DevCon

Protect yourself against supply chain attacks

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https://devopsjournal.io

https://myoctocat.com

Security issues are ubiquitous

CNN BUSINESS Markets Tech Media Calculators Videos

Massive SolarWinds hack has big businesses on high alert

By Rishi Iyengar, CNN Business
Published 10:14 AM EST, Sat Decemb

FEDERAL TRADE COMMISSION
PROTECTING AMERICA'S CONSUMERS

Men

FTC warns companies to remediate Log4j security vulnerability

Log4j is a ubiquitous piece of software used to record activities in a wide range of systems found in consumer-facing products and services. Recently, a serious vulnerability in the popular Java logging package, Log4j (CVE-2021-44228) was disclosed, posing a severe risk to millions of consumer products to enterprise software and web applications. This vulnerability is being widely exploited by a growing set of attackers.

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Microsoft AI researchers accidentally exposed terabytes of internal sensitive data

Carly Page

@carlypage_ / 3:05 PM GMT+2 • September 18, 2023

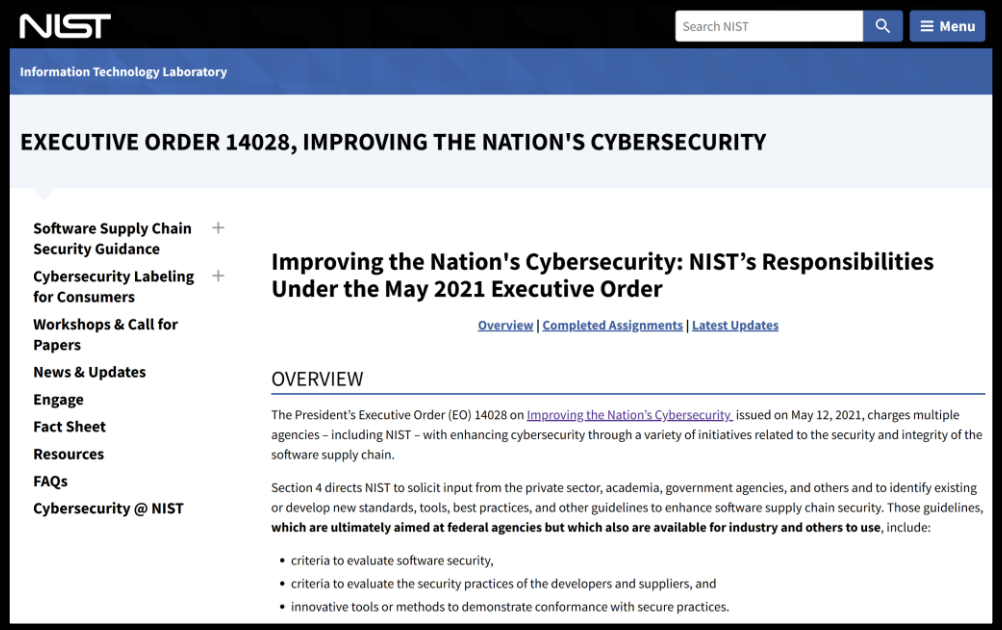
Comment

Image Credits: Getty Images

Microsoft AI researchers accidentally exposed tens of terabytes of sensitive data, including private keys and passwords, while publishing a storage bucket of open source training data on GitHub.

Governmental Regulations

USA, 2021



EU, 2024 to member states, 24 months

Governmental Regulations

EU 2024: NIS2

Research / Advanced search / The NIS2 Directive: A high common level of cybersecurity in the EU

The NIS2 Directive: A high common level of cybersecurity in the EU

Briefing – 08-02-2023

The Network and Information Security (NIS) Directive is the first piece of EU-wide legislation on cybersecurity, and its specific aim was to achieve a high common level of cybersecurity across the Member States. While it increased the Member States' cybersecurity capabilities, its implementation proved difficult, resulting in fragmentation at different levels across the internal market. To respond to the growing threats posed with digitalisation and the surge in cyber-attacks, the Commission has submitted a proposal to replace the NIS Directive and thereby strengthen the security requirements, address the security of supply chains, streamline reporting obligations, and introduce more stringent supervisory measures and stricter enforcement requirements, including harmonised sanctions across the EU. The proposed expansion of the scope covered by NIS2, by effectively obliging more entities and sectors to take measures, would assist in increasing the level of cybersecurity in Europe in the longer term. Within the European Parliament, the file was assigned to the Committee on Industry, Research and Energy. The committee adopted its report on 28 October 2021, while the Council agreed its position on 3 December 2021. The co-legislators reached a provisional agreement on the text on 13 May 2022. The political agreement was formally adopted by the Parliament and then the Council in November 2022. It entered into force on 16 January 2023, and Member States now have 21 months, until 17 October 2024, to transpose its measures into national law. Fourth edition. The 'EU Legislation in Progress' briefings are updated at key stages throughout the legislative procedure.

EU, 2023 to member states, 24 months

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Home › Digital Operational Resilience Act (DORA)

Digital Operational Resilience Act (DORA)

The Digital Operational Resilience Act (DORA) is a EU regulation that entered into force on 16 January 2023 and will apply as of 17 January 2025.

It aims at strengthening the IT security of financial entities such as banks, insurance companies and investment firms and making sure that the financial sector in Europe is able to stay resilient in the event of a severe operational disruption.

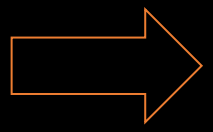
DORA brings harmonisation of the rules relating to operational resilience for the financial sector applying to 20 different types of financial entities and ICT third-party service providers.

Topics

- Why:
  - Attack examples
- Protection / Maturity: frameworks
  - OWASP Software Component Verification Standard (SCVS)
  - Supply chain Levels for Software Artifacts (SLSA)

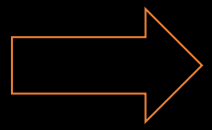
Supply Chain – Dependencies

- Libraries used by your application:
  - Authentication
  - Encryption
  - Database connections

