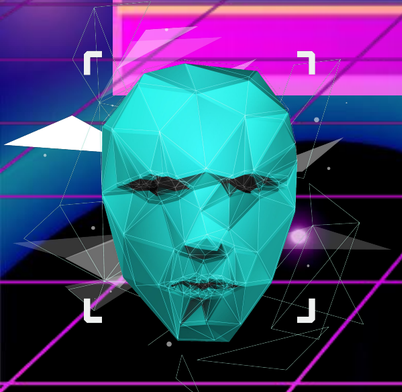
The Lazy Guide to Open Source Software (OSS) Risk Assessment



Cyberface says *“Managing Risk is the best!”*

Stir Trek 2024

CONTENT

- WHO IS THIS GUY?
- RISK MANAGEMENT ESSENTIALS
- WHAT IS OUR PROBLEM STATEMENT?
- YOU ARE DOING IT WRONG
- CONCLUSIONS

Astroface says
“ALL SYSTEMS GO! ….for ASSESSING RISK!!!”

WHO?

CRob, n, adj, and v

Pronunciation: U.S. (K-robe)

43rd level Dungeon Master

26th level Securityologist

Security Lorax, Cat-herder

Pirate-enthusiast & hat-owner

CyberFace wants to know when the movie is? He only came for the movie.

CRob_at_Intel_dot_com

@SecurityCRob

@SecurityCRob@infosec.exchange

https://github.com/SecurityCRob

The Security Unhappy Hour,
Chips & Salsa
What is in the SOSS (new!)

https://www.linkedin.com/in/darthcrob/

OpenSSF
OPEN SOURCE SECURITY FOUNDATION

The Rising Tide lifting all boats

- The OpenSSF is a cross-industry collaboration that brings together leaders to improve the security of open source software (OSS) by building a broader community, targeted initiatives, and best practices
- The OpenSSF brings together open source security initiatives under one foundation to accelerate work through cross-industry support. This includes working groups that address vulnerability disclosures, security tooling and more.
- OpenSSF is committed to collaboration and working both upstream and with existing communities to advance open source security for all.

