NDC { Porto }

Securing your .NET application software supply-chain the practical approach! (workshop)

Niels Tanis

Who am I?

- Niels Tanis
- Sr. Principal Security Researcher
  - Background .NET Development, Pentesting/ethical hacking, and software security consultancy
  - Research on static analysis for .NET apps
  - Enjoying Rust!
- Microsoft MVP – Developer Technologies

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Agenda

- Introduction
- DocGenerator Library
- Signing artifacts
- Reproducible Builds
- Software Bill Of Materials (SBOM)
- Google SLSA
- Docker SBOM
- I got hacked!

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Agenda

- https://github.com/nielstanis/ndcporto2023-supply/
- https://github.com/nielstanis/docgenerator

What is a Supply Chain?

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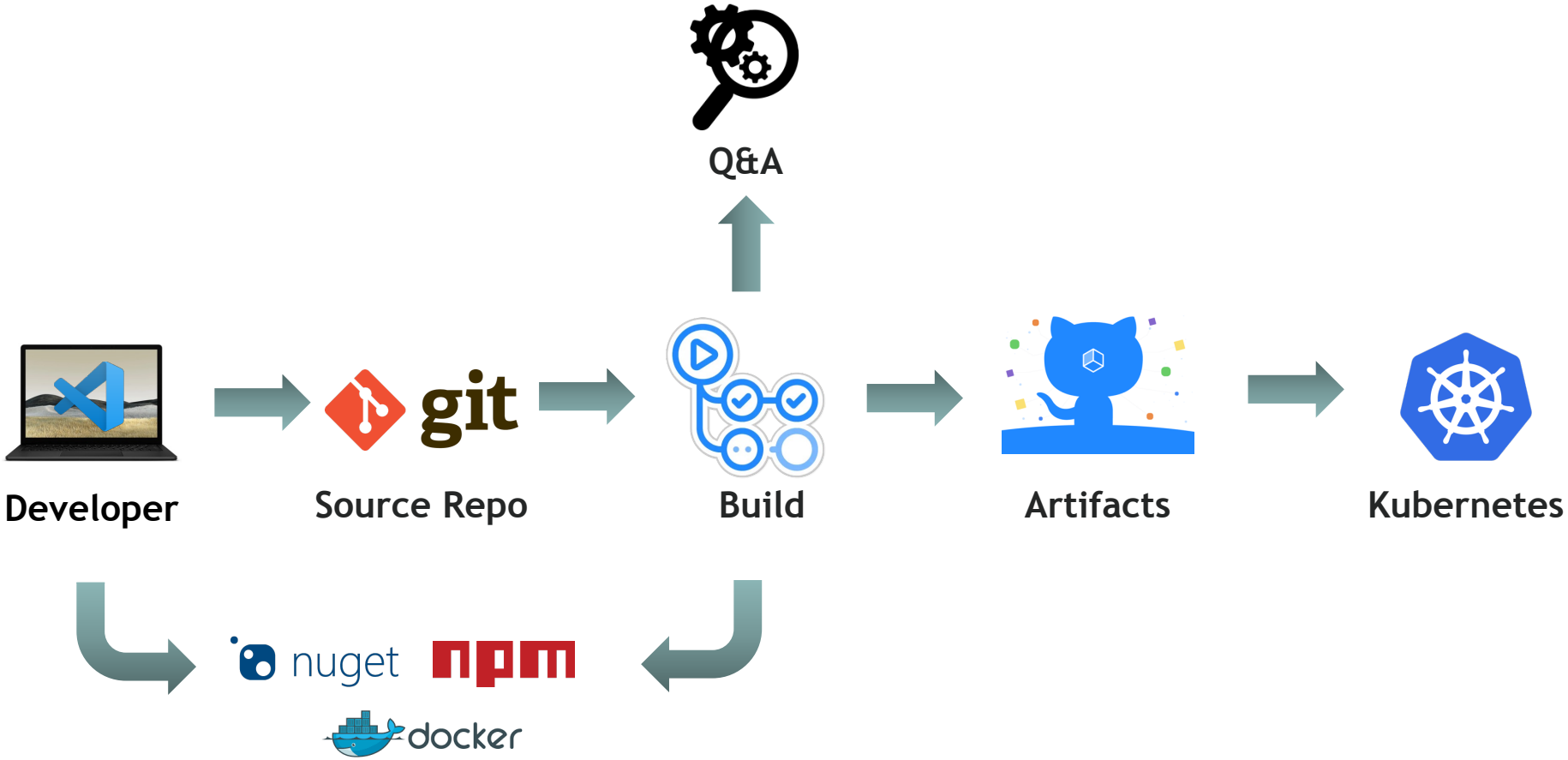
Software Supply Chain



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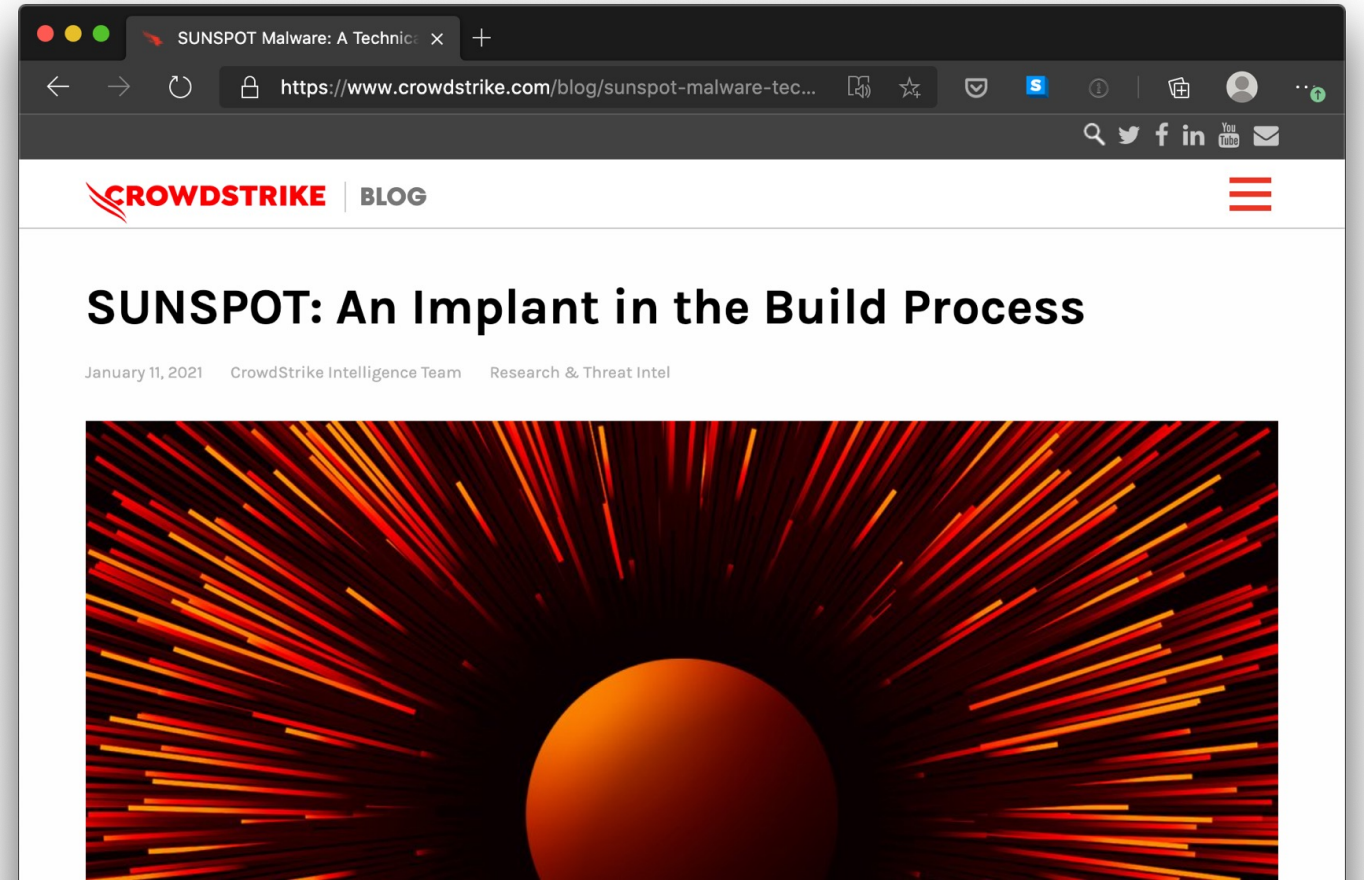
SolarWinds SunSpot