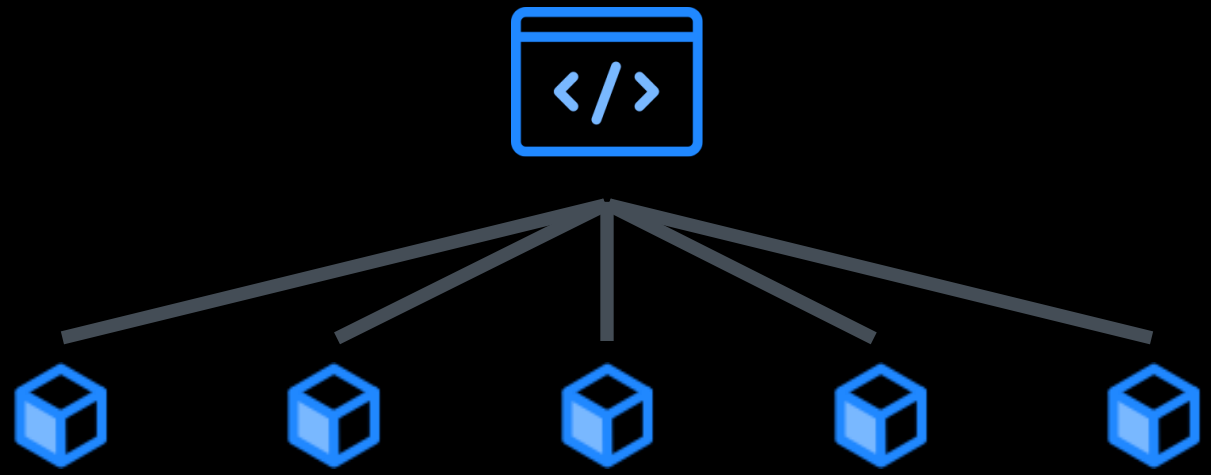


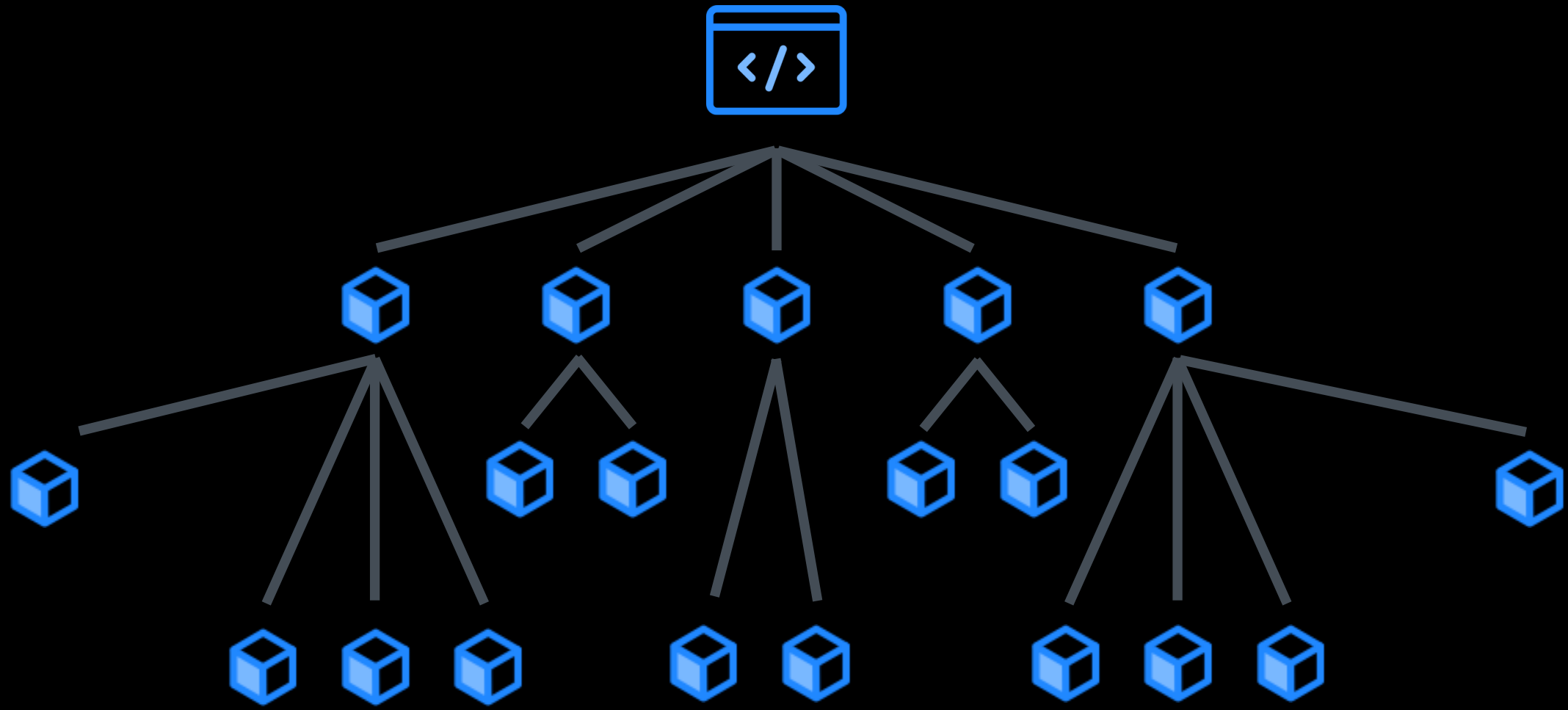
Package managers

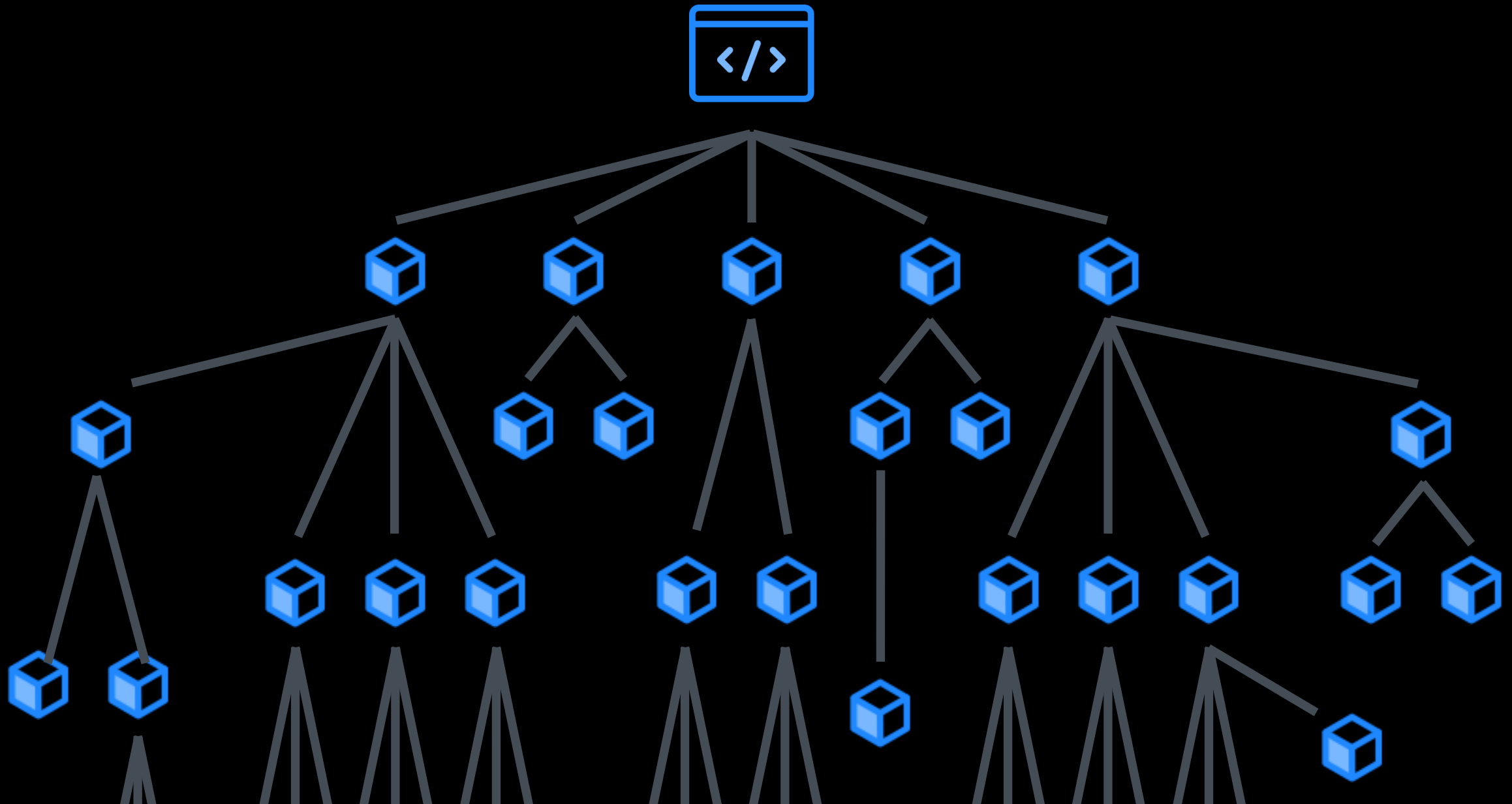
- Tooling used for building your application:
  - npm ci
  - dotnet build
  - pipelines

