-that-is-wrong-with-cves/

CISA Known Exploited Vulnerability Catalog
https://www.cisa.gov/known-exploited-vulnerabilities-catalog

Exploit Prediction Scoring System
https://www.first.org/epss/

Log4Shell Reading List

Dealing with log4shell (detection, mitigation, workarounds):
https://cloudsecurityalliance.org/blog/2021/12/14/dealing-with-log4shell-aka-cve-2021-44228-aka-the-log4j-version-2/

Keeping up with log4shell (post mortem)
https://cloudsecurityalliance.org/blog/2021/12/16/keeping-up-with-log4shell-aka-cve-2021-44228-aka-the-log4j-version-2/

Mysterious tweet hinting at the exploit:
https://twitter.com/sirifu4k1/status/1468951859381485573

Another mysterious tweet:
https://twitter.com/CattusGlavo/status/1469010118163374089

“THE” pull request:
https://github.com/apache/logging-log4j2/pull/608

Cloudflare digs for evidence of pre-disclosure exploits in the wild:
https://twitter.com/eastdakota/status/1469800951351427073

SBOM Takeaways

00 SBOMs enable continuous, automated security/compliance checks, reduce time spent identifying and remediating issues

01 SBOMs improve a lot of things but do not solve every problem you have

02 Log4j is extremely easy to find, OpenSSL 3 is often obscured

03 SBOMs are more effective when created by maintainers rather than consumers, but something is better than nothing

SBOM Reading List

Making Better SBOMs: https://kccncna2022.sched.com/event/182GT/ – https://www.youtube.com/watch?v=earq775L4fc

Reflections on Trusting Trust: https://www.cs.cmu.edu/~rdriley/487/papers/Thompson_1984_ReflectionsonTrustingTrust.pdf

Generate sboms with syft and jenkins: https://www.youtube.com/watch?v=nMLveJ_TxAs

Profound Podcast - Episode 10 (John Willis and Josh Corman):
https://www.buzzsprout.com/1758599/8761108-profound-dr-deming-episode-10-josh-corman-captain-america

GitHub Self-Service SBOMs: https://github.blog/2023-03-28-introducing-self-service-sboms/

Q&A

Download Syft

https://github.com/anchore/syft

Download Grype

https://github.com/anchore/grype

Let us know if you like it by giving us a star on GitHub

Get an invite to our open source community Slack at
https://anchore.com/slack/

These slides and lab examples archived here:

https://github.com/pvnovarese/2023-09-lessons-of-log4shell