Surviving in Dependency Hell 😰

c0c0n 2023 | Kumar Ashwin

About Me

Kumar Ashwin

- Security Engineer
- Deals in Web, Cloud & Software Supply Chain Security
- Talks & Trainings - c0c0n, x33fcon, ...

@0xCardinal (https://0xcardinal.com) on socials

Agenda

Premise

Strategies

⛳

Conclusion

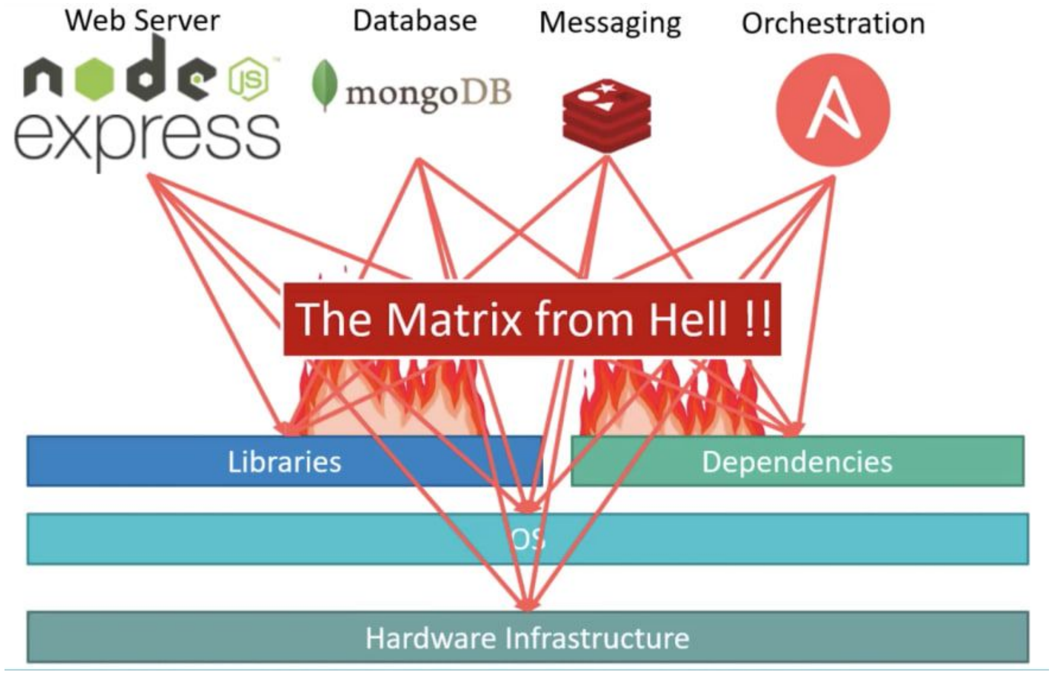
Disclaimer

The research was conducted within the Node Ecosystem, but the strategies discussed in the slides can be applied to other package ecosystems as well.