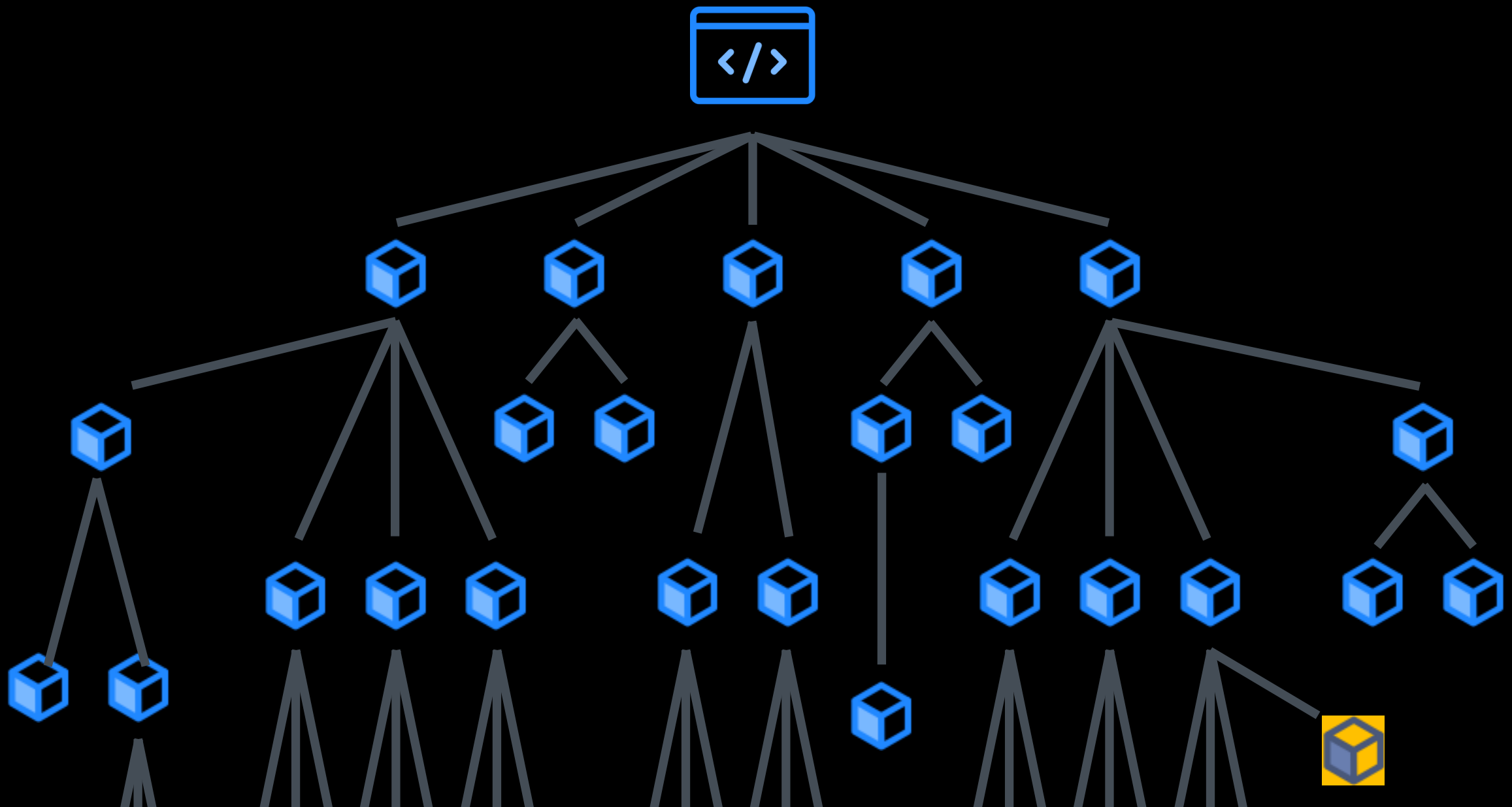


Build tools









Supply chain depth

- npm cli: https://github.com/npm/cli/network/dependencies

~**80-90%** of all code in distributed applications is Open Source

4 years

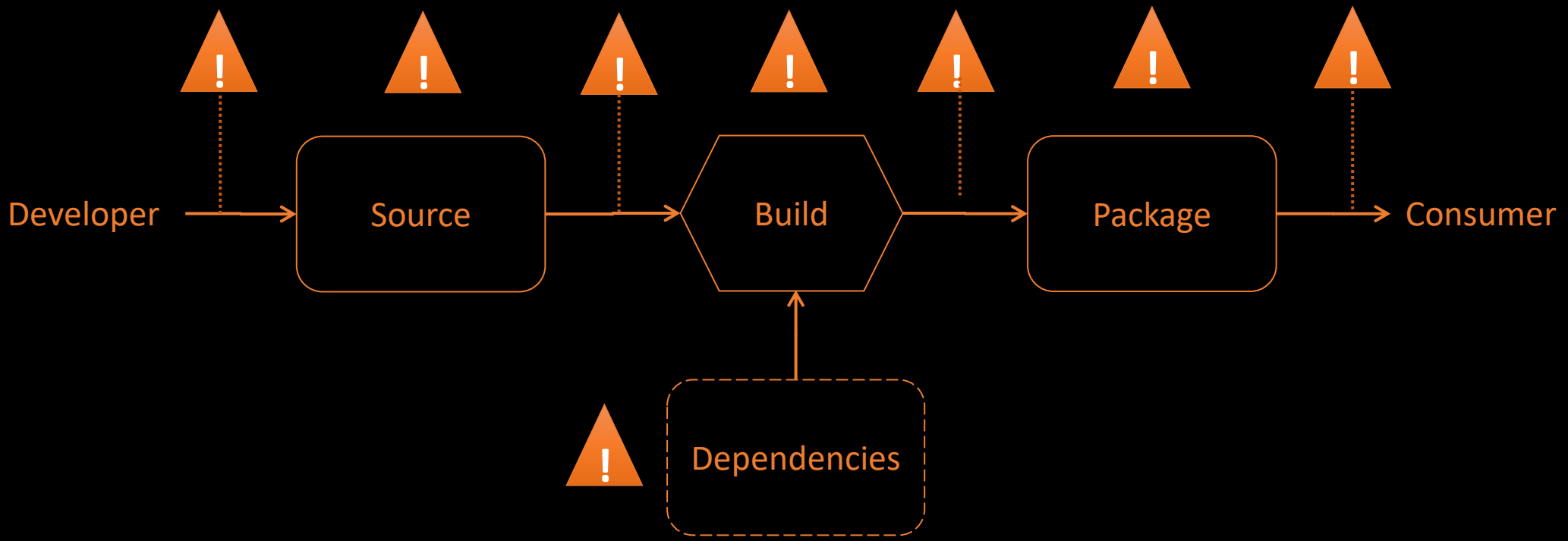
On average, vulnerabilities go undetected for four years before being identified.

Sometimes, even longer than that: Log4j was vulnerable for ~7 years

180+ days

Mean time to remediate (MTTR)
Industry norm

Attack entries



Solorigate / SolarWinds – Orion

SolarWinds produces Network monitoring software

Supply Chain Confusion

- Typo squatting
- Namespace shadowing
- Configuration files

- Pipeline attacks
- Pipeline artifact attacks

Typo squatting 101

`npm install crossenv`  Steals all your environment variables

`npm install cross-env`  Normal package

Add Namespaces

```
npm install @babel/helper-regex
```

More specific, less change of squatting

Not all publishers use a namespace

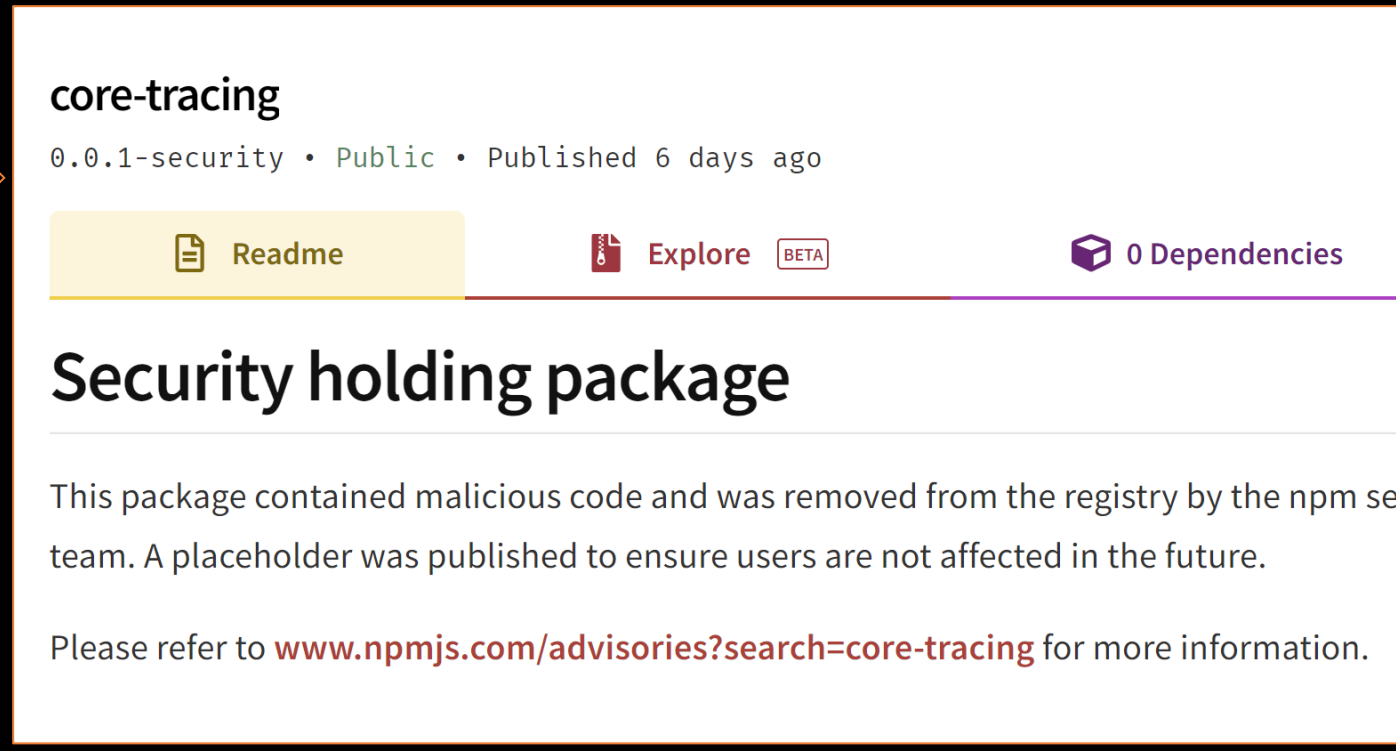
March 2022 – Namespace confusion

```
npm install @azure/core-tracing

vs

npm install core-tracing
```