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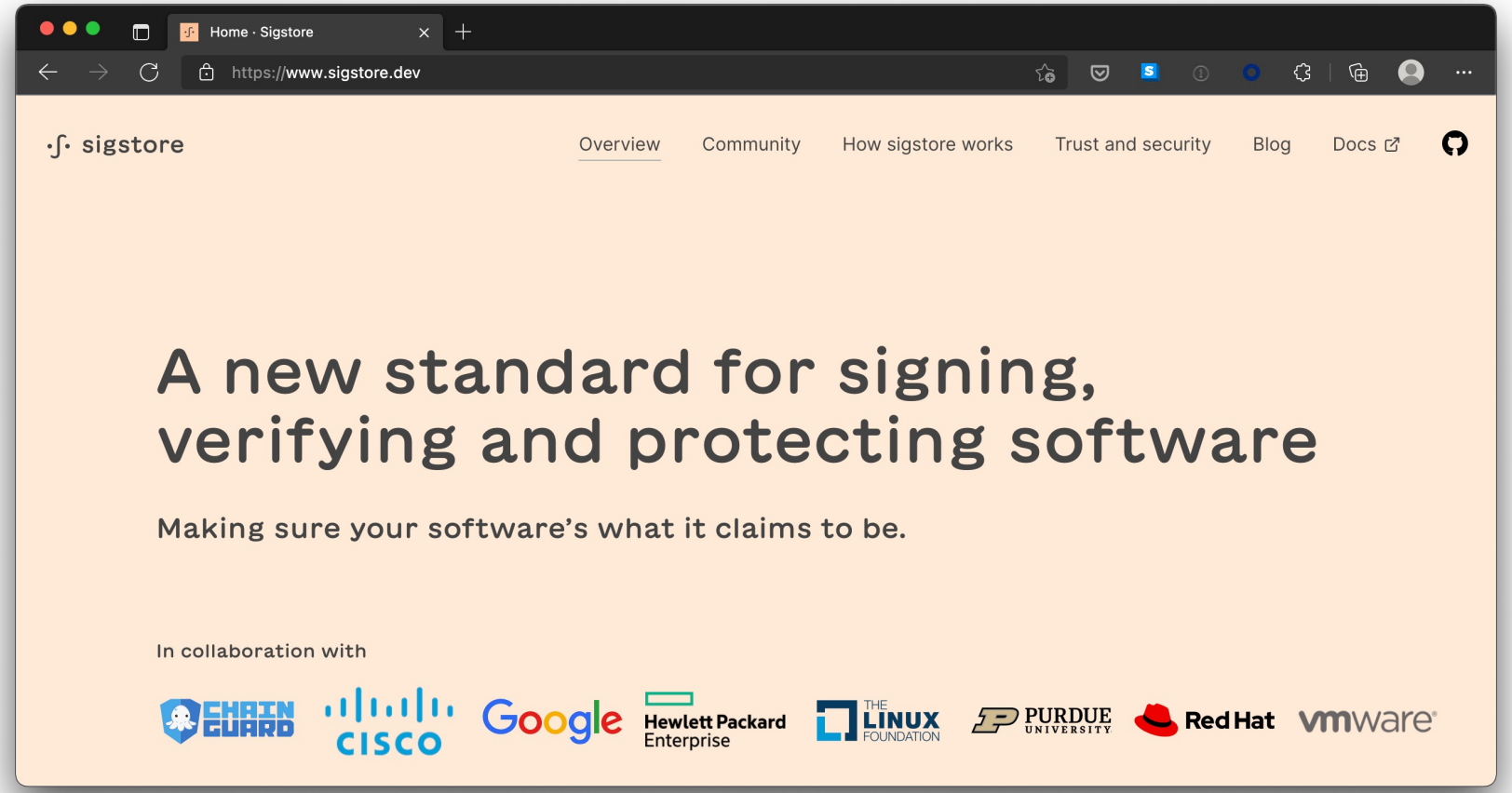
Signing artifacts



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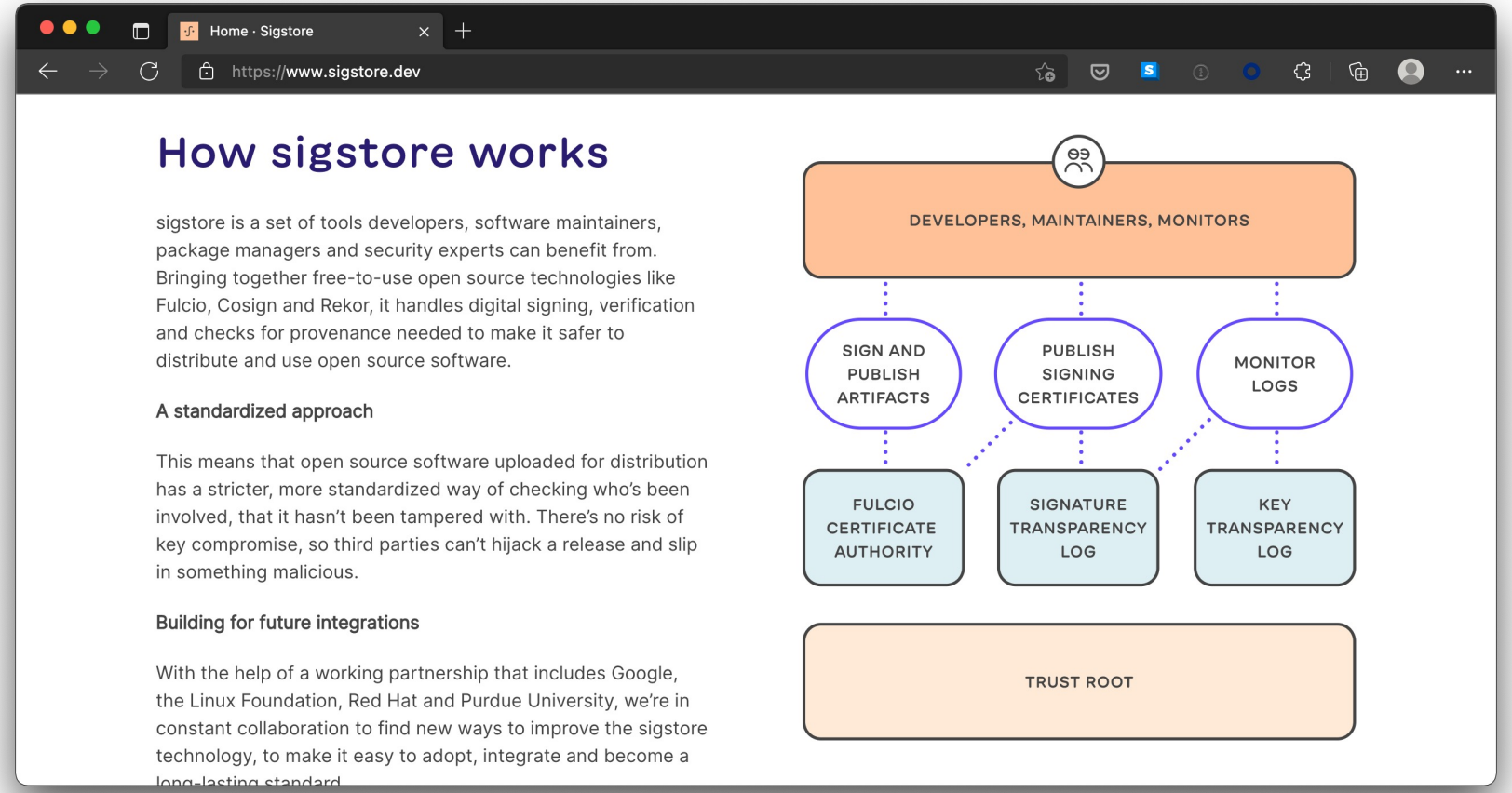
Signing artifacts