https://openssf.org/

OpenSSF

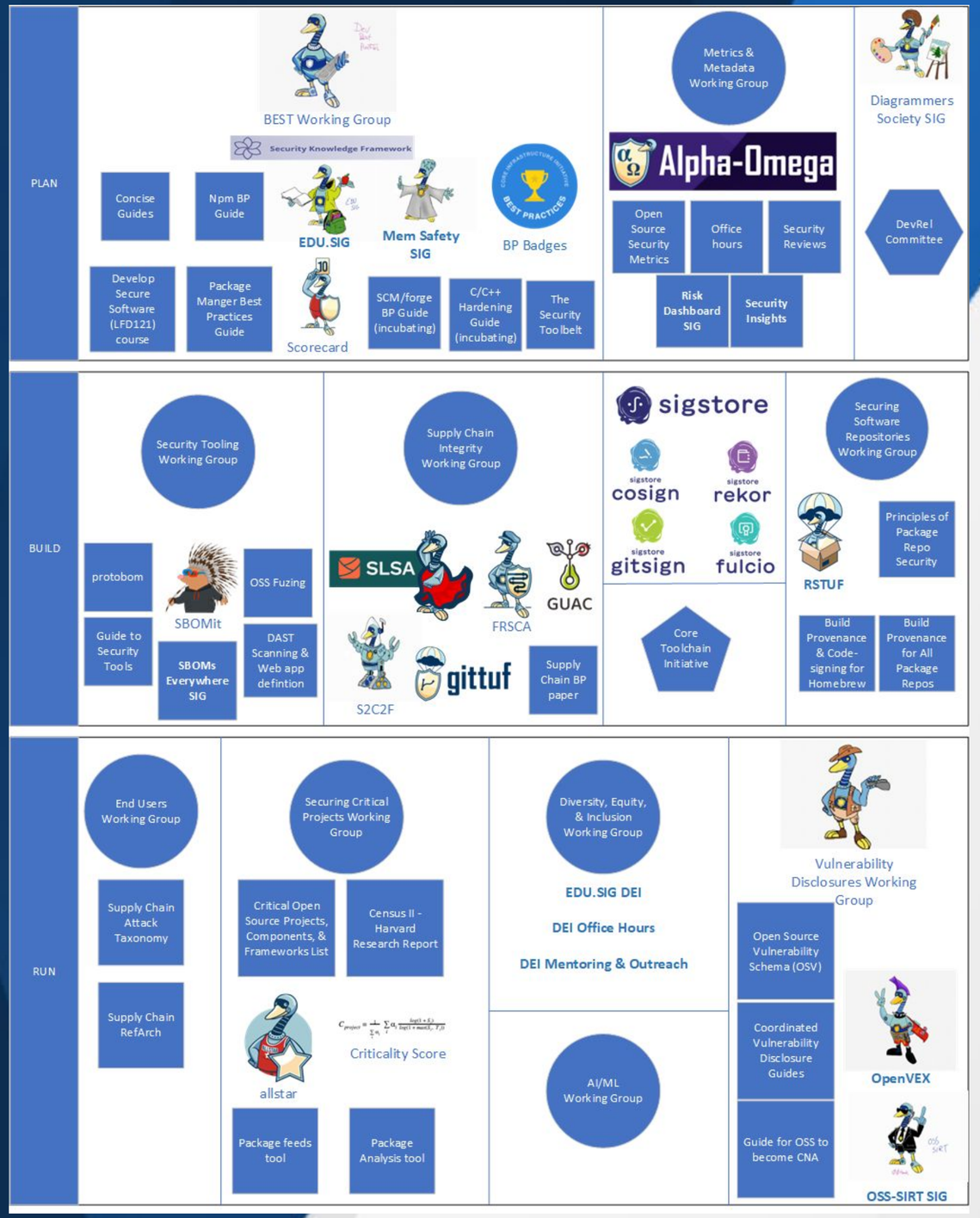
OPEN SOURCE SECURITY FOUNDATION

A Gaggle of Geese!

We have numerous software projects, guidelines, specs, and experts to help both upstream OSS developers AND downstream OSS consumers

https://openssf.org/community/openssf-working-groups/

What's up with all the Geese?



WAT

TALKING ABOUT RISK FOR FUN AND PROFIT

SPOILERS - it's ALL about the business!

CyberFace says "Wordz matter!"

https://github.com/SecurityCRob/presentations/blob/main/Measuring%20and%20Reporting%20Risk2.pdf

WHY?

Risk Management's purpose is ensure effective & efficient strategy & strategic decisions so that the organization can deliver on their desired outcomes. The primary tool for providing this input to the strategy is risk assessments.

Risk-taking is an intrinsic component of business.

CyberFace says *"We all contribute to that risk management culture!"*

WAT is RISK?

A **risk** is a possibility of damage or harm. A risk is described by a **threat** and a **vulnerability**. It is often documented as:

RISK = Threat x Vulnerability

*A **threat** is the potential cause of an incident that may result in harm to a system or organization.*

*A **vulnerability** is a weakness of software, hardware, or online service that can be exploited and that has security implications.*

It can also be described in terms of **Impact** and **Likelihood**

RISK = Likelihood x Impact

FIRST PSIRT Lexicon

RISK MANAGEMENT GOALS

IDENTIFY

Identify KNOWN risks; explore UNKNOWN risks

DOCUMENT

Collect all relevant data around the potential problem

ASSESS

Following your Risk Management Framework (RMF), analyze and score the severity of the problems - in BUSINESS TERMS

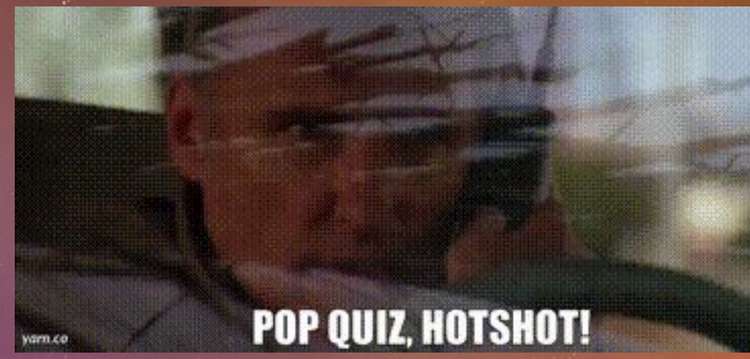
RECOMMEND

Following our Risk.Strategy, provide the business calm, trusted advice on possible courses of action

MONITOR

Set targets for periodic review and monitor progress as old risks are resolved and as new risks evolve

POP! Quiz, hotshots



How many folks here use open source software?
(hint - do you own a smartphone or use the internet/cloud?)

How many folks here CONTRIBUTE to open source software?