→ 218 packages squatted

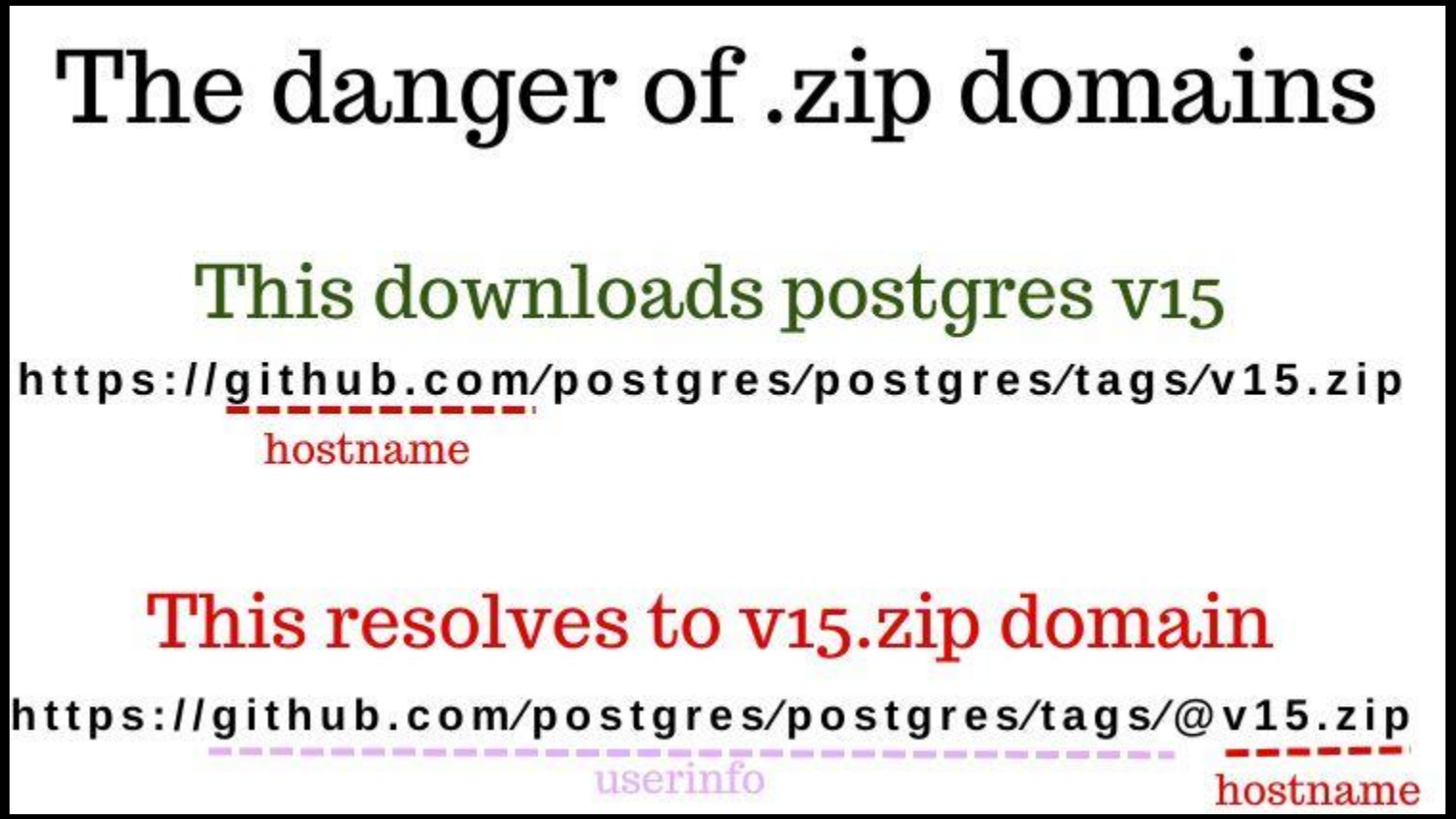
Timelines

- Attacks spread fast, lots of targets
- @azure namespace attack: 50 downloads per package (x 218 packages!)
- Found within 1-2 days
- Blocked by npm after noticing
- Damage is already done by then



Typo squatting 101

And this is only getting worse!



Protect yourself

- Software Composition Analysis (SCA) is the starting point
- Use SAST or DAST (shift left or you are to late!)

- Package manager scanners:
  - WhiteSource
  - BlackDuck
  - JFrog Artifactory + Xray
  - Snyk.io
  - GitHub Dependabot + Vulnerability alerts

Checks package + version against CVE databases

AFTER THE FACT

Protect yourself

`npm audit`

- Gets a list of the dependencies and posts that to:
  https://registry.npmjs.org/-/npm/v1/security/advisories/bulk

- Might send out private data!
- Any packages without a version field will be ignored!

AFTER THE FACT

npm audit – results

```
node_modules/url-parse

ws  5.0.0 - 5.2.2 || 6.0.0 - 6.2.1
Severity: moderate
ReDoS in Sec-Websocket-Protocol header - https://github.com/advisories/GHSA-6fc8-4gx4-v693
ReDoS in Sec-Websocket-Protocol header - https://github.com/advisories/GHSA-6fc8-4gx4-v693
fix available via `npm audit fix`
node_modules/jest-environment-jsdom-fourteen/node_modules/ws
node_modules/webpack-dev-server/node_modules/ws
node_modules/ws

57 vulnerabilities (25 moderate, 31 high, 1 critical)

To address issues that do not require attention, run:
  npm audit fix

To address all issues (including breaking changes), run:
  npm audit fix --force
```