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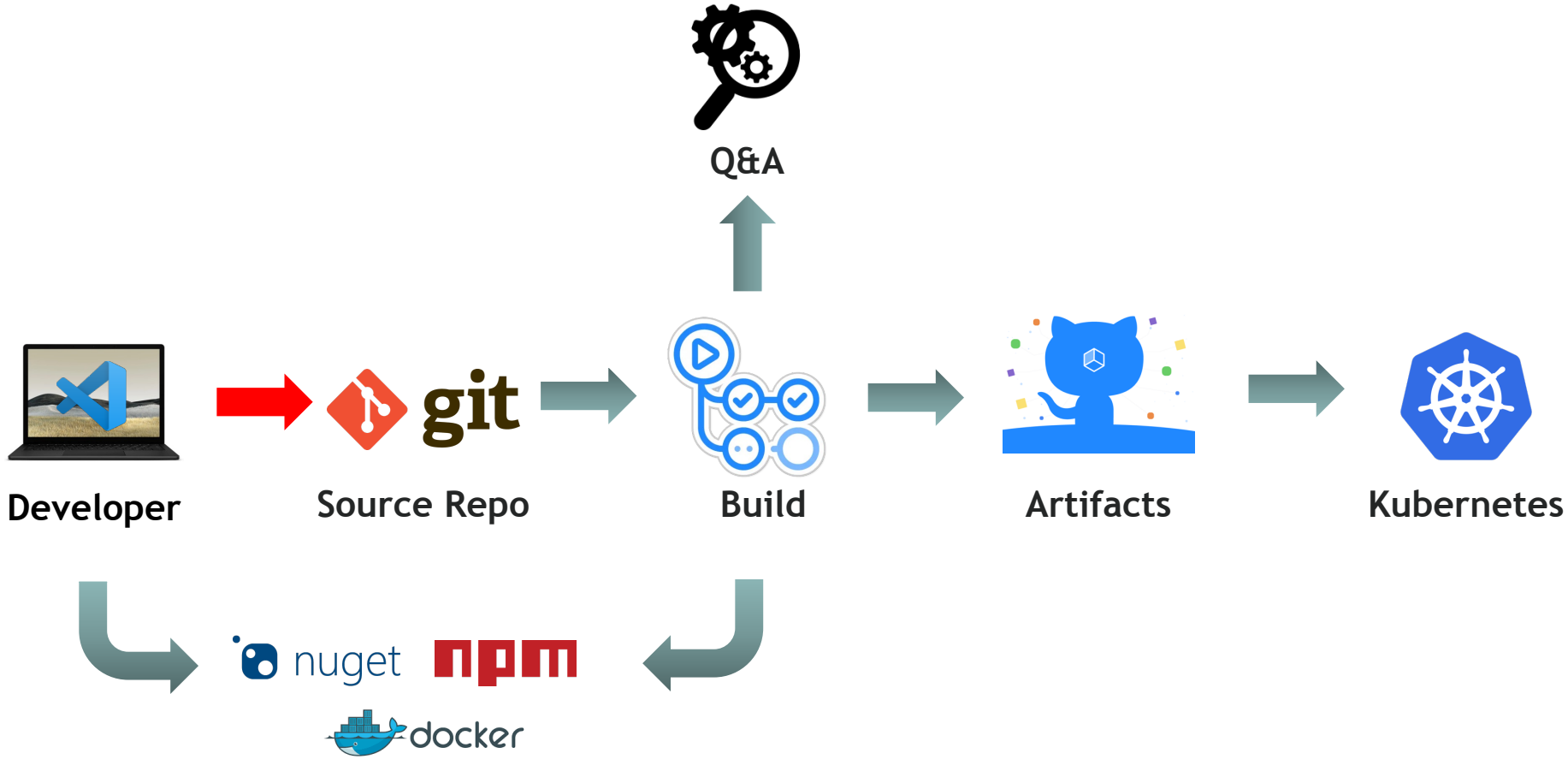
Lab 1

Signing artfifacts with Sigstore

Software Supply Chain



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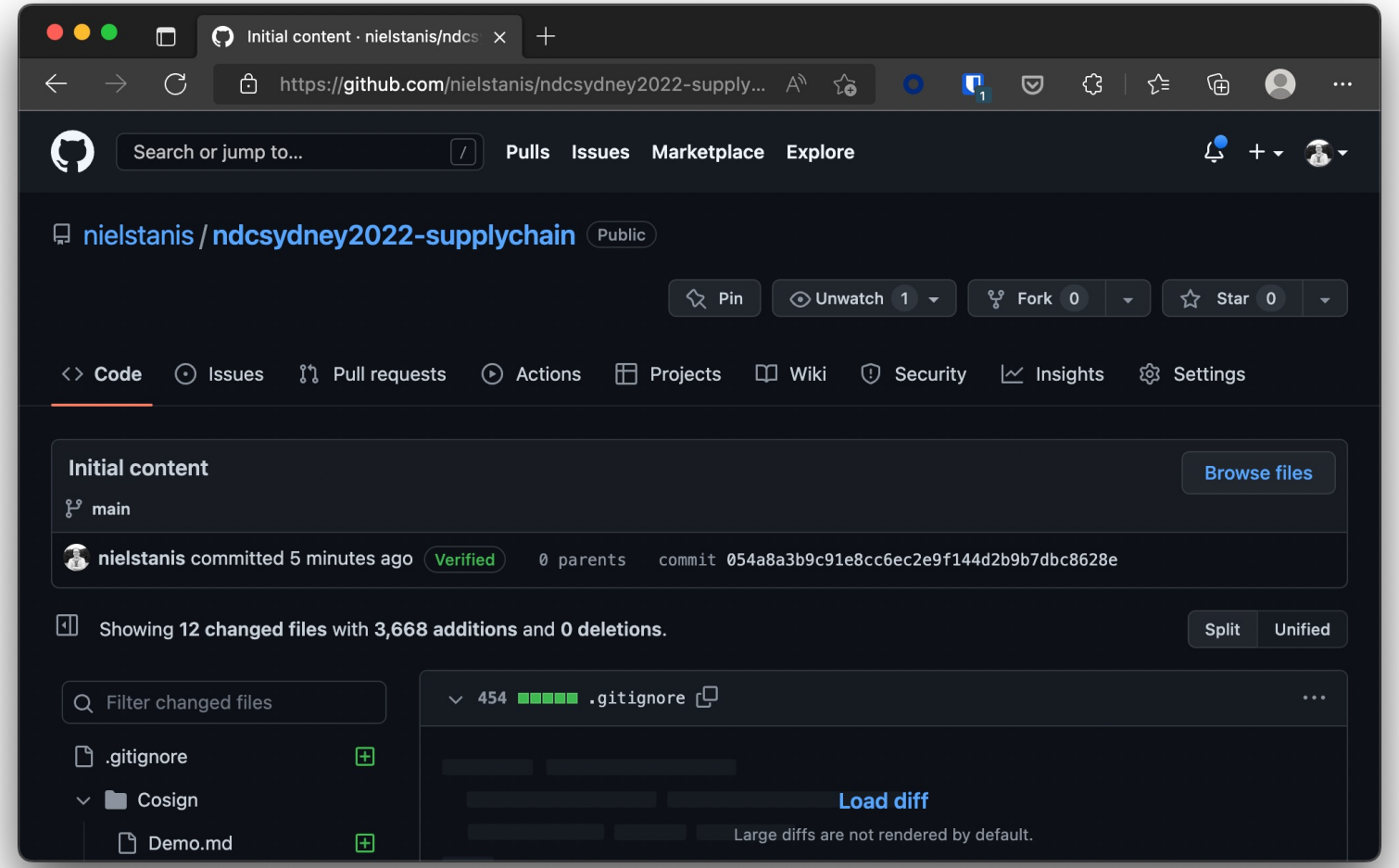
GIT Commit Signing



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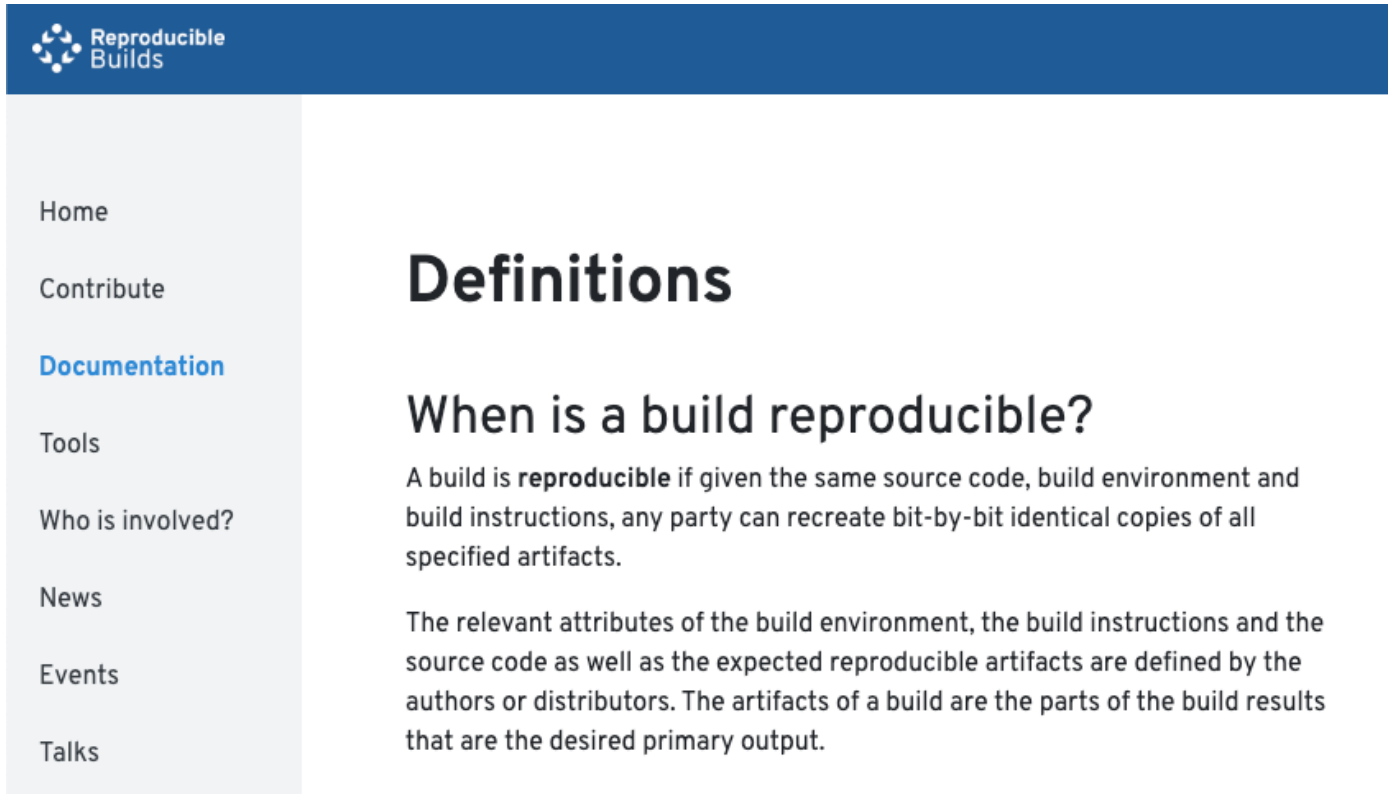
Lab 2