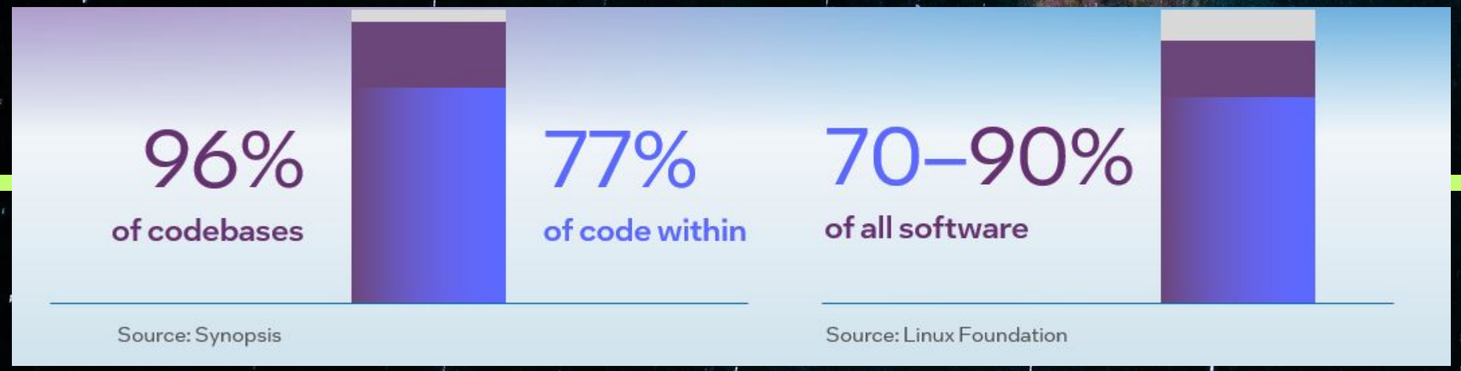
How much money do you think your company has made/saved because you decided to use someone else's software instead of writing it yourselves?

CISA estimates that OSS has generated over $6-8 TRILLION dollars of value to the global economy.

Image Source

Problem Statement

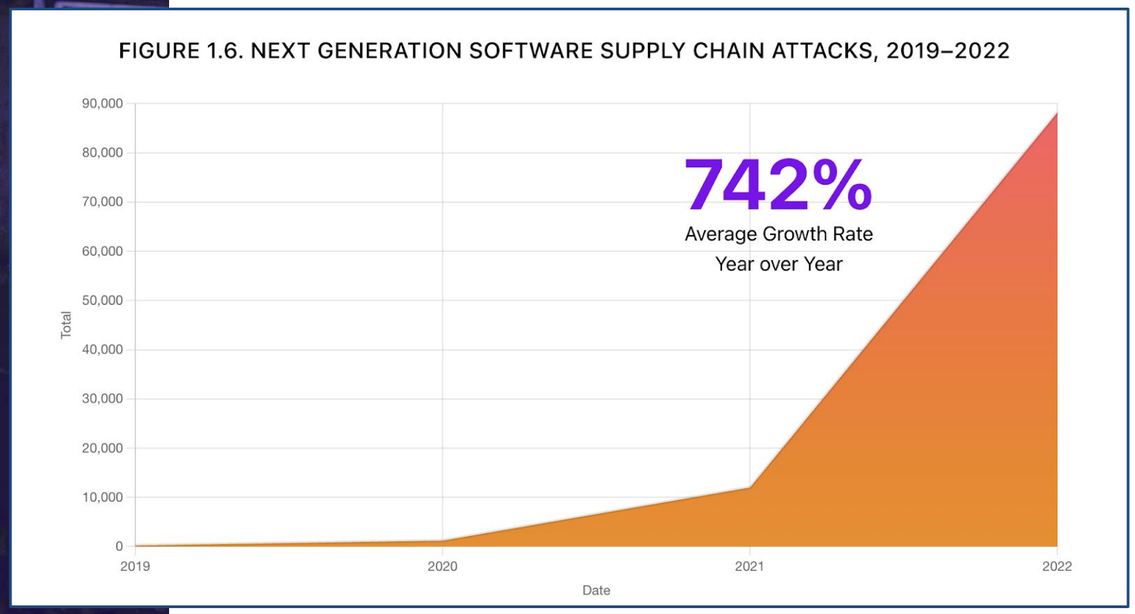
- Studies cite that anywhere between 90-98% of commercial software contains open source software(1)(2)
- Supply Chain attacks have risen 450%-600% over the last several years(3)
- Most Suppliers and Downstream Consumers do not understand upstream open source



Astroface says “*Numbers are FUN!*”

1.) https://www.synopsys.com/software-integrity/resources/analyst-reports/open-source-security-risk-analysis.html
2.) https://www.linuxfoundation.org/blog/blog/a-summary-of-census-ii-open-source-software-application-libraries-the-world-depends-on
3.) https://www.csoonline.com/article/3677228/supply-chain-attacks-increased-over-600-this-year-and-companies-are-falling-behind.htm l

A Tour of many “popular” open source & supply chain attacks over the years



<- The “OG” Supply Chain attack 1194–1184 BC

<- Typically the 1st time “supply chain attack” was recognized as an issue in cybersec

https://www.sonatype.com/resources/vulnerability-timeline
https://www.reversinglabs.com/blog/a-partial-history-of-software-supply-chain-attacks
https://linuxfoundation.eu/newsroom/the-rising-threat-of-software-supply-chain-attacks-managing-dependencies-of-open-source-projects

Outside of direct supply chain attacks, vuln counts have risen over the years

https://www.cve.org/About/Metrics

Let’s Talk about what you’re doing wrong

“I am an organization that pulls code straight from upstream”

“I am an organization that has my software supplied by a vendor”

You never checked who wrote your software

Was it one person?