***We will not** be talking about creating **Dependency Heaven**,*

*but **will** talk about how to be the **Lucifer in the hell**.*

Matrix Of Hell



Source: KodeKloud

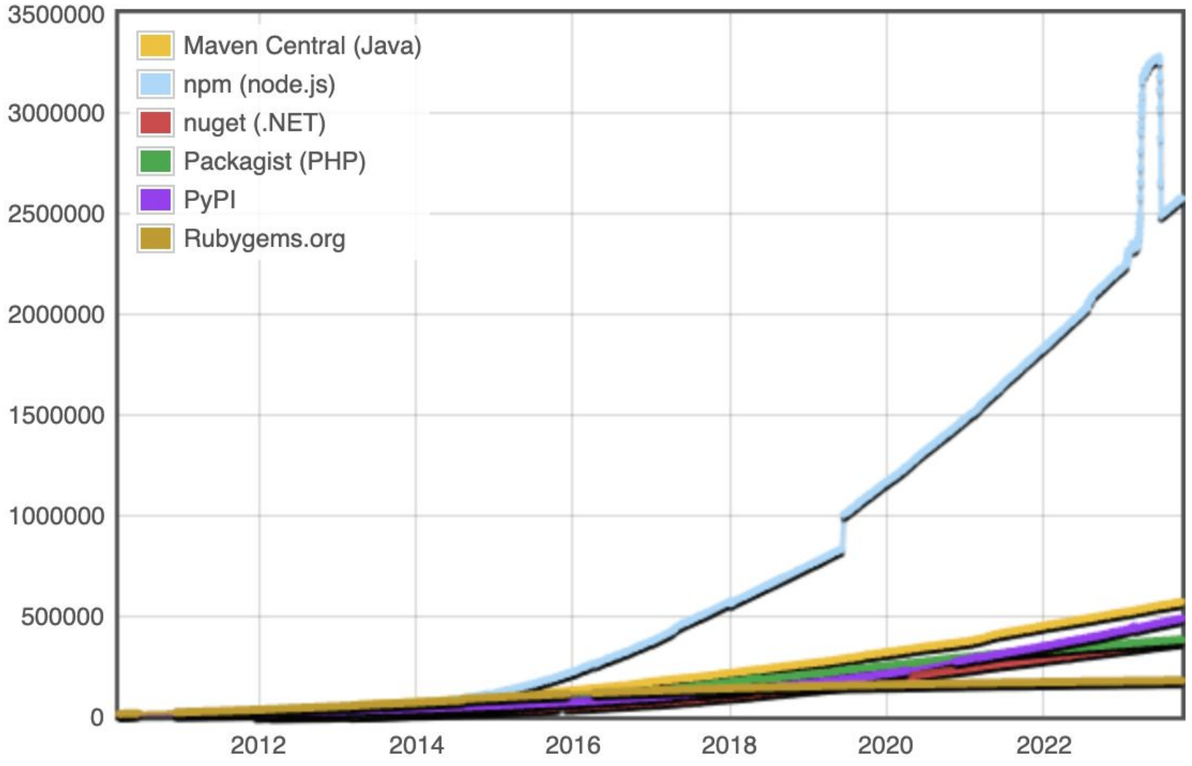
Dependencies

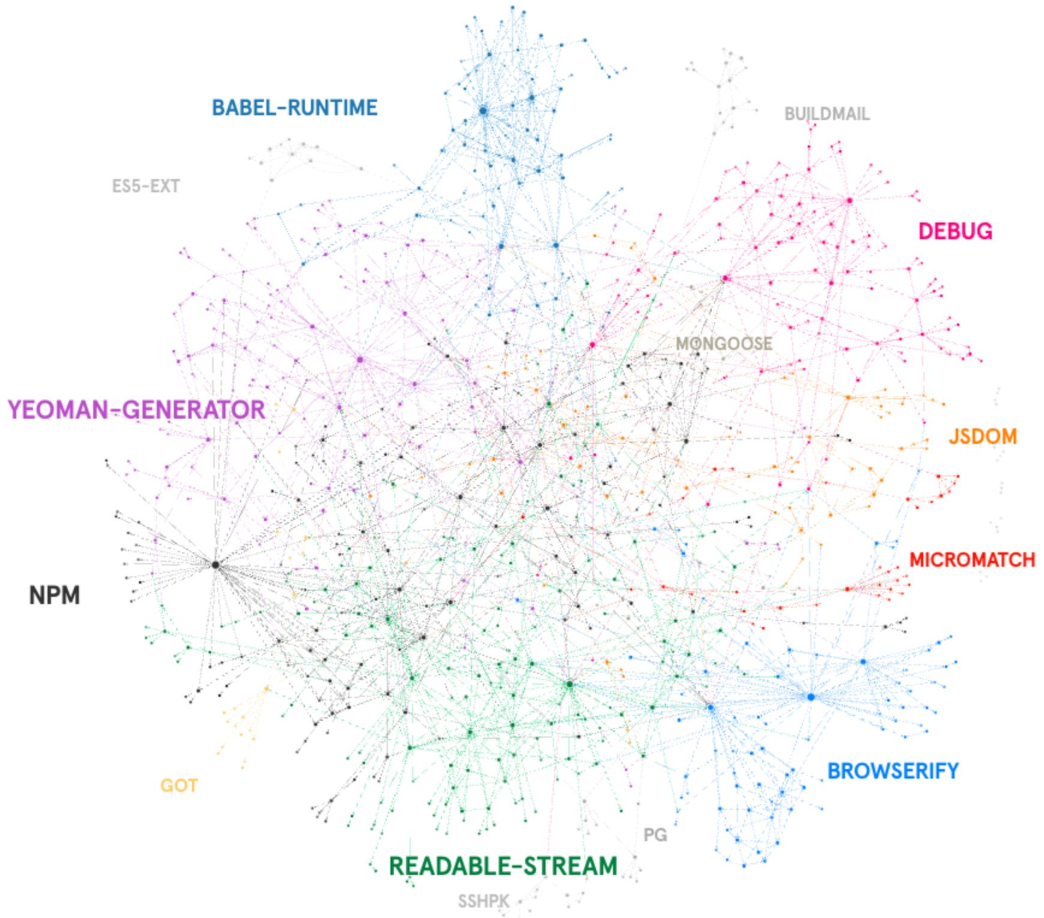
Dependency is a term used when your code depends on someone else’s code usually someone external.