Setup repository, build and git signing with GitSign

Reproducible/Deterministic Builds



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Lab 3

.NET reproducibility

Reproducible/Deterministic Builds

- Roslyn v1.1 started supporting some kind of determinism on how items are emitted
- Given same inputs, the compiled output will always be deterministic
- Inputs can be found in Roslyn compiler docs ‘Deterministic Inputs’

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Reproducible/Deterministic Builds

- DotNet.ReproducibleBuilds NuGet Package
  - MSBuild *ContinuousIntegrationBuild*
  - SourceLink

- Dotnet.ReproducibleBuilds.Isolated NuGet Package
  - Hermetic builds

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Lab 4

DotNet.Reproducible

Reproducible Build Validation

- Design to validate NuGet packages & .NET binaries
  - Does linked source code match binaries?
  - Capable to compare at IL level
  - Ability to rebuild reproducible based on given inputs
  - .NET CLI Validate tool `dotnet validate`

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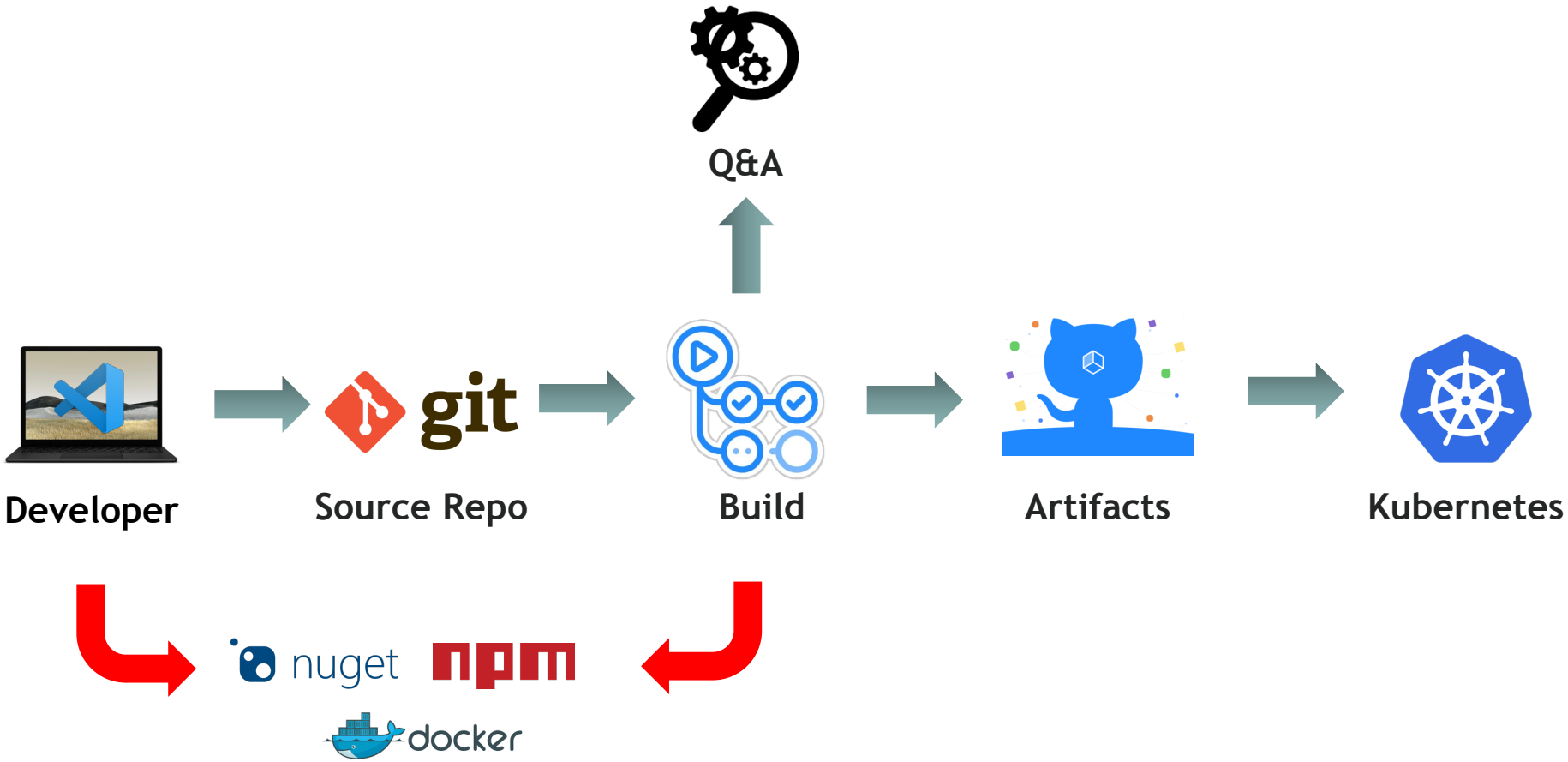
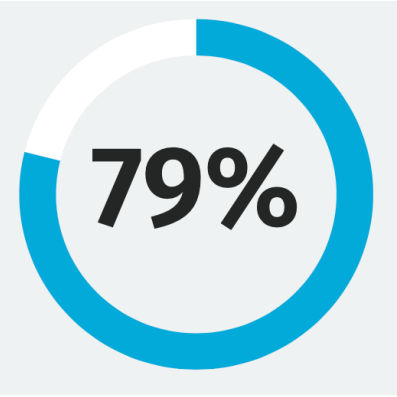
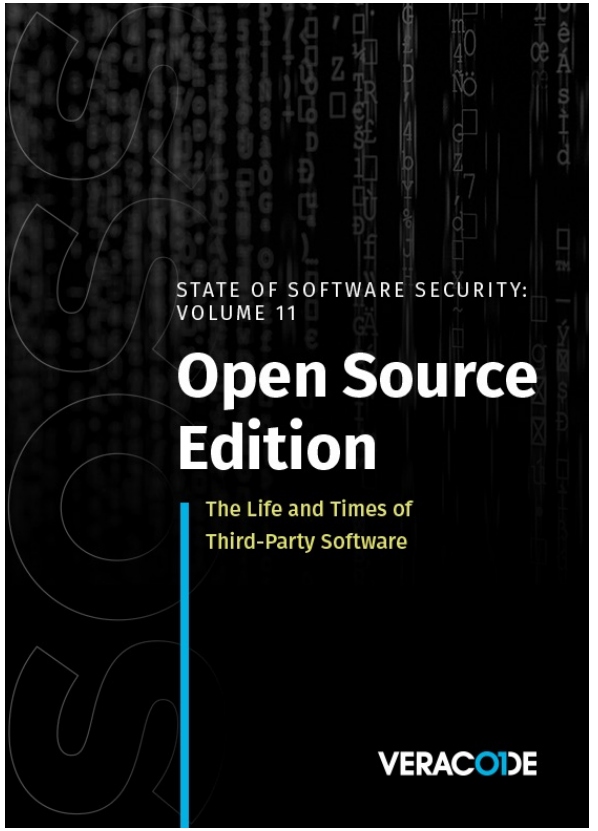
3rd Party Libraries



State Of Software Security v11 2021

”Despite this dynamic landscape, 79 percent of the time, developers never update third-party libraries after including them in a codebase.”