Was it many people?

Did your vendor ACTUALLY write it, or did they embed Open Source into it?

if they did that, what did they add in?

Does that person(s) understand software engineering?

Do they understand SECURE application development?

SOME ORGANIZATIONS may also care about country of origin*

*A CORE OSS tenant is that “all patches are welcome”, regardless of person/nation of origin

Image Source

RISK:

3rd party software your company uses has unknown or unverified components that are of unknown pedigree, provenance, quality, and origin used within your operations and prod environment

How this RISK can be managed:

- ONLY acquire software from known, vetted & trusted sources! (Pastebin is ….just the worst)
- Require your suppliers to give you an electronic, machine readable **Software Bill of Materials** (SBOMs) that does multiple levels of dependency checking to see Pedigree and Provenance of the code as it travels through the software supply chain
- Use tools like OpenSSF Scorecard, which provides critical security health metrics about OSS projects -
- OpenSSF Concise Guide to Evaluating Open Source Software
- OpenSSF Secure Supply Chain Consumption Framework (S2C2F)
-

Cyberface says *"Did you know there are multiple SBOM types (Design, Source, Build, Analyzed, Deployed) as well as multiple electronic formats (SPDX, CycloneDX) to generate them in (and yes, there are some vendors that will default to FAXING you a PDF….be warned"*

https://www.cisa.gov/sites/default/files/2023-04/sbom-types-document-508c.pdf

Brief SBOM tangent……

https://www.youtube.com/watch?v=sNjVQaK5QW4

Cyberface says *"Say 'SBOM' three times and Alan will appear!"*

You never checked that what they wrote is actually what you installed

Predominantly, OSS is about the source code, which is publicly available to view, test, reuse

How the software is compiled, tested, composed, built, and published is JUST as important as the software itself

You will run into two of the hardest problems in all of computers: Naming & Versioning

Depending on how you consume software, there are things you can do to ensure integrity/authenticity

Image Source

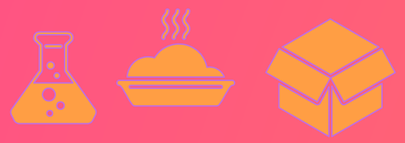
What could **possibly** go wrong?

AV-100 - Develop & Advertise Distinct Malicious Package from scratch

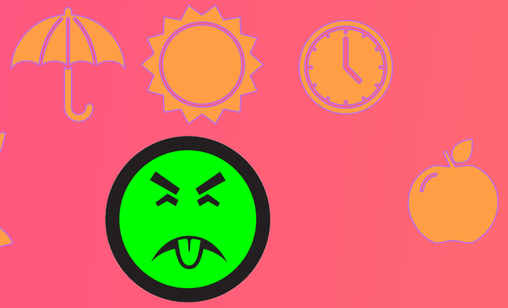
AV800 -Become the Maintainer

Moira
Developer Queen

AV-001 -Subvert Legitimate Package

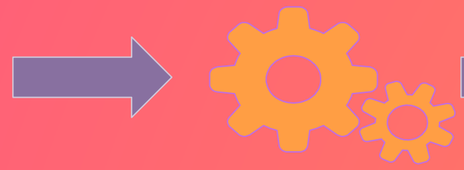


AV-302 Contribute as Maintainer
AV-700 Compromise Maintainer System



AV-200 - Create Name Confusion with Legitimate Package

AV-403 -Tamper with Exposed Build System



AV-500 -Distribute Malicious version of Legitimate Package

Estaban
Software Enjoyer

AV-701 Exploiting Config Vuln Counterfeiting
AV-702 Exploiting Software Vuln

...quite a lot, actually

Source : Taxonomy of Attacks on Open-Source Software Supply Chains - https://arxiv.org/pdf/2204.04008.pdf

RISK:

3rd party software your company uses within your operations and prod environment has unknown or unverified build, test, and publication information

How this RISK can be managed:

- Understand how the software you use is compiled, assembled, tested, and published
- Only used signed software artifacts (SBOM, packages, etc.) from trusted sources
- OpenSSF Supply Chain Levels of Software Artifacts (SLSA)
- OpenSSF sigstore for digital signing for integrity/authenticity checking
- Scanning, scanning, scanning
  - SAST, DAST, SCA, Fuzzing, dependency checking, known vuln scanning, etc.
- OpenSSF C/C++ Compiler Hardening Options Guide
- OpenSSF Source Code Management Best Practices Guide
- OpenSSF + CISA Principles of Package Repository Security
- OpenSSF Concise Guide to Evaluating Open Source Software