AFTER THE FACT

npm install -g npq

- Wrapper from snyk.io
- Alias it to overwrite npm commands

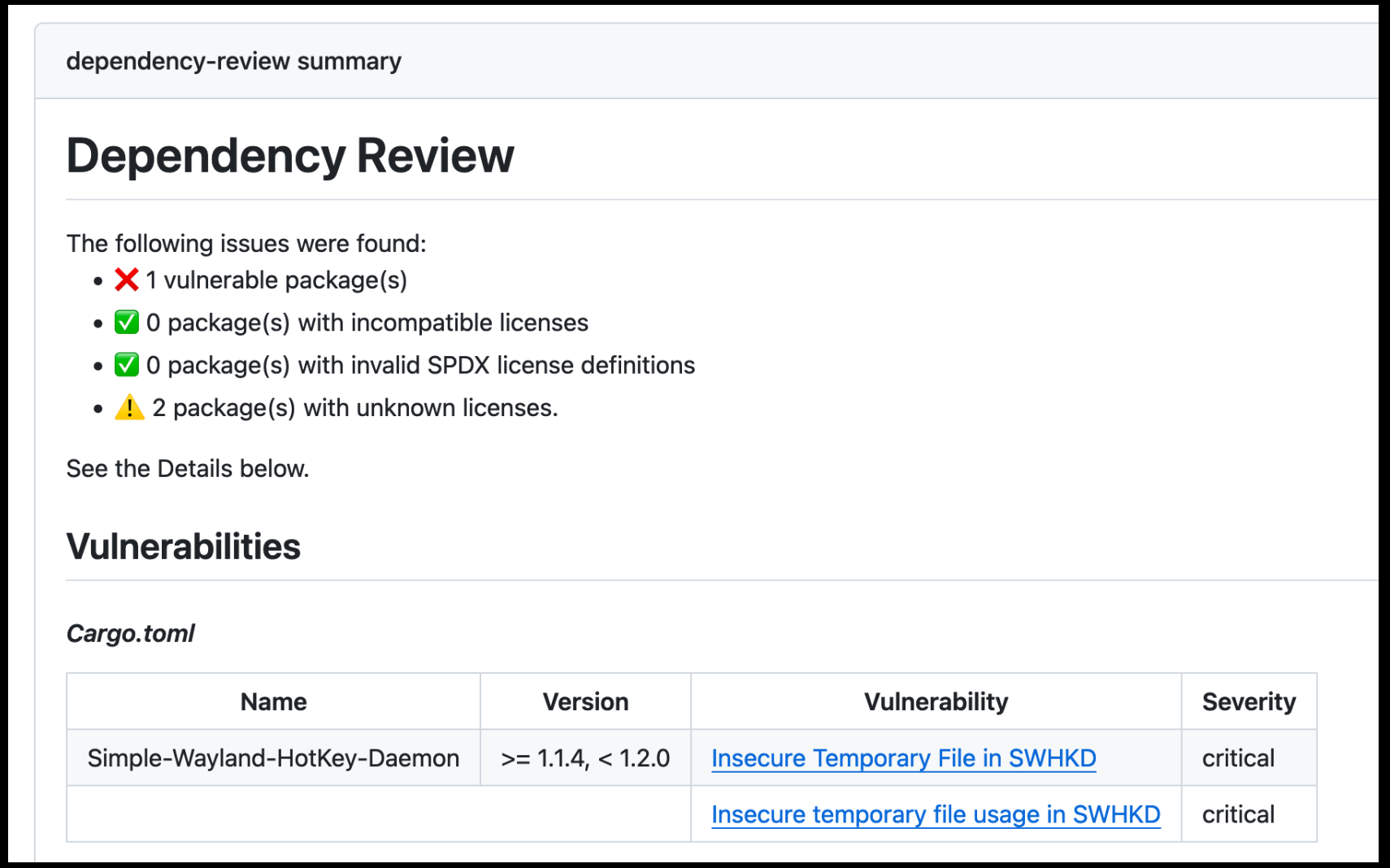
```
➜ npm install amp-html
  ✔ Checking package maturity
  ✖ Identifying package author...
  ✖ Checking package download popularity
  ✔ Checking availability of a LICENSE
  ✔ Checking availability of a README
  ✔ Identifying package repository...
  ✔ Checking package for pre/post install scripts
  ✖ Checking for known vulnerabilities
Detected possible issues with the following packages:
  [amp-html]
    - the package description has no e-mail associated with author(s). Proceed with care.
    - detected a low download-count package (downloads last month < 20)
    - 1 vulnerabilitie(s) found: https://snyk.io/vuln/npm:amp-html

? Would you like to continue installing package(s)? (y/N)
```

.npmrc – misconfiguration

```
registry=https://registry.npmjs.org/

@myscope:registry=https://mycustomregistry.example.org
```

All your private packages will now get pulled from npmjs.org!

dependency-review-action



dependency-review summary

Dependency Review

The following issues were found:

- ❌ 1 vulnerable package(s)
- ✅ 0 package(s) with incompatible licenses
- ✅ 0 package(s) with invalid SPDX license definitions
- ⚠️ 2 package(s) with unknown licenses.

See the Details below.

Vulnerabilities

Cargo.toml

Name	Version	Vulnerability	Severity
Simple-Wayland-HotKey-Daemon	>= 1.1.4, < 1.2.0	Insecure Temporary File in SWHKD	critical
		Insecure temporary file usage in SWHKD	critical

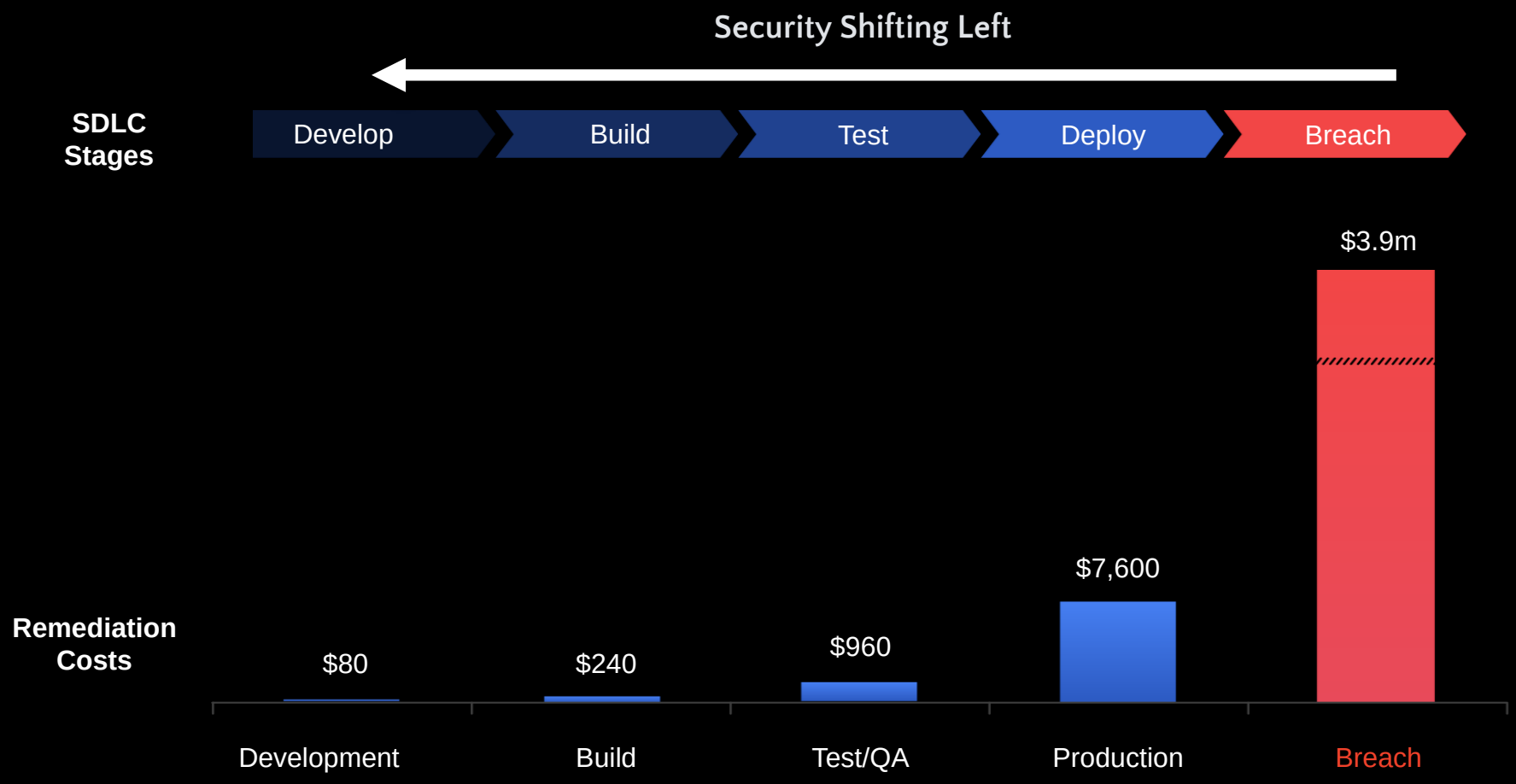
Topics

- Why:
  - Attack examples
- Protection / Maturity: frameworks
  - OWASP Software Component Verification Standard (SCVS)
  - Supply chain Levels for Software Artifacts (SLSA)

