NDC { London }

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

Niels Tanis

Who am I?

- Niels Tanis
- Sr. Principal Security Researcher @ Veracode
  - Background .NET Development, Pentesting/ethical hacking, and software security consultancy
  - Research on static analysis for .NET apps

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Agenda

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What is a Supply Chain?

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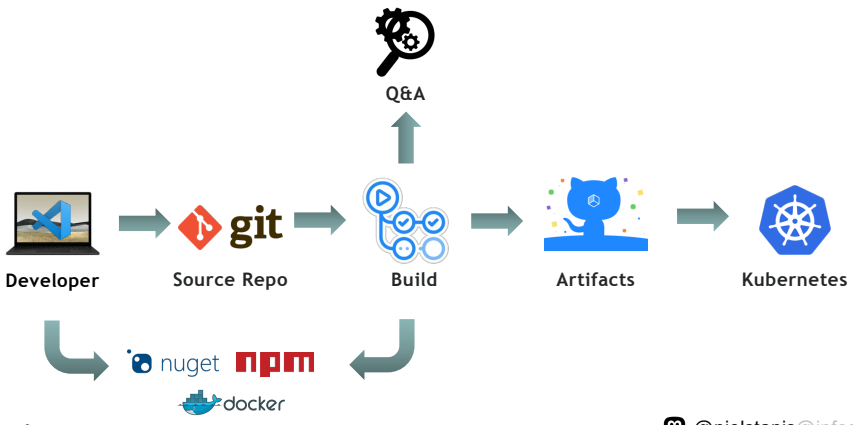
Image source:
https://www.wardsauto.com/sites/wardsauto.com/files/styles/article_featured_retina/public/Renault%20Kadjar%20assembly%20line%20-%20Palencia%20Spain-5_8.jpg?

Software Supply Chain



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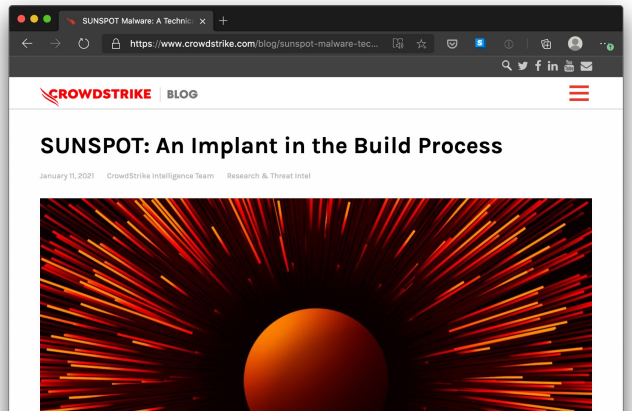
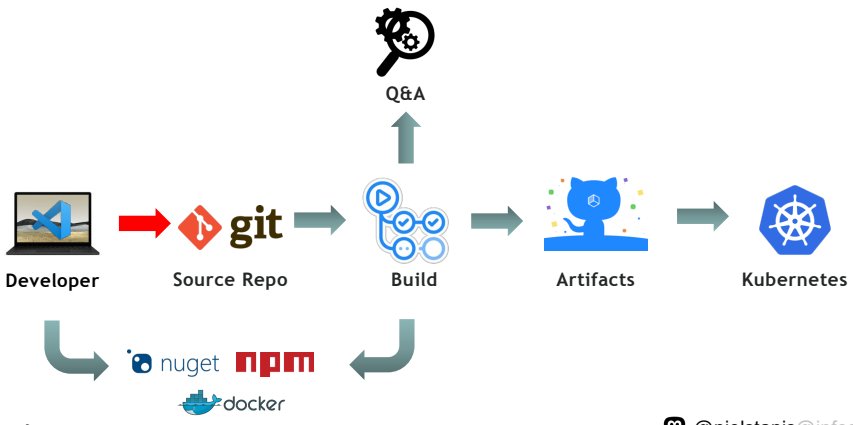
SolarWinds SunSpot



https://www.crowdstrike.com/blog/sunspot-malware-technical-analysis/
https://www.microsoft.com/security/blog/2020/12/18/analyzing-solorigate-the-compromised-dll-file-that-started-a-sophisticated-cyberattack-and-how-microsoft-defender-helps-protect/