Cyberface says *“ Sometimes HOW something is made is JUST AS important as what it does.”*

You never checked how they secure the software (or maybe they don't)

FUN FACT - The majority of OSS software projects are maintained by a single maintainer

A large portion are “weekend warriors” that don’t have tools, resources, or peers to assist with the maintenance of the project

To learn more about Diana the Weekend Warrior:

https://github.com/ossf/toolbelt/tree/main/personas#name-diana-the-weekend-warrior

Depending on how you consume software, there are things you can do to ensure integrity/authenticity

Open Source Developer Spectrum

- There are MANY motivations for why people choose to create and collaborate with open source software (1).
- Many large and mature open source projects have specialists or teams that help manage security for the effort.
- The majority of open source projects are single-maintainer projects that do not have access to those resources, nor an understanding of how (2).

Cyberface says *"Free software is *FREE*, right? BWAHAHAHAAHAHAHAHAHAHAHAHAAAAAA!"*

(1) - https://www.linuxfoundation.org/hubfs/LF%20Research/MaintainerSecurityBPs_011724.pdf?hsLang=en
(2) - https://anchore.com/blog/open-source-is-bigger-than-you-imagine/

RISK:

3rd party software your company uses within your operations and prod environment was created and is maintained with unknown SDLC practices

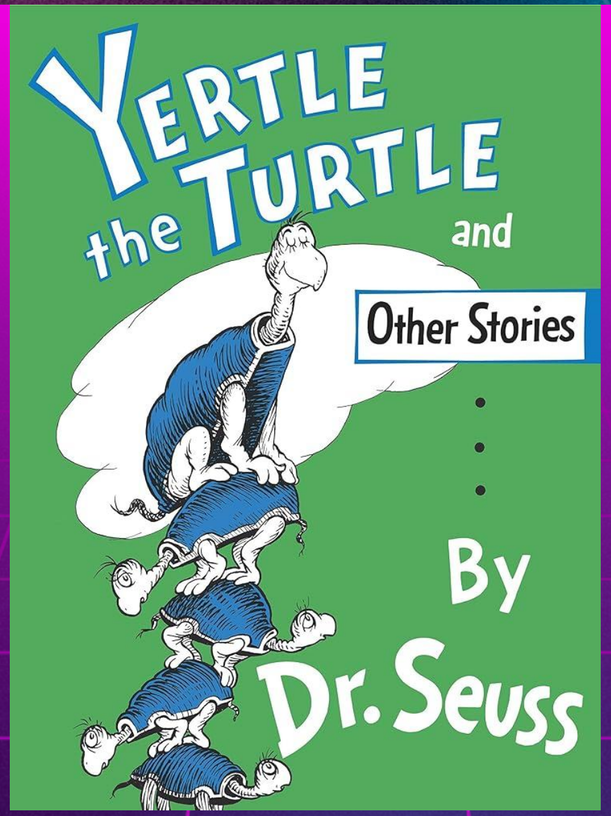
How this RISK can be managed:

- For software that matters to you, find out what the project's development processes, tooling, lifecycle activities are
- Check for the OpenSSF Best Practices Badge, which provides verification of project's SDL activities
- OpenSSF Concise Guide to Developing More Secure Software
- OpenSSF Secure Supply Chain Consumption Framework (S2C2F)

Cyberface says *"Education is the **SINGLE** greatest tool in a secure developer's toolbelt. Once you learn something, you ALWAYS have access to that knowledge! "*

You don't really know what software you have installed or what it installed to make itself work