Mistakes happen

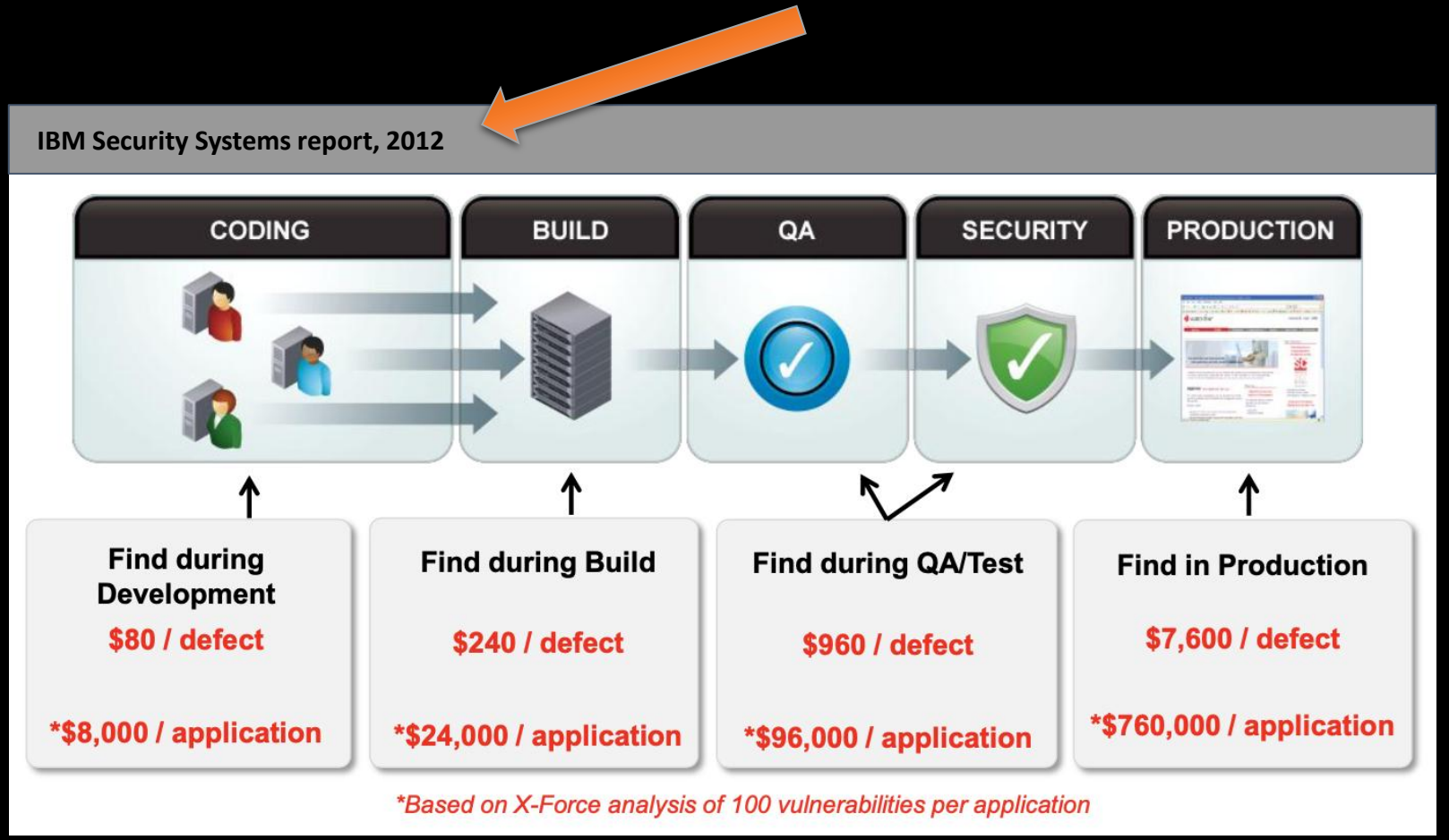
Some of those become a security risk!

Everyone wants to shift security left…



Source: Ponemon Institute Cost of a Data Breach 2020

… but the industry has been trying to shift left for at least a decade



Frameworks

OWASP

Software Component Verification Standard

v1 since 2020: https://xpir.it/SCVS

The Linux Foundation

Supply chain Levels for Software Artifacts

v1.0: April 2023: https://slsa.dev/

OWASP SCVS:
Software Component Verification Standard

- Assessment of your software components and how they came to be

Packages/Source

Pipelines

OWASP SCVS

	L1	L2	L3	L4
V1 – Inventory				
V2 – Software Bill of Materials (SBOM)				
V3 – Build Environment				
V4 - Package Management				
V5 – Component Analysis				
V6 – Pedigree and Provenance				

OWASP SCVS – V1 Inventory

All direct and transitive components and their versions are known at completion of a build

Package managers are used to manage all third-party binary components

Software bill of materials continuously maintained and current for all systems

Software bill of materials are required for new procurements

The component type is known throughout inventory

The component function is known throughout inventory

V1 – Inventory

Software Composition Analysis

- GitHub Dependabot
- Black Duck
- Mend (form. WhiteSource) Bolt
- Snyk
- Jfrog Xray

Dependabot Example: https://github.com/devops-actions/.github

OWASP SCVS – V2 Software Bill of Materials

- SBOM creation is automated and reproducible
- SBOM has been signed by publisher, supplier, or certifying authority
- SBOM signature verification exists and is performed
- SBOM is analyzed for risk

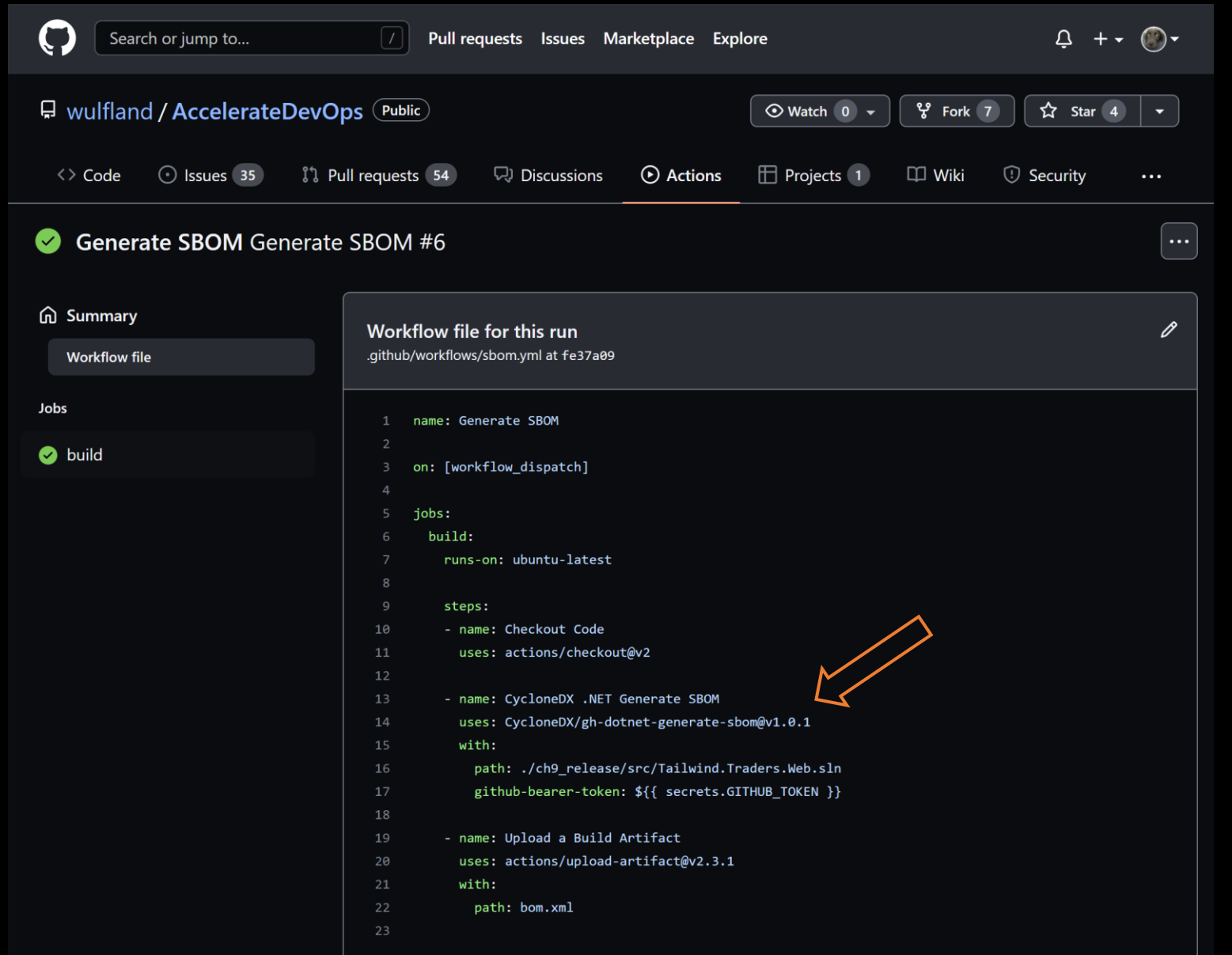
V2 Software Bill of Materials

- Multiple standards for SBOM formats:
  - SPDX (Software Package Data Exchange) – Linux Foundation
    - Focusses on license information
    - ISO Standard
  - CycloneDX – OWASP
    - Focusses on vulnerabilities and security