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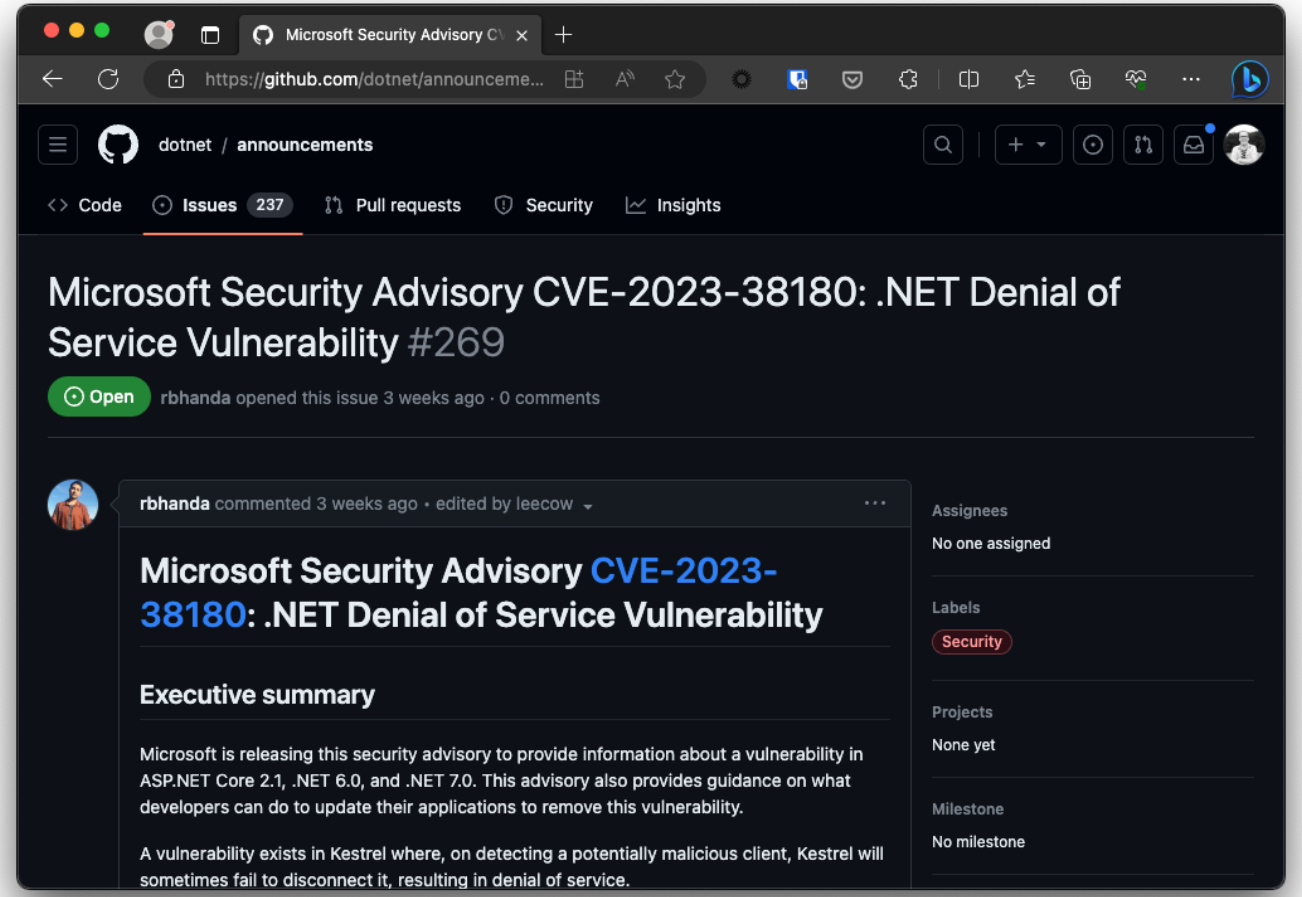
Vulnerabilities in libraries



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Automotive Industry

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Car Supply Chain

Tata Steel Factory

- Iron Ore from Sweden
- ISO 6892-1 Tested/Certified
- Batch #1234

Bosch Factory

- Steel Batch #1234 Tata
- ECE-R90 Tested/Certified
- Serie #45678
- Used by Ford, Volkswagen and Renault

Renault Manufacturing

- Bosch Disk #45678
- Bosal Exhaust #RE9876
- Goodyear Tires #GY8877
- Kadjar VIN 1234567890

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Software Bill of Materials (SBOM)

- Industry standard of describing the software
  - Producer Identity – Who Created it?
  - Product Identity – What's the product?
  - Integrity – Is the project unaltered?
  - Licensing – How can the project be used?
  - Creation – How was the product created? Process meets requirements?
  - Materials - How was the product created? Materials/Source used?

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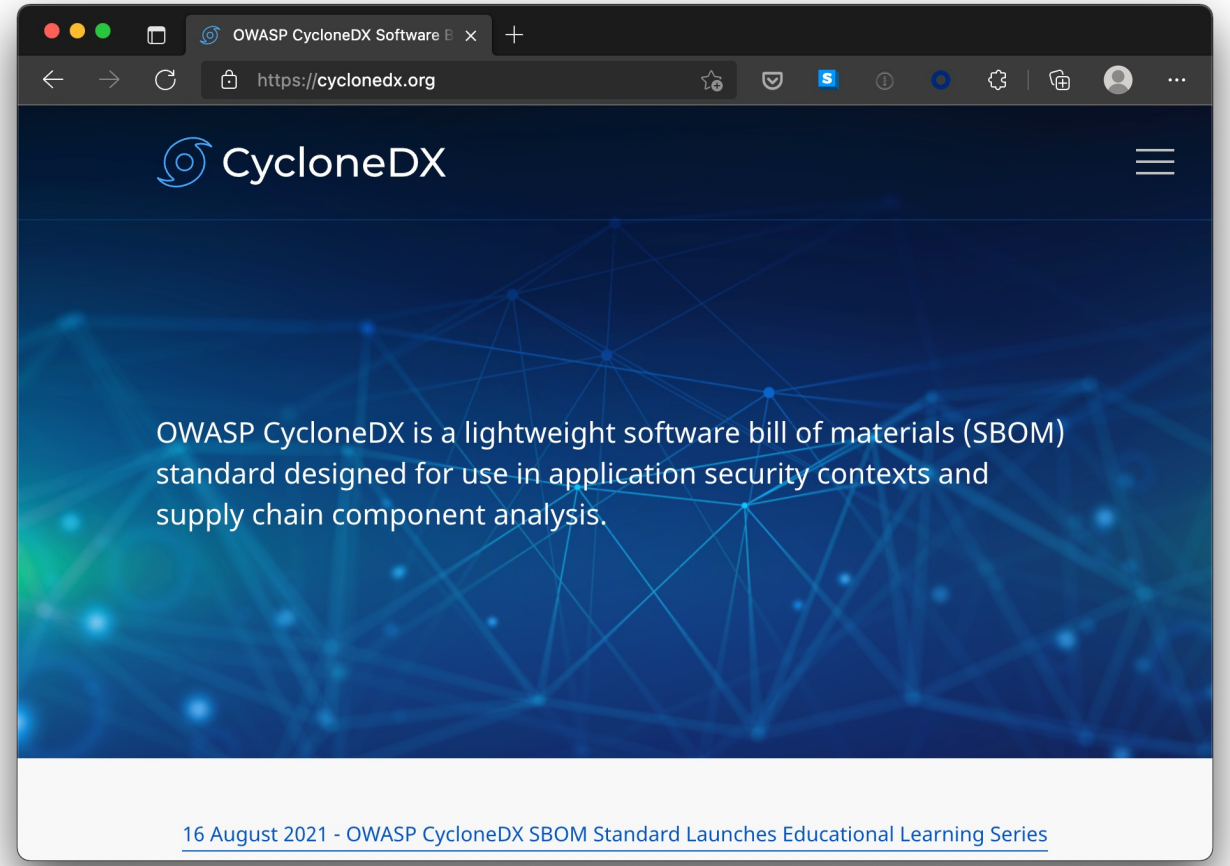
Software Bill of Materials (SBOM)



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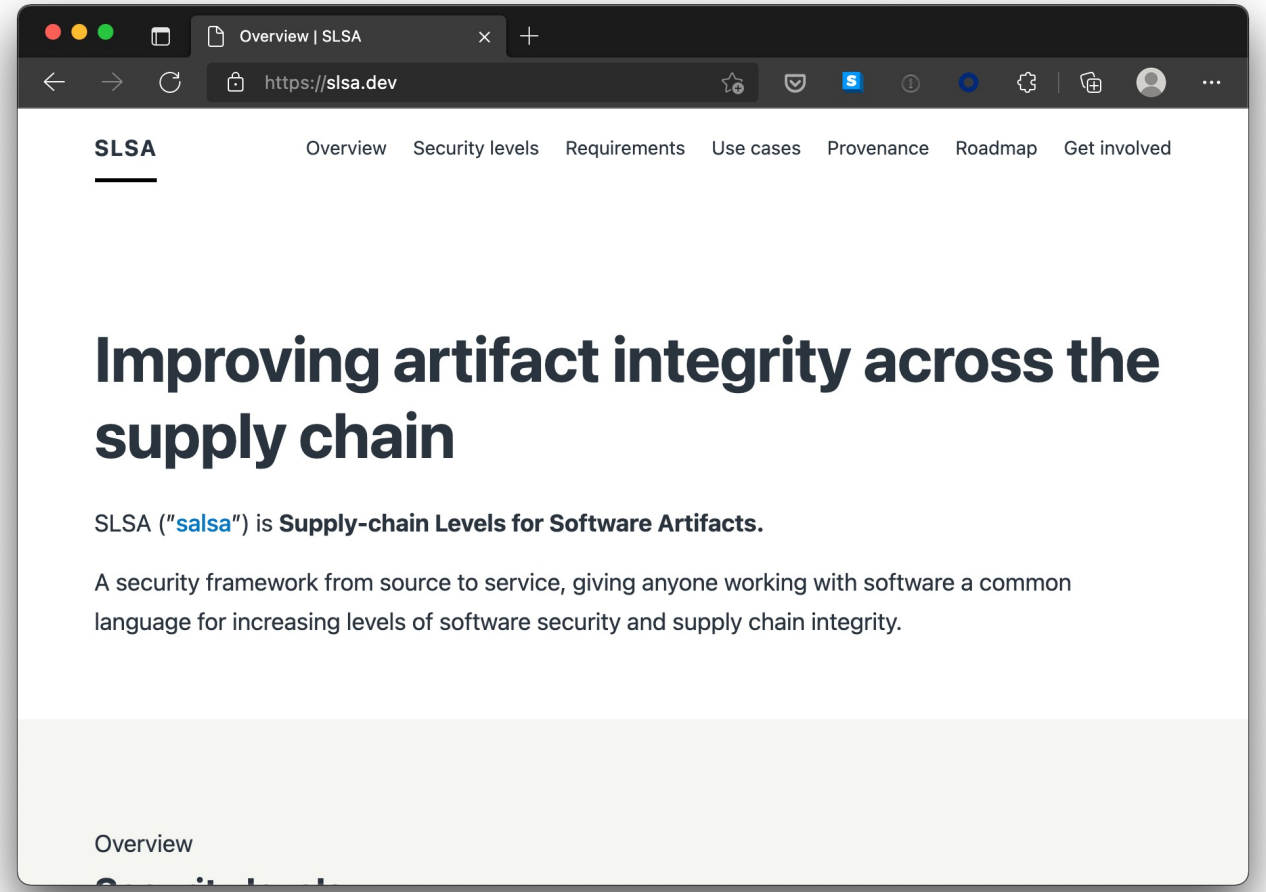
Lab 5

CycloneDX .NET
Any vulnerabilities?