Types of Dependencies

- Direct
- Transitive

Packages

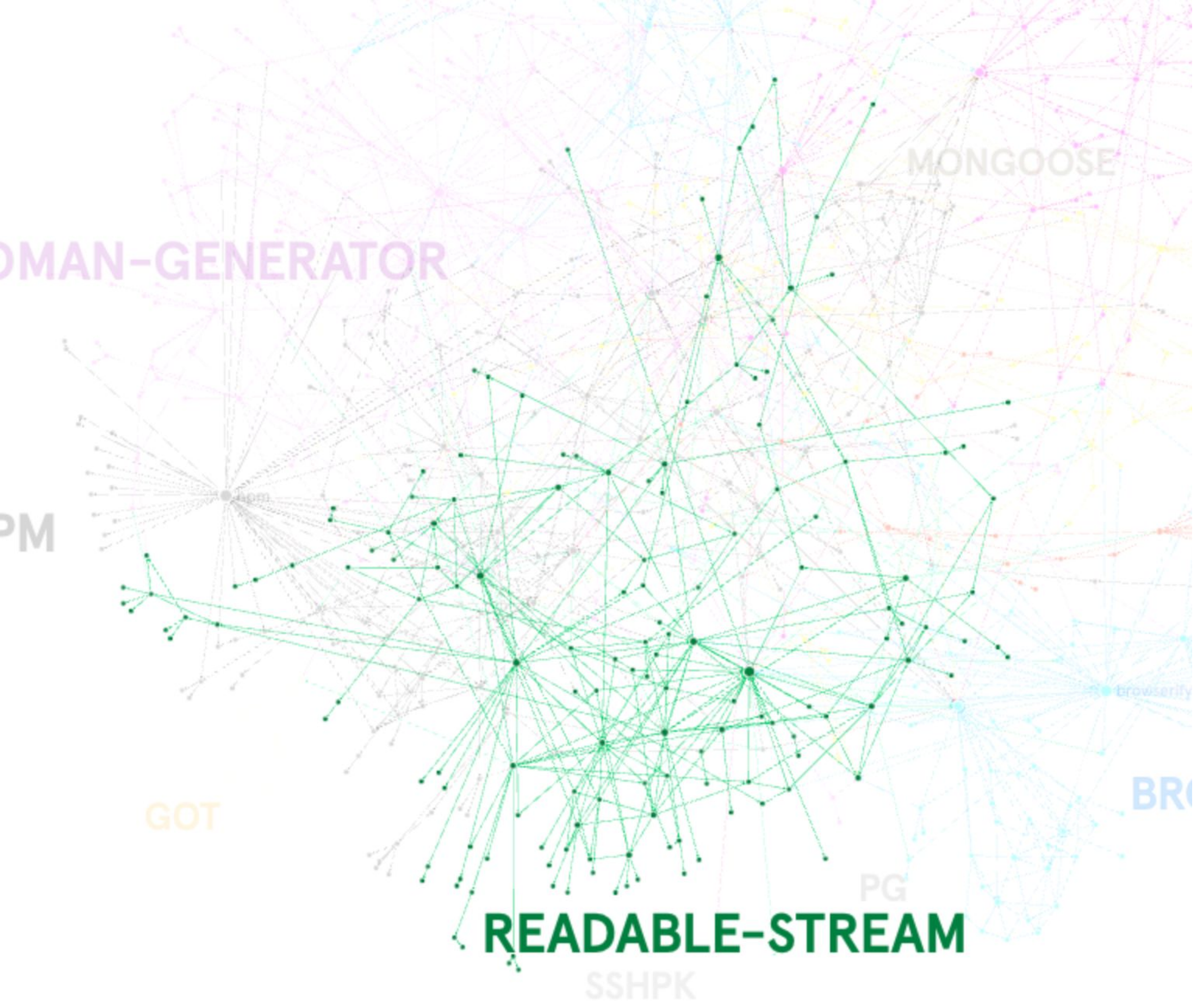

3500000
3000000
2500000
2000000
1500000
1000000
500000
0
2012
2014
2016
2018
2020
2022
Maven Central (Java)
npm (node.js)
nuget (.NET)
Packagist (PHP)
PyPI
Rubygems.org