- Example SBOM creation with GitHub Actions & CycloneDX:

  AccelerateDevOps/sbom.yml at main · wulfland/AccelerateDevOps · GitHub

V2 Software Bill of Materials – demo



V2 Software Bill of Materials – demo

bom.xml

C: > Users > RobBos > AppData > Local > Temp > Temp1_artifact.zip > bom.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<bom xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" serialNumber=
  <metadata>
    <tools>
      <tool>
        <vendor>CycloneDX</vendor>
        <name>CycloneDX module for .NET</name>
        <version>2.3.0.0</version>
      </tool>
    </tools>
    <component type="application" bom-ref="Tailwind.Traders.Web@0.0.0">
      <name>Tailwind.Traders.Web</name>
      <version>0.0.0</version>
    </component>
  </metadata>
  <components>
    <component type="library" bom-ref="pkg:nuget/Azure.Core@1.8.1">
      <publisher>Microsoft</publisher>
      <name>Azure.Core</name>
      <version>1.8.1</version>
      <description>This is the implementation of the Azure Client Pipeline</description>
      <scope>required</scope>
      <hashes>
        <hash alg="SHA-512">87135CD530138F27E7C52BA23FB91CE37DE7AE0A016E08D4A5ABF33BD80B0D168996E3A437378B8BDC16667E2
      </hashes>
      <licenses>
        <license>
          <id>MIT</id>
        </license>
      </licenses>
      <copyright>© Microsoft Corporation. All rights reserved.</copyright>
      <purl>pkg:nuget/Azure.Core@1.8.1</purl>
      <externalReferences>
        <reference type="website">
          <url>https://github.com/Azure/azure-sdk-for-net/blob/Azure.Core_1.8.1/sdk/core/Azure.Core/README.md</url>
        </reference>
```

OWASP SCVS V3 – Build Environment

- Application build pipeline may only perform builds of source code maintained in version control systems
- Application build pipeline prohibits alteration of DNS and network settings during build
- Application build pipeline prohibits alteration of certificate trust stores
- Application build pipeline enforces authentication and defaults to deny
- Application build pipeline enforces authorization and defaults to deny
- Application build pipeline requires separation of concerns for the modification of system settings
- Application build pipeline maintains a verifiable audit log of all system changes
- Application build pipeline maintains a verifiable audit log of all build job changes
- Application build pipeline has required maintenance cadence where the entire stack is updated, patched, and re-certified for use
- Compilers, version control clients, development utilities, and software development kits are analyzed and monitored for tampering, trojans, or malicious code
- All build-time manipulations to source or binaries are known and well defined
- Checksums of all first-party and third-party components are documented for every build
- Checksums of all components are accessible and delivered out-of-band whenever those components are packaged or distributed
- Unused direct and transitive components have been identified
- Unused direct and transitive components have been removed from the application

OWASP SCVS V3 – Build Environment

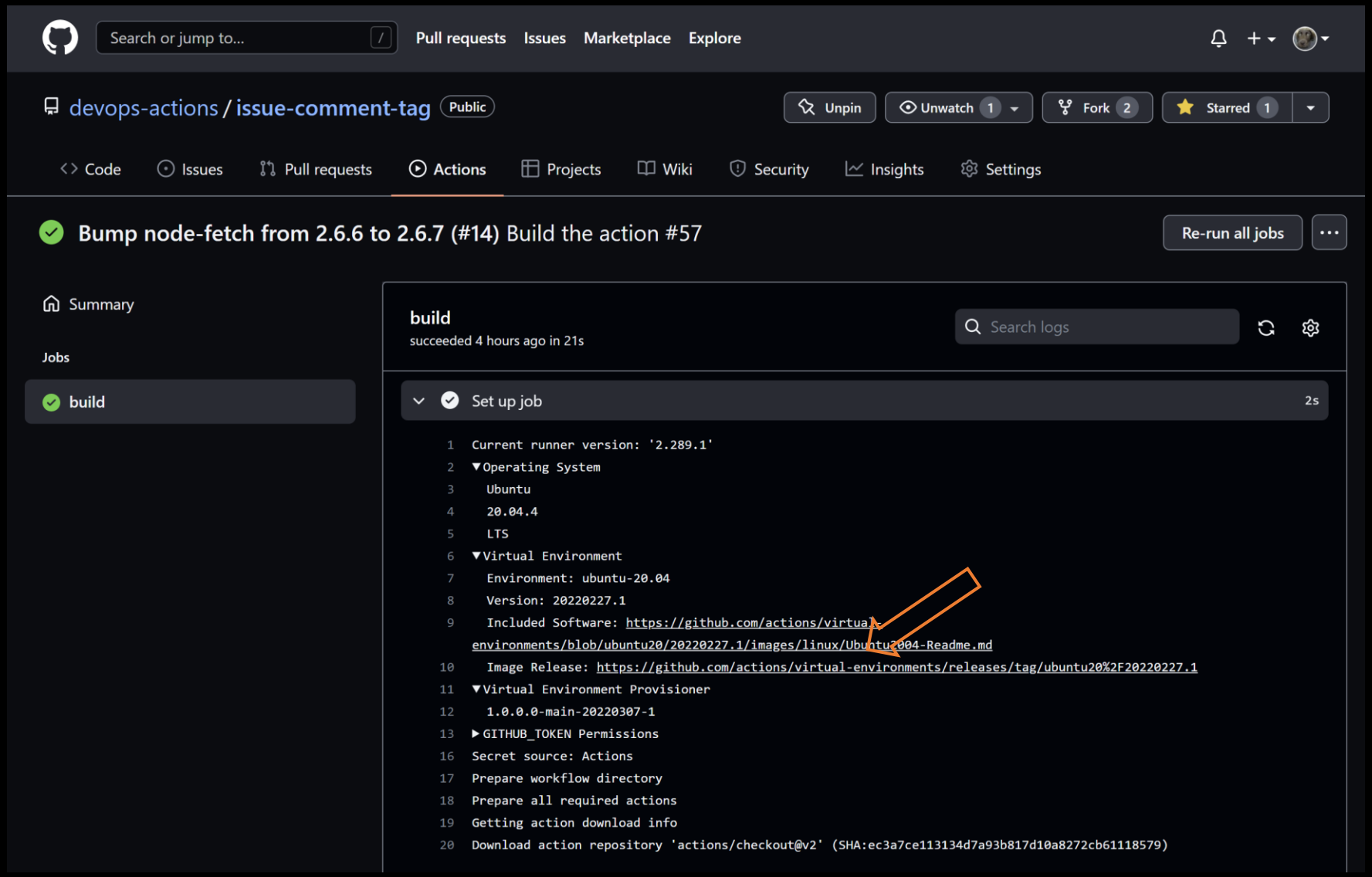
- Application build pipeline maintains a verifiable audit log of:
  - build job changes
  - system changes
- The entire build stack is updated, patched, and re-certified for use
- Everything is analyzed and monitored for tampering, trojans, or malicious code
  - Compilers
  - Version control clients
  - Development utilities
  - Software development kits

V3 – Build Environment

- Application build pipeline maintains a verifiable audit log of:
  - build job changes
  - system changes

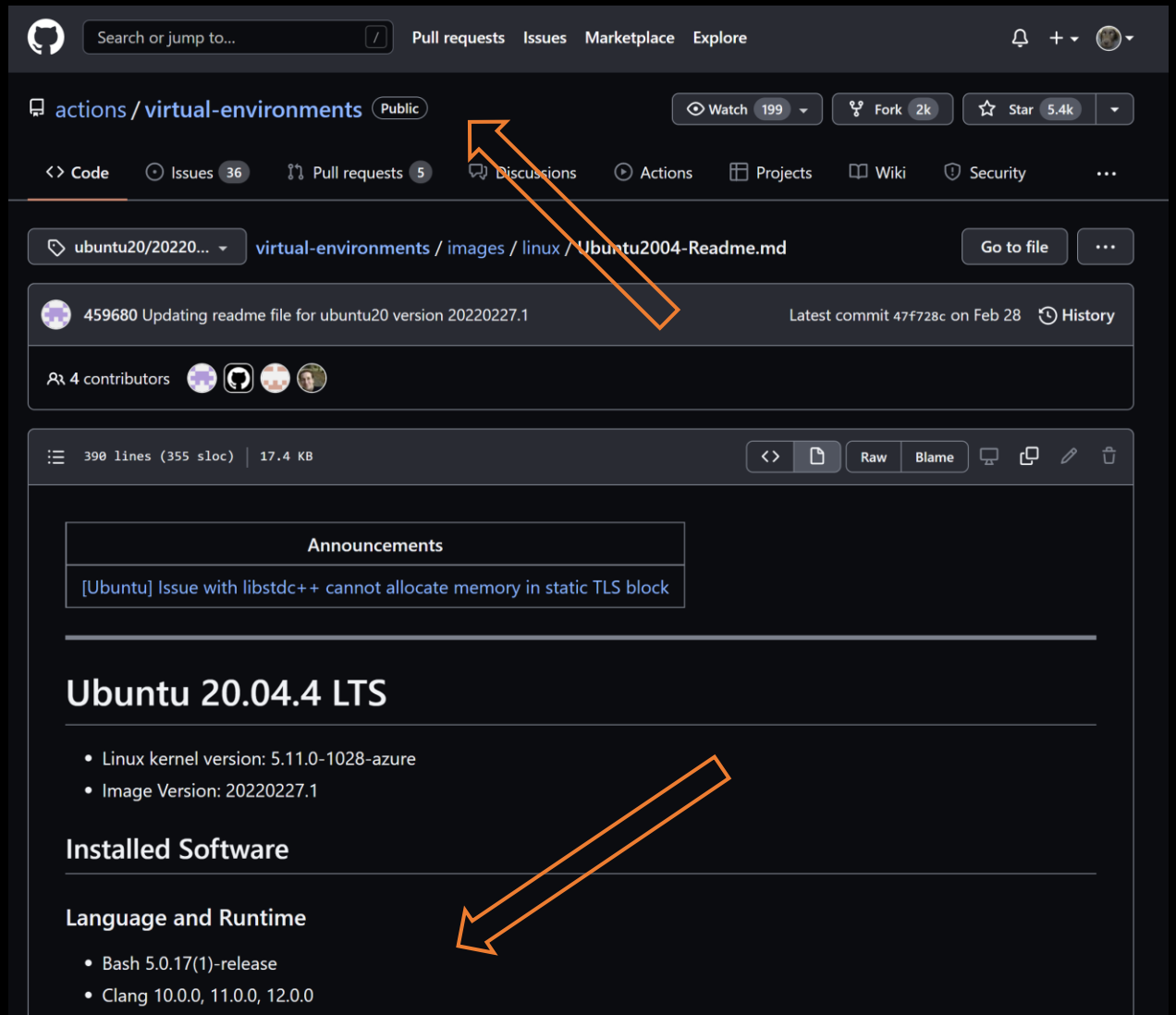
- Example in GitHub Actions: end-to-end traceability:
  - Workflow changes in commits
  - Execution environment in the logs
    - https://github.com/devops-actions/issue-comment-tag/blob/main/.github/workflows/testing.yml