Google SLSA



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Google SLSA Levels

Level	Description	Example
1	Documentation of the build process	Unsigned provenance
2	Tamper resistance of the build service	Hosted source/build, signed provenance
3	Extra resistance to specific threats	Security controls on host, non-falsifiable provenance
4	Highest levels of confidence and trust	Two-party review + hermetic builds

Google SLSA Levels

1. The build process must be fully scripted/automated and generate provenance.
2. Requires using version control and a hosted build service that generates authenticated provenance.
3. The source and build platforms meet specific standards to guarantee the auditability of the source and the integrity of the provenance respectively.
4. Requires two-person review of all changes and a hermetic, reproducible build process.

SLSA GitHub Action

- Released April 2022

- SLSA level 2 provenance generator in GitHub Action
- SLSA level 3+ provenance generator for Go binaries

- GitHub Hosted Runner
- Uses SigStore to do keyless signing with GitHub OIDC
- Verifier included

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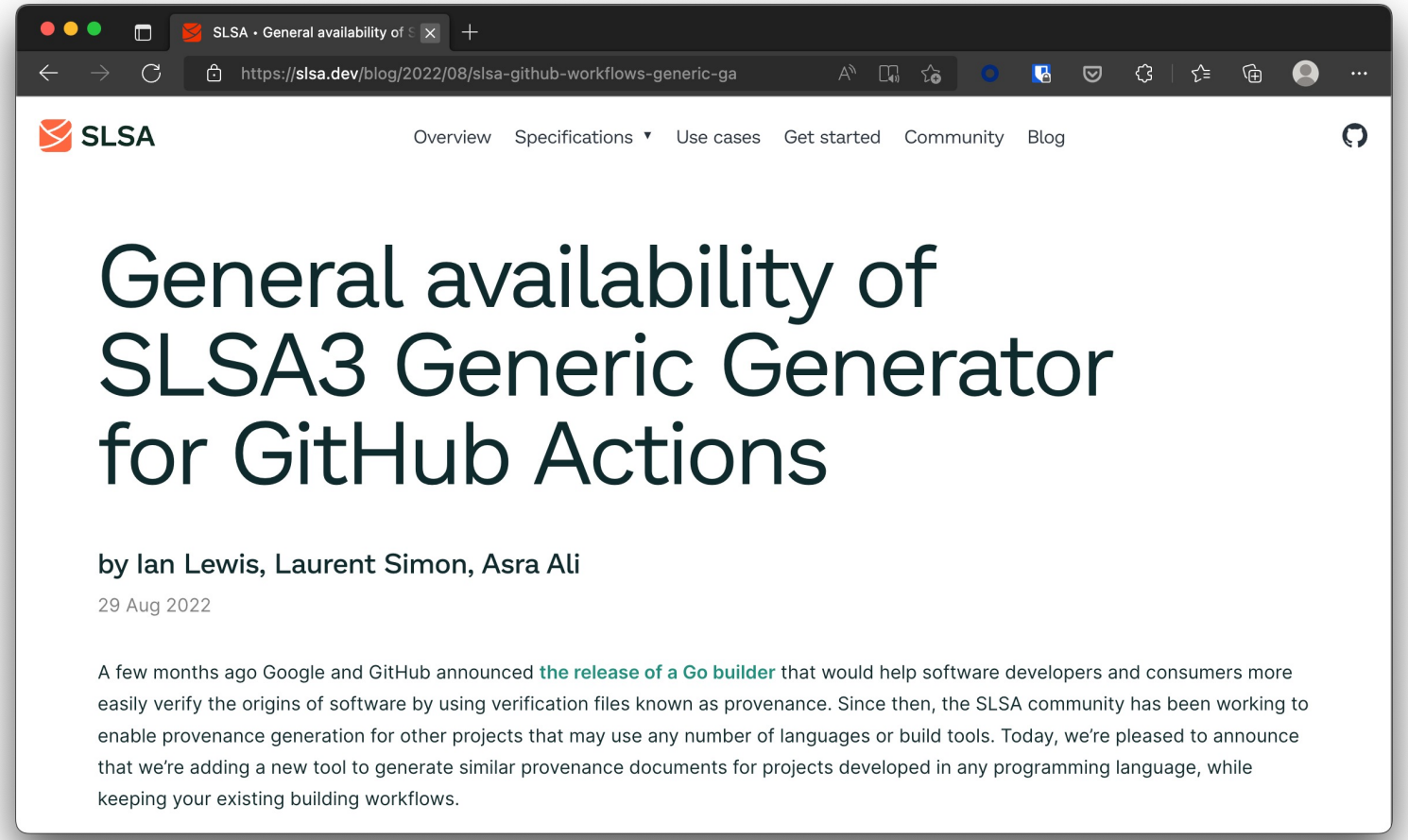
SLSA3 Generator GitHub Actions



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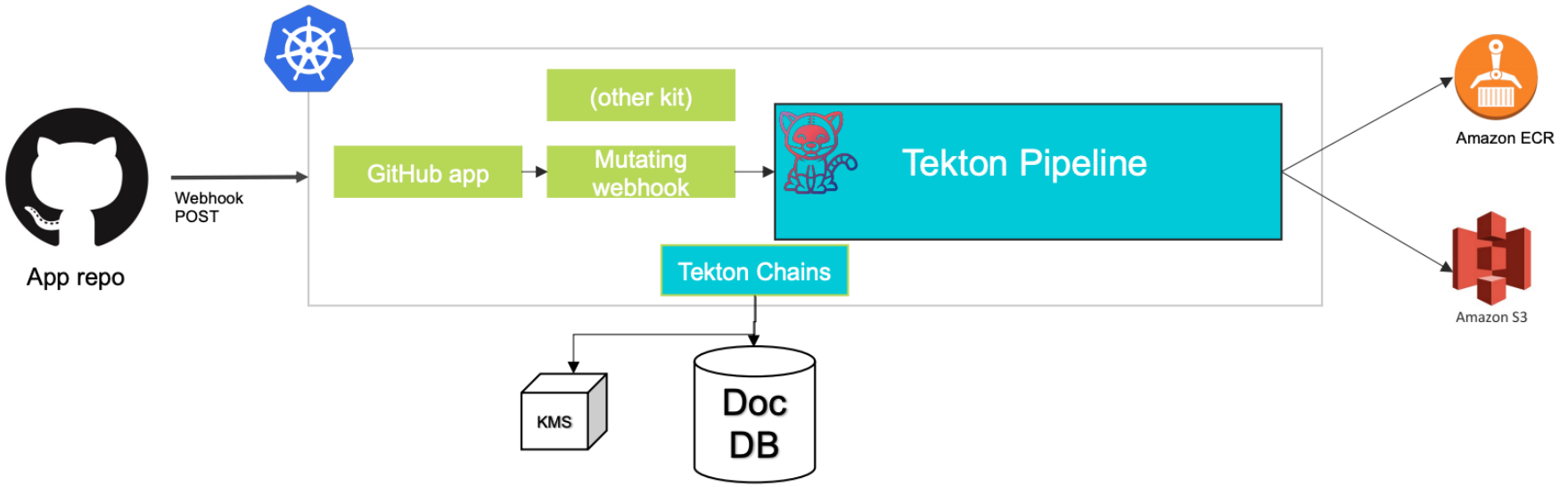
Lab 6