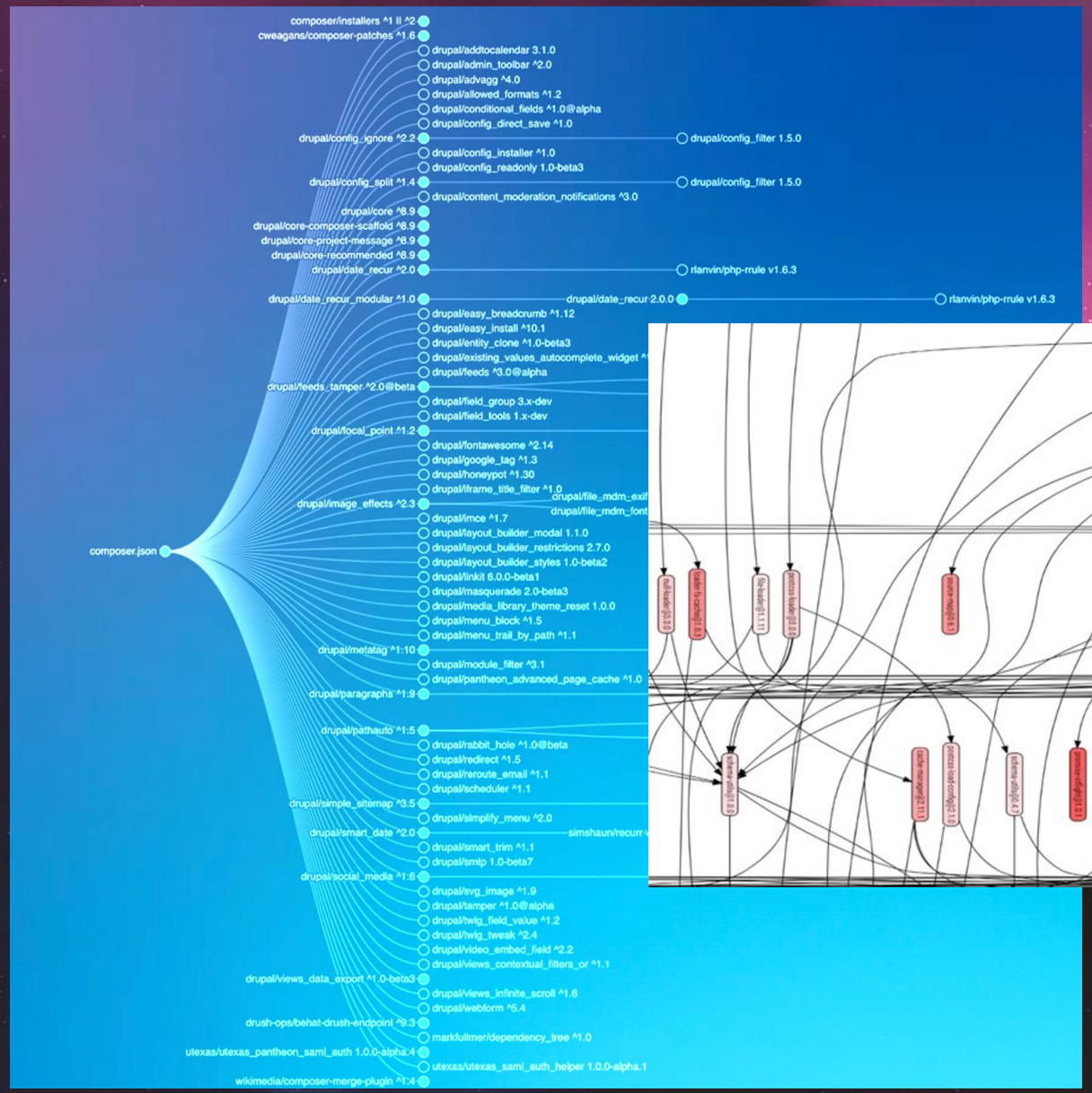
Depending on the language and ecosystem, that ONE component you ingest could have 1 to *n* dependencies just to make it work