V3 – Build Environment – demo



V3 – Build Environment – demo

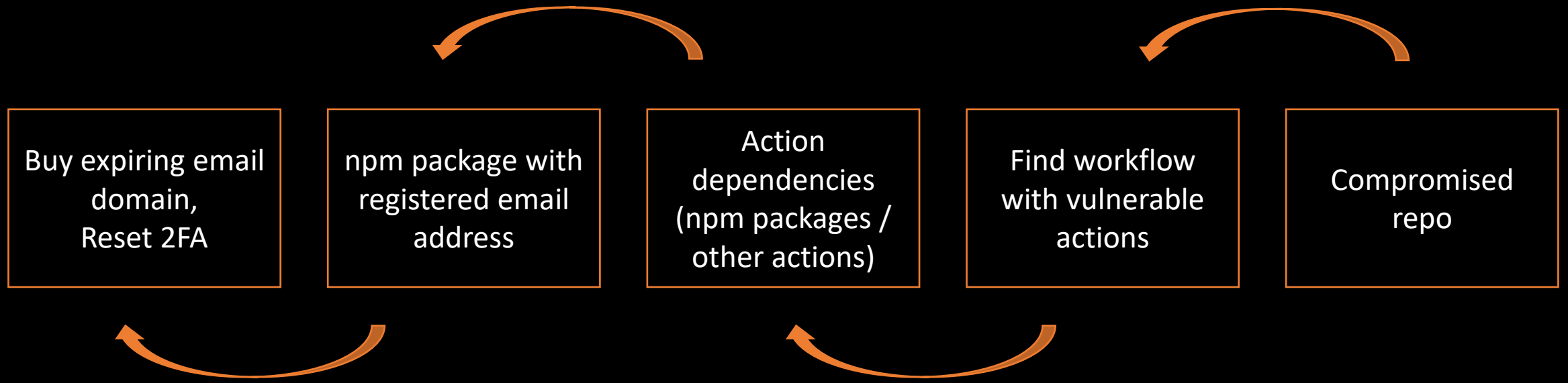
https://github.com/actions/virtual-environments/blob/ubuntu20/20220227.1/images/linux/Ubuntu2004-Readme.md



What happens during build?

- GitHub Actions: runner will download the actions
- Actions do their thing(s)?
  - https://xpir.it/universe-2021
- Harden runner: link

GitHub Actions attacks



devopsjournal.io

Defcon ‘23:
https://www.paloaltonetworks.com/blog/prisma-cloud/github-actions-worm-dependencies/

OWASP SCVS V4 – Package management

- Package repository components have been published with multi-factor authentication
- Package repository notifies publishers & users of security issues
- Package repository requires code signing to publish packages to production repositories
- Package manager verifies the integrity of packages when they are retrieved:
  - From remote repository
  - From file system

OWASP SCVS V4 – Package management

- Package repository components have been published with multi-factor authentication – npm improvements with 2FA
- Package repository notifies publishers & users of security issues
  - Dependabot does this
- Package repository requires code signing to publish packages to production repositories
  - Most package managers do not have support
  - npm focusses on 2FA
  - NuGet, Maven / Gradle / Ant (uploads through Maven central), RubyGems

OWASP SCVS V5 – Component Analysis

- Component is analyzed using linters and/or static analysis tools
- Linting and/or static analysis is performed with every upgrade
- An automated process for:
  - Identifying all publicly disclosed vulnerabilities is used
  - Identifying confirmed dataflow exploitability is used
  - For identifying end-of-life / end-of-support components is used

V5 – Component Analysis

- Component is analyzed using linters and/or static analysis tools
  - Trigger workflow on push
- Linting and/or static analysis is performed with every upgrade
  - Branch protection rules

- An automated process for:
  - Identifying all publicly disclosed vulnerabilities is used: Dependabot
  - Identifying confirmed dataflow exploitability is used: SAST / DAST
  - For identifying end-of-life / end-of-support components is used: ?

OWASP SCVS V6 – Pedigree and Provenance

- Point of origin is verifiable for components
- Chain of custody is auditable for components

V6 – Pedigree and Provenance

- Point of origin is verifiable for components
  - Dependabot dependency graph
- Chain of custody is auditable for components
  - Where did the component came from:
    - Pipeline link
    - Commit history

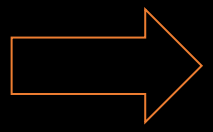
Example: https://github.com/devops-actions/issue-comment-tag/releases

V6 – Pedigree and Provenance

- Point of origin is verifiable for components
  - Cosign + sigstore = verification options for containers
- Chain of custody is auditable for components
  - SLSA is doing this for other binaries

Wrap up: Supply Chain – Dependencies

- Libraries used by your application:
  - Authentication
  - Encryption
  - Database connections



Package managers

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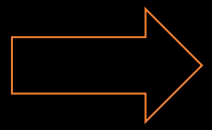

Build tools

Wrap up – topics:

- Why:
  - Attack examples

- Protection / Maturity: frameworks
  - OWASP Software Component Verification Standard (SCVS)
  - Supply chain Levels for Software Artifacts (SLSA)

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GitHub Accredited Trainer

LinkedIn Learning Instructor (GitHub subjects)

Book author: “GitHub Actions in Action”

Blogger: https://devopsjournal.io

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Protect yourself against supply chain attacks

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DevOps Consultant – Xebia

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