SLSA Level 3 Provenance

SolarWinds Project Trebuchet

Pipeline With Attestations



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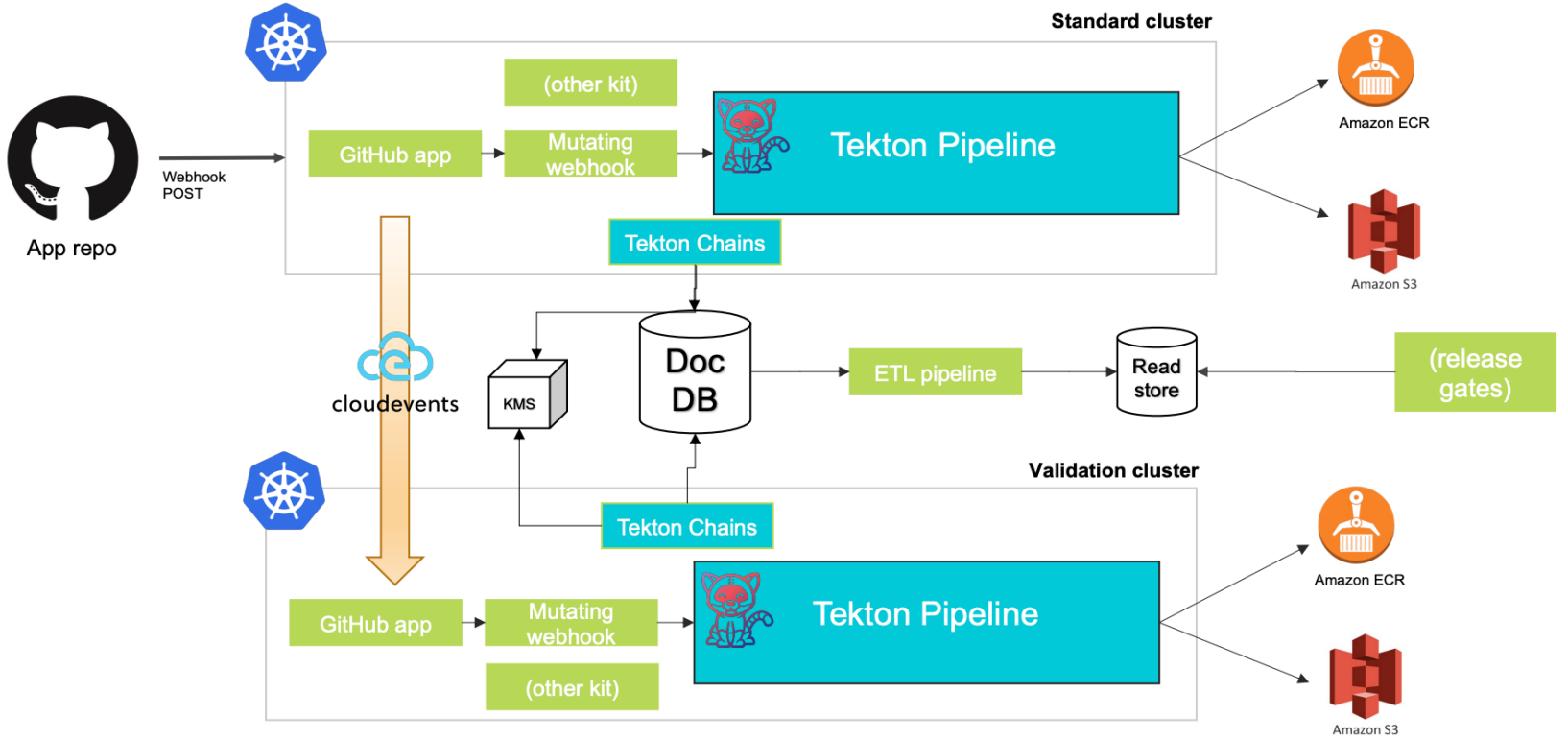
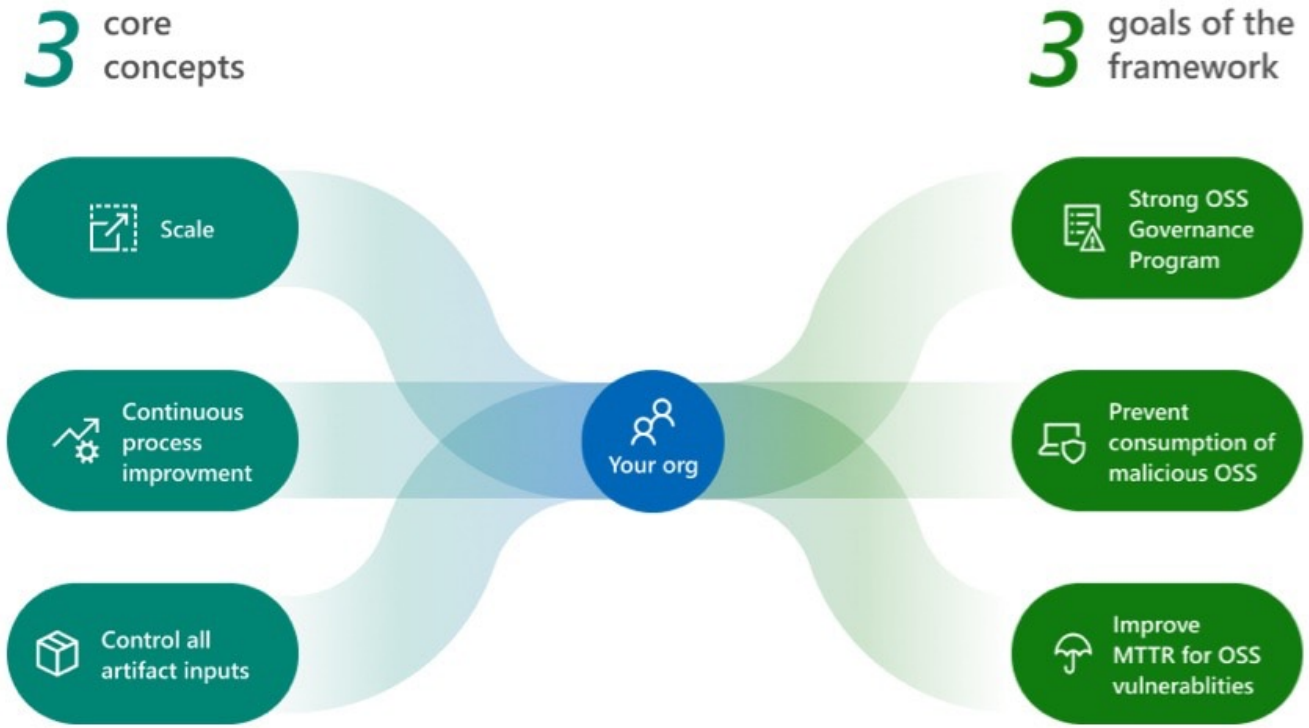
SolarWinds Project Trebuchet

Reading Results



Secure Supply Chain Consumption Framework (S2C2F)



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Secure Supply Chain Consumption Framework Practices

1. Ingest It – I can ship any existing asset if external OSS sources are compromised or unavailable
2. Scan It - I know if any OSS artifact in my pipeline has vulnerabilities or malware
3. Inventory It - I know where OSS artifacts are deployed in production.
4. Update It - I can deploy updated external artifacts soon after an update becomes publicly available.
5. Audit It - I can prove that every OSS artifact in production has a full chain-of-custody from the original artifact source and is consumed through the official supply chain
6. Enforce It - I can rely on secure and trusted OSS consumption within my organization.
7. Rebuild It - I can rebuild from source code every OSS artifact I'm deploying.

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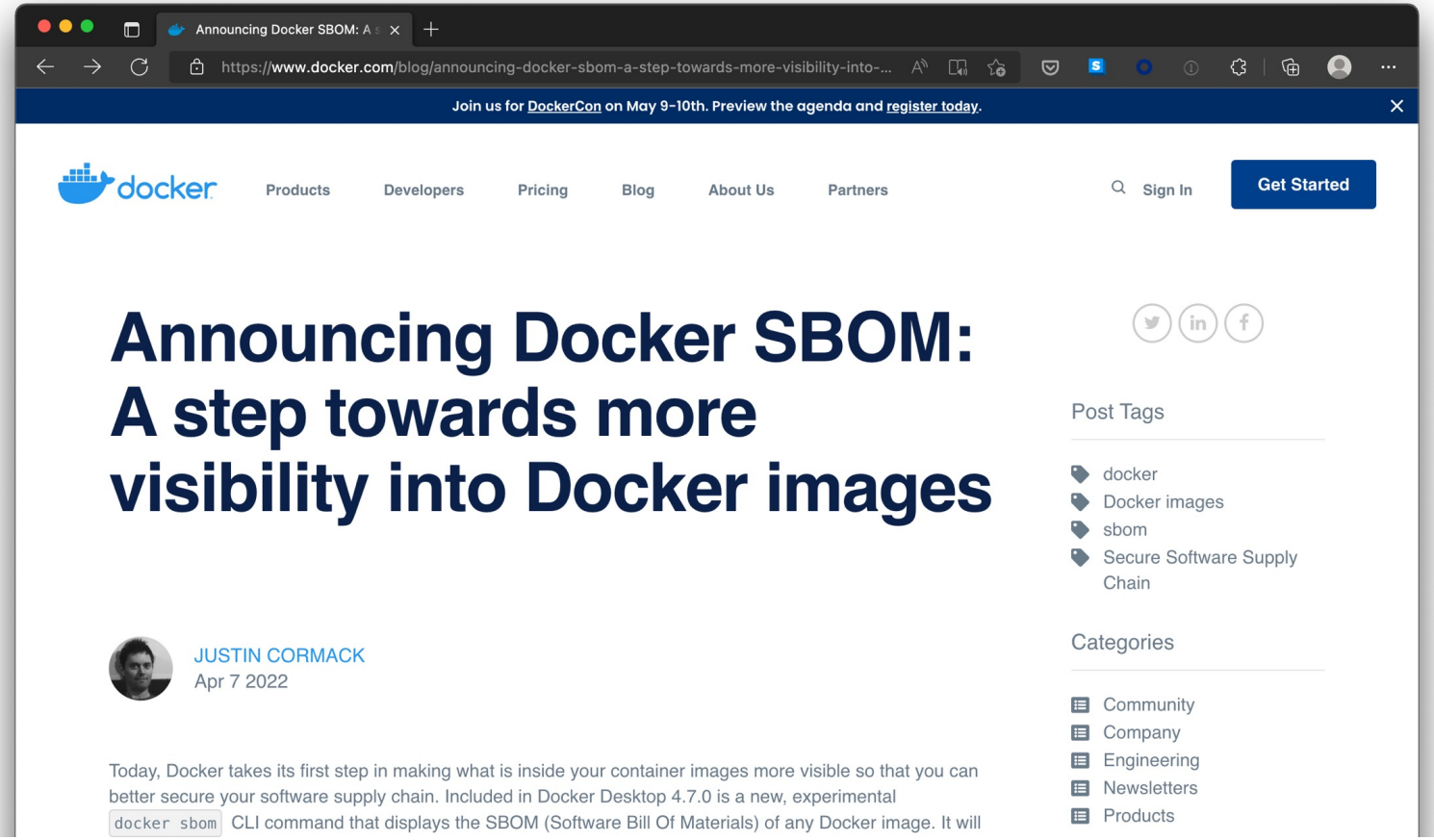
Lab 7