Top 100 Projects having 4 level of transitive dependencies.

https://medium.com/graph-commons/analyzing-the-npm-dependency-network-e2cf318c1d0d

https://legacy.graphcommons.com/graphs/a7ec343d-2a0c-47bb-9658-bb8315e8a096?show=analysis-cluster



Graph of Readable-stream package with around 144 nodes (containing 4 level deep dependencies)

Dependency Hell

OKAY, LET'S TALK STRATEGIES

9 Circles of Dependency Hell

- Problems with Package Management
  - Are my dependencies even correct?
  - Updating a new package and breaking something else.
  - Bloated bundles. Too many dependencies.
  - Multiple package managers.
  - The package or version you need isn't in your package manager.
  - Monkey patching a dependency.
  - Breaking changes on a minor or patch version.
  - Circular dependencies.
  - The diamond dependency problem.

https://about.sourcegraph.com/blog/nine-circles-of-dependency-hell

9 Circles of Dependency Hell //

Are my dependencies even correct?

Mismatched Manifests
Restrictive Licenses

9 Circles of Dependency Hell //

Are my dependencies even correct?

Set-up a proper dependency vetting process.
Dependency manifest(s) as single source of truth to avoid inconsistency.

Are my dependencies even correct?

- One should vet the dependency before using upon multiple factors -
  - Number of maintainers
  - Number of issues
  - Number of downloads
  - Longest open issue
  - Discussion on the issues, etc.
- Setup processes to identify the drift between the packages installed and the packages that are mentioned in the manifest.

https://github.com/safedep/vet.git
https://www.mariokandut.com/how-to-check-unused-npm-packages/

9 Circles of Dependency Hell //

Updating a new package and breaking something else.

No dependency vetting
3rd party author’s trustworthiness

https://evertpot.com/npm-revoke-breaks-the-build/
https://qz.com/646467/how-one-programmer-broke-the-internet-by-deleting-a-tiny-piece-of-code
https://www.bleepingcomputer.com/news/security/dev-corrupts-npm-libs-colors-and-faker-breaking-thousands-of-apps/

9 Circles of Dependency Hell //

Updating a new package and breaking something else.

Can’t emphasize enough, setup a proper vetting process.
Keeping a local cached copy of the dependencies used (if you are big enough to maintain)

9 Circles of Dependency Hell //

Bloated bundles. Too many dependencies.

Slow builds
Older/unused dependencies in the environment

https://www.darkreading.com/vulnerabilities-threats/on-shaky-ground-why-dependencies-will-be-your-downfall
https://bundlephobia.com/
https://www.bitovi.com/blog/why-your-angular-bundle-is-bloated

9 Circles of Dependency Hell //

Bloated bundles. Too many dependencies.

Inventory & audit the dependencies.

```
npm list --depth 100
npm audit
```

9 Circles of Dependency Hell //

Multiple package managers.

Slow builds
Package conflicts

9 Circles of Dependency Hell //

Multiple package managers.

Ideal scenario is to use one package manager per language.

9 Circles of Dependency Hell //

The package or version you need isn’t in your package manager.

9 Circles of Dependency Hell //

The package or version you need isn't in your package manager.

Use Git Repositories to install packages locally.

a technique used to dynamically update the behavior of a piece of code at run-time without altering the original source code.

9 Circles of Dependency Hell //

Monkey patching a dependency.

Difficult to upgrade
Malicious Monkey Patch

https://arstechnica.com/information-technology/2009/05/mozilla-ponders-policy-change-after-firefox-extension-battle/

9 Circles of Dependency Hell //

Monkey patching a dependency.

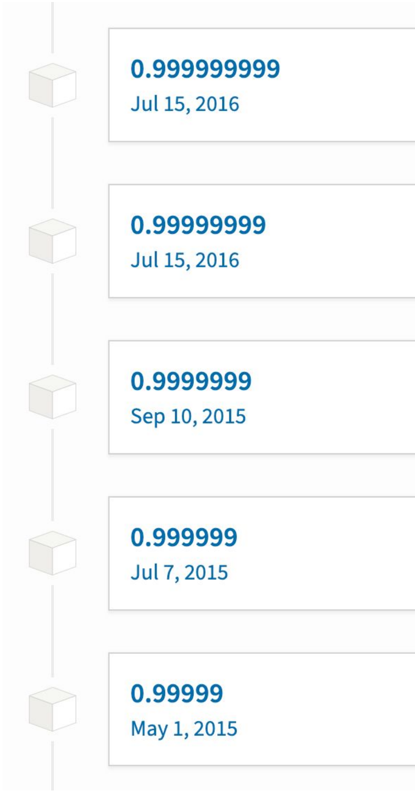
Again in an ideal world you should not monkey patch, but if you must then properly store and document.