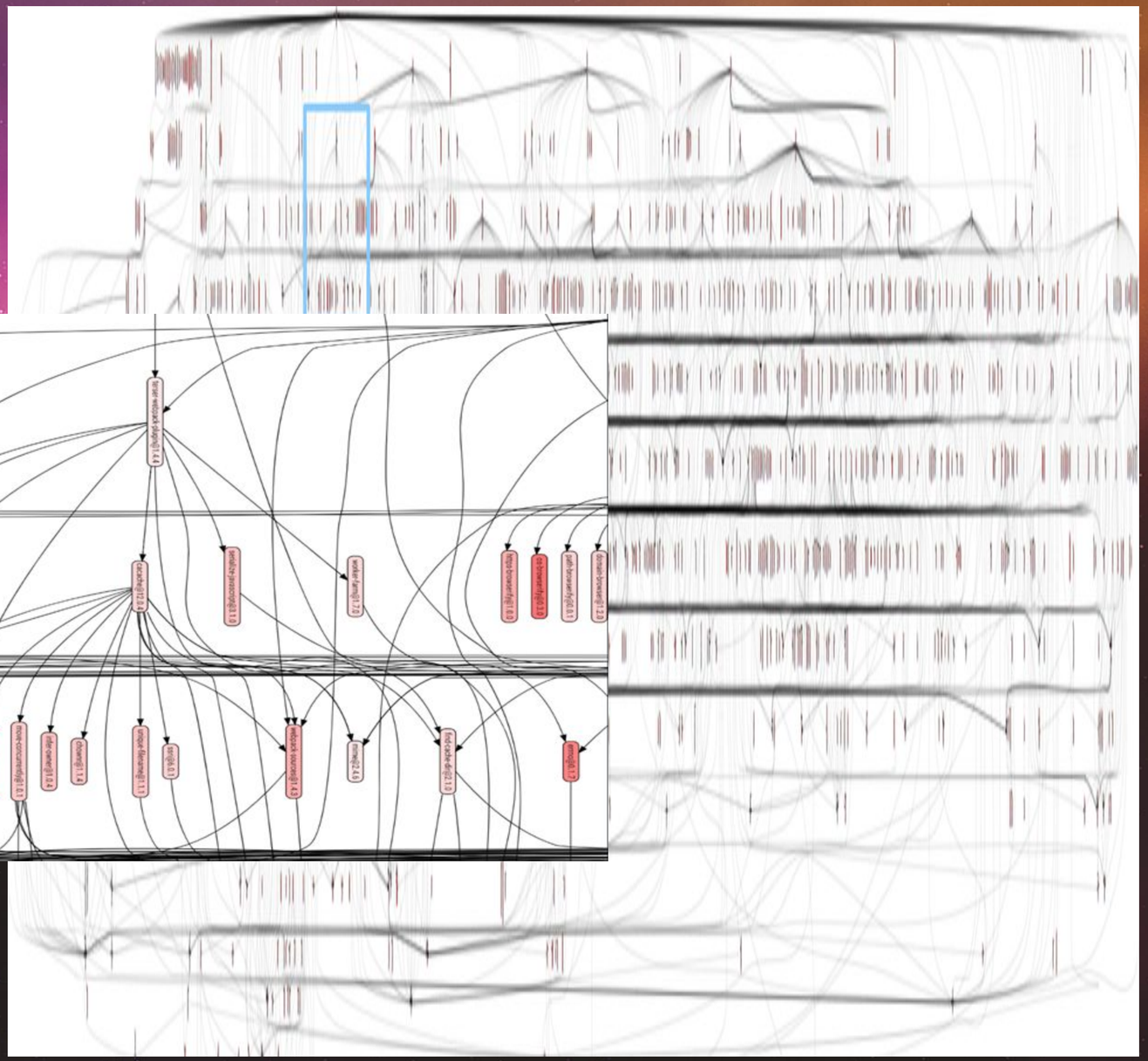


FUN FACT - oftentimes your dependencies ALSO have dependencies that may not get documented (pulled in at build or runtime)

Image Source

.....So many dependencies





https://www.drupal.org/project/composer_dependency_tree

https://www.gatsbyjs.com

Thanks to Intel's Ryan Ware & Katharine Druckman for letting me open source these images!

RISK:
3rd party software your company uses within your operations and prod environment has unknown or unverified transitive and intransitive dependencies

How this RISK can be managed:

- Reduce the attack surface of your software and eliminate unneeded dependencies wherever possible
- Use tools like the **OpenSSF's GUAC** (Graph for Understanding Artifact Composition) to show dependency tree graphs to analyze "hidden" or "unadvertised" software components -
- OpenSSF Concise Guide to Evaluating Open Source Software
- OpenSSF Secure Supply Chain Consumption Framework (S2C2F) - Documents levels of maturity to ease your journey of ingesting OSS and so that you can improve over time

Image Source

Astroface says *"Removing software dependencies and packages you don't need ultimately makes less work for you in the future!* ***Future-you*** *will thank you!! "*

You never checked that the dev made any kind of commitment to fix problems in the software

Free software doesn’t always include free support and maintenance.

Upstream typically supports latest version and *maybe* one version back with updates.

COMPLETELY EXPECTED “ripped from the headlines” reference

Back to the Diana persona, many projects truly are “as is” with no commitment to fix defects or vulnerabilities.

Our “pal” Jia Tan of XZ-Utils fame, highlights a common pattern of upstream maintainer burnout being exploited by bad actors

https://openssf.org/blog/2024/03/30/xz-backdoor-cve-2024-3094/

OSS Licensing “Fun Facts”

Here is a snippet from the Apache 2.0 License, which is broadly used, and very similar to other OSS licenses in these two paragraphs.

As always, your mileage varies, read the licenses for the software you consume/use for specifics.

7. Disclaimer of Warranty. Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

8. Limitation of Liability. In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

RISK:

The 3rd party software you use within your operational and production environment has a different perspective on how the software is supported and maintained than what your requirements state.

How this RISK can be managed:

- Ensure that software you consume have documented support policies that meet your organizational requirements. As needed, consider finding commercial support for open source packages critical to your business. Better yet, consider contributing back upstream to projects you use
- Check upstream repositories for a security.md, security policy, or vulnerability disclosure policy (VDP) to understand how the project will address vuln reports (or if they won't!)
- This signal can be found in Scorecard, Best Practices Badge, Allstar, Security Insights and others
- Check critical projects' historic advisories, git repo commits to understand how reports are addressed

Cyberface says *"Actors like 'Jan Tai' have been conducting social engineering attacks like what happened with XZ-Utils for many years now. Originally the attackers would only embed malware and BitCoin miners, but now Nation State Actors see this as a prime attack pattern (Solarwinds, MS Exchange hack [Forest Blizzard], and many others). Enjoy!"*

You aren’t monitoring upstream for CVEs, bug fixes, or other activitiy

Open Source Projects are like snowflakes….each one is delicate, beautiful, and completely different from every other one

There are multiple ways you can monitor upstream activity to get the information you need to manage your software

Also, software ages more like milk than wine…..