DocGenerator on
ASP.NET Core MVC &
Docker

Docker SBOM



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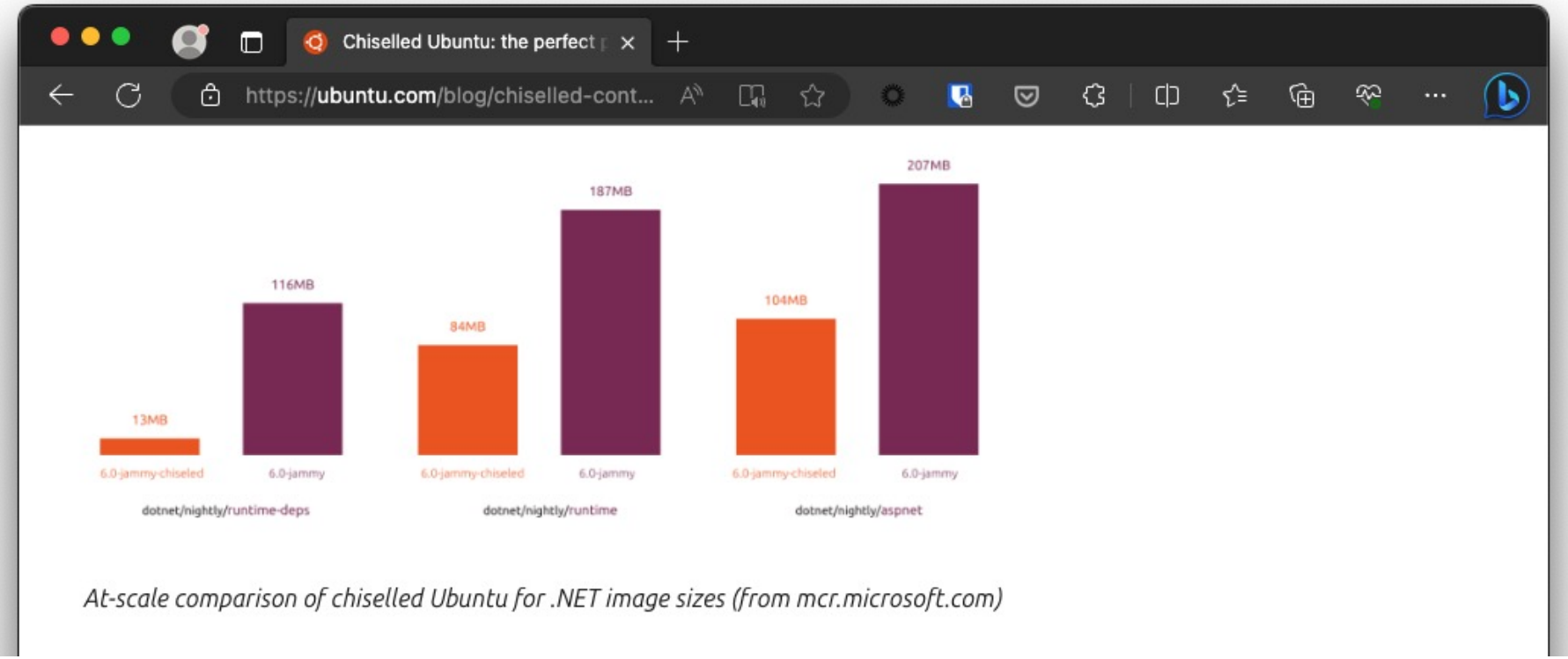
Lab 8

Docker SBOM with
Anchore Syft

Lab 9

Cosign on Docker in
GitHub Actions

Ubuntu Chiseled - Distroless Linux



At-scale comparison of chiselled Ubuntu for .NET image sizes (from mcr.microsoft.com)

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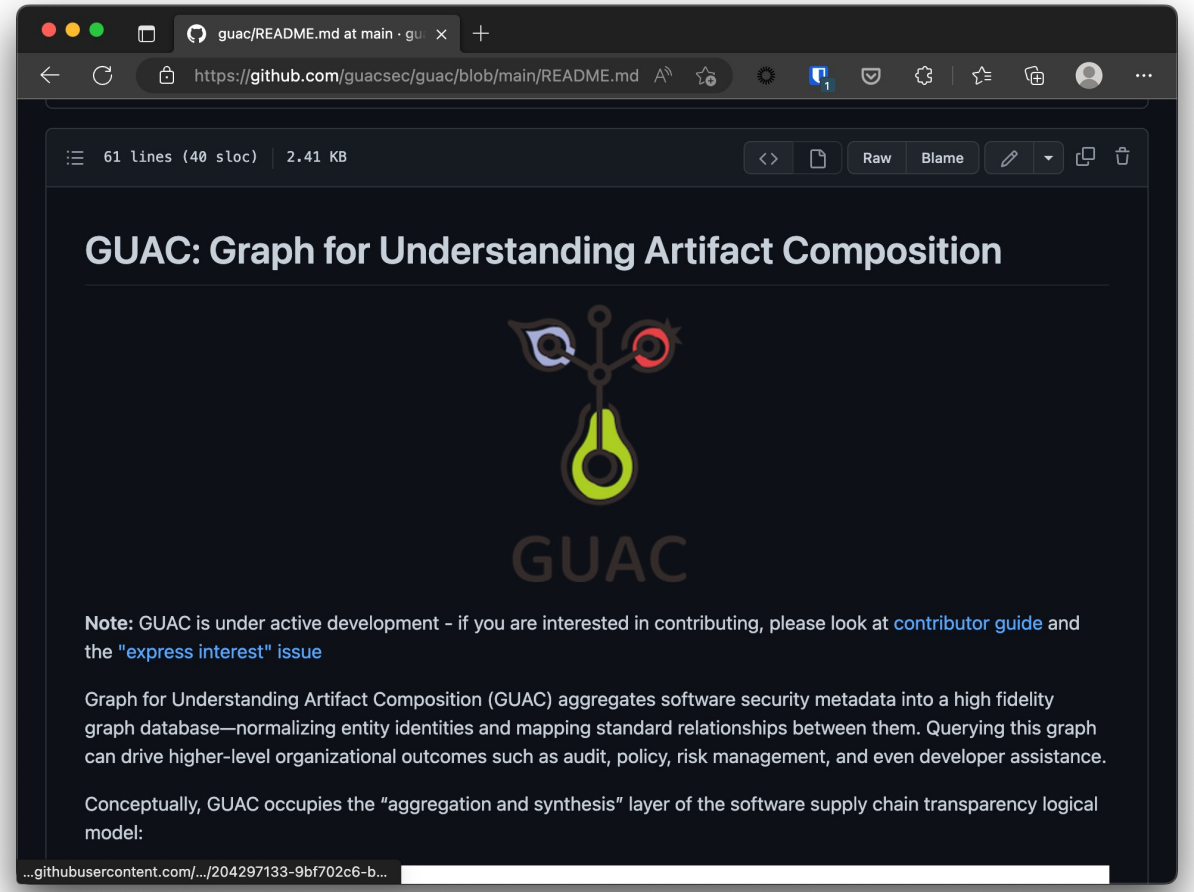
Lab 10

You got HACKED!

GUAC: Graph for Understanding Artifact Composition



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Conclusion

- It’s not how it’s more a matter of when!
- Be aware of your used software supply chain(s).
- Know what you’re using and pulling into projects.

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Conclusion

- Integrate security into your software lifecycle.
- Start working on creating SBOM's and see how SLSA can fit into your process.
- Try to work with SBOM output and use it!

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VERACODE

Thanks!

https://github.com/nielstanis/cphdevfest2023

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