9 Circles of Dependency Hell //

Breaking changes on a minor or patch version.

Patches
Non Semantic Versioning

https://pypi.org/project/html5lib/#history


0.999999999
Jul 15, 2016

0.99999999
Jul 15, 2016

0.9999999
Sep 10, 2015

0.999999
Jul 7, 2015

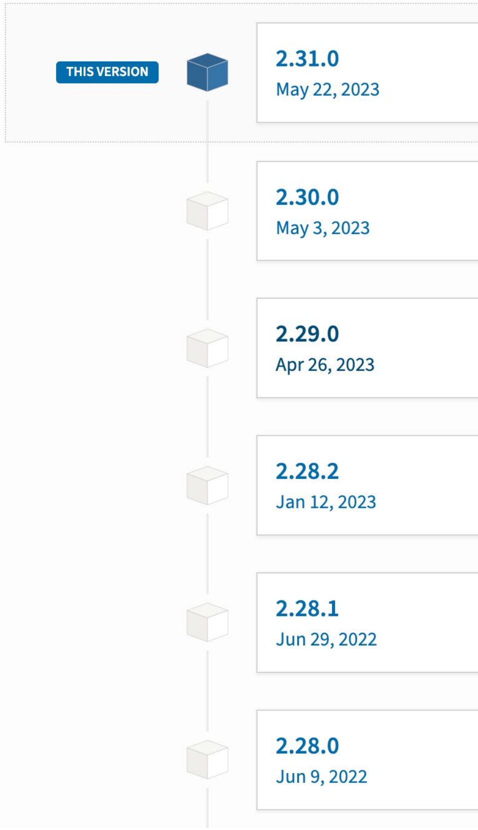
0.99999
May 1, 2015

9 Circles of Dependency Hell //

Breaking changes on a minor or patch version.

Keep the semantic versioning and follow the started ruleset to define a version - MAJOR.MINOR.PATCH

https://pypi.org/project/requests/#history



2.31.0	May 22, 2023
2.30.0	May 3, 2023
2.29.0	Apr 26, 2023
2.28.2	Jan 12, 2023
2.28.1	Jun 29, 2022
2.28.0	Jun 9, 2022

9 Circles of Dependency Hell //

Circular Dependencies.

A → B → A
Unintended consequences.

https://medium.com/@louismrc/fix-your-circular-dependencies-with-dependency-inversion-e22b6f4c9510
https://discuss.python.org/t/handling-installation-of-circular-dependencies/25531/8
https://spin.atomicobject.com/2018/06/25/circular-dependencies-javascript/

9 Circles of Dependency Hell //

Circular Dependencies.

Identify & Avoid using circular dependencies.
Use different design pattern while working on the project.

https://www.npmjs.com/package/madge

9 Circles of Dependency Hell //

The diamond dependency problem.

Different version of same package

https://docs.copado.com/articles/#!copado-methodology-temp/the-diamond-dependency-problem
https://well-typed.com/blog/2008/08/solving-the-diamond-dependency-problem/

9 Circles of Dependency Hell //

The diamond dependency problem.

Performs the deduplication of the dependency.

https://docs.copado.com/articles/#!copado-methodology-temp/the-diamond-dependency-problem
https://well-typed.com/blog/2008/08/solving-the-diamond-dependency-problem/

Security ❤️ Product

- Compliment each other.
- Reduce load from product teams by validating the issues.
- Understand the technical impact by reachability analysis and then propose the solution.

Closing Pointers

- Minimize dependencies.
- Standardize the package manager.
- Follow semantic versioning.
- Vet the dependency properly.
    - Check for the associated security issues.
    - Backward compatibility and lock file.
    - You Ain’t Gonna Need It (YAGNI) Principle
    - Licensing & Legal Considerations
    - Duplicated functionality
    - Popularity
- Check for the unused or too complex dependencies.

Thank you!

Embrace the chaos!

Kumar Ashwin

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