Image Source

Another sad issue “ripped from the headlines” that is COMPLETELY avoidable…

Log4Shell was **fixed** on Dec 6, 2021

Screen cap made on April 29, 2024

log4j Latest Statistics

379,128,634

Total Downloads Since Dec 10, 2021

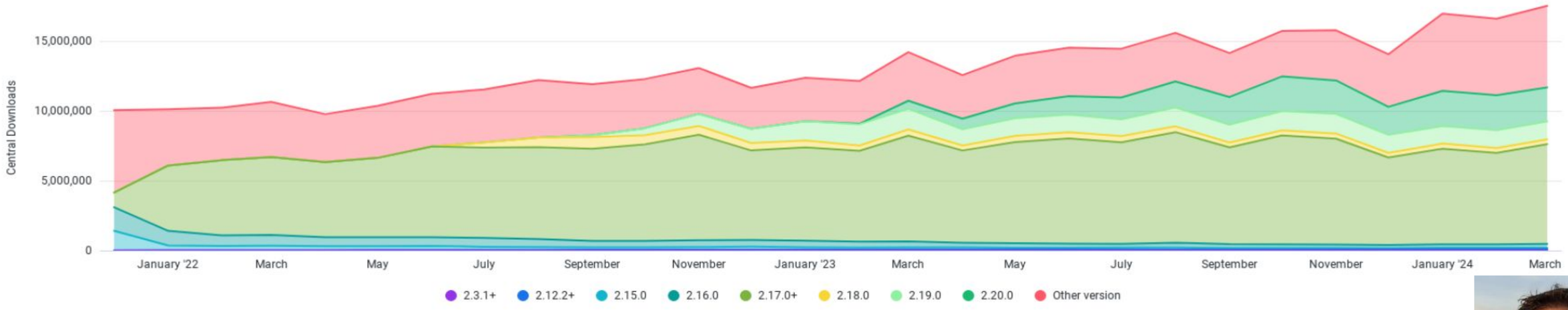
29 % vulnerable

34 %

Vulnerable Downloads Last 7 Days

4,112,685 total downloads

log4j Monthly Central Downloads



https://www.sonatype.com/resources/log4j-vulnerability-resource-center

Brian Fox, CTO & Co-founder of Sonotype *“**PLEASE** stop downloading the old, vulnerable versions of log4j! Log4Shell has been fixed for **years** now!”*

RISK:

You do not understand how the 3rd party software you use within your operational and production environment intakes, triages, prioritizes, fixes, and communicates security vulnerabilities and other functional updates and don't have it plugged into your SDLC practices.

How this RISK can be managed:

- Find out how critical software you use communicates changes and updates. SUBSCRIBE to those channels. Add these signals to your SDLC to ensure integration.
- The OpenSSF's OSV (Open Source Vulnerability database and schema) is one of the best places to monitor for OSS vulnerabilities
- Databases like NVD may not have complete, accurate, or timely data about all known CVEs + their metadata
- oss-security lists are the BEST thing to monitor for traditional OSS projects as CVEs go PD
- Tools like VEX (or the awesome OSS' OpenVEX) help maintainers and vendors notify their downstream of the affectedness of their software to vulns quickly (VEX works GREAT with SBOMs!)
- OpenSSF SIREN (new!) is a new list that will help advertise IoCs and TTPs for oss projects that are being actively exploited

Cyberface says *"A good friend of mine once said that 'Knowing is HALF the battle!' "*

CONCLUSION

Open Source Software is a vibrant and energetic source of ideas and innovation than can be used by downstream to power their dreams….

Using it is NOT FREE, and requires patience, discipline, and lots of additional hard work, including….

Parting Thoughts to Manage Your Risk of Using OSS

1. Understand what OSS you are using today (through scans, SBOMs, code review, etc.); conduct due-dilligence to learn more about how it is written, stored, compiled, and published
2. Reduce your attack surface when it comes to # of installed packages and dependencies
3. Combine your asset inventories with SBOMs with vuln scanner info and VEX statements to get a better picture of where your OSS risk lies
4. Use the latest, patched versions of software. Old software = vulnerable software
5. Monitor your upstream suppliers and OSS projects for updates (particularly CVE notifications)
6. **CVSS != Risk** A number or colour is not Risk. You need to apply your org's Risk Appetites, Tolerances, and RM methodology to understand what vulns matter to YOU most
7. **If you use OSS, consider supporting OSS**

THANK YOU!

CyberFace says *“This isn’t the end, this is only the BEGINNING! (mwahaha)”*

CREDITS

Slides Carnival

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