Software Supply Chain



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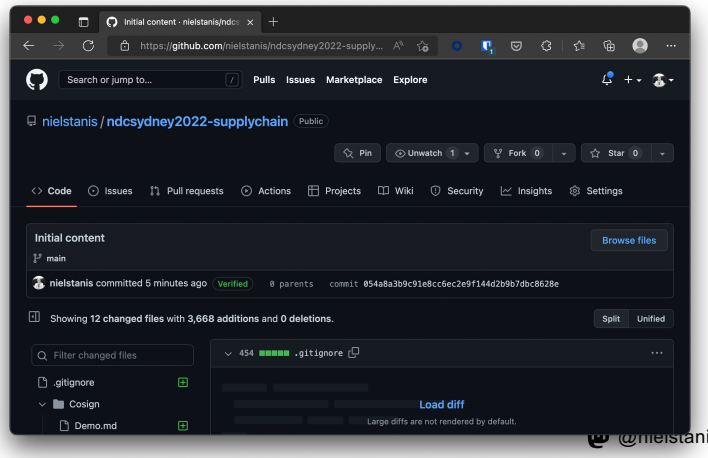
GIT Commit Signing



https://www.hanselman.com/blog/HowToSetupSignedGitCommitsWithAYubiKeyNEOAndGPGAndKeybaseOnWindows.aspx

Lab 1

DocGenerator

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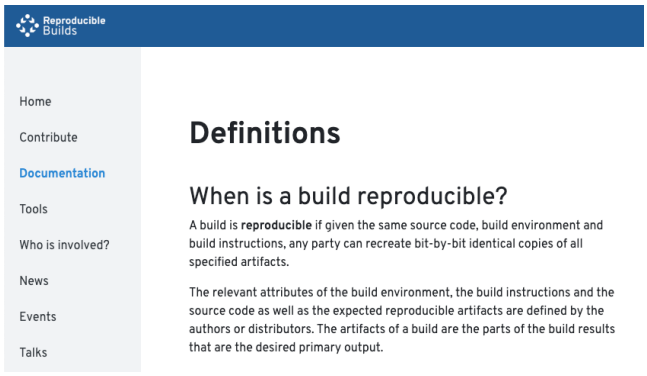
Reproducible/Deterministic Builds



https://reproducible-builds.org/docs/definition/

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’

https://blog.paranoidcoding.com/2016/04/05/deterministic-builds-in-roslyn.html
https://github.com/dotnet/roslyn/blob/master/docs/compilers/Deterministic%20Inputs.md
https://github.com/clairernovotny/DeterministicBuilds

Lab 2

.NET 7 reproducible

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Reproducible/Deterministic Builds

- DotNet.Reproducible NuGet Package
  - MSBuild *ContinuousIntegrationBuild*
  - SourceLink
- Dotnet.Reproducible.Isolated NuGet Package
  - Hermetic builds

https://blog.paranoidcoding.com/2016/04/05/deterministic-builds-in-roslyn.html
https://github.com/dotnet/roslyn/blob/master/docs/compilers/Deterministic%20Inputs.md
https://devblogs.microsoft.com/dotnet/producing-packages-with-source-link/
https://github.com/dotnet/reproducible-builds

Lab 3

DotNet.Reproducible
NuGet Package

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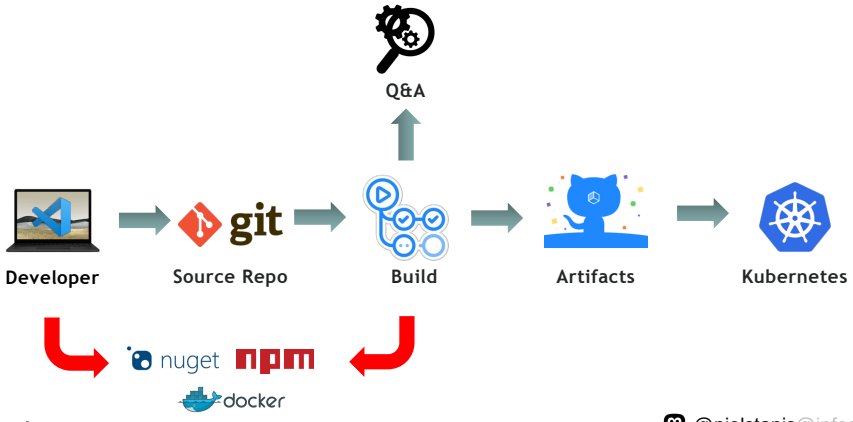
Reproducible Build Validation

- 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`

https://github.com/dotnet/designs/blob/main/accepted/2020/reproducible-builds.md

3rd Party Libraries



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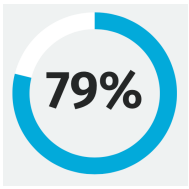
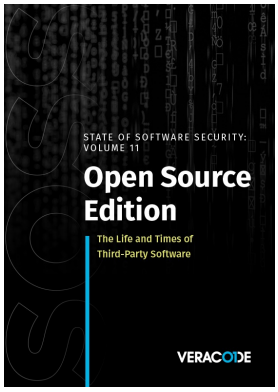
State Of Software Security v11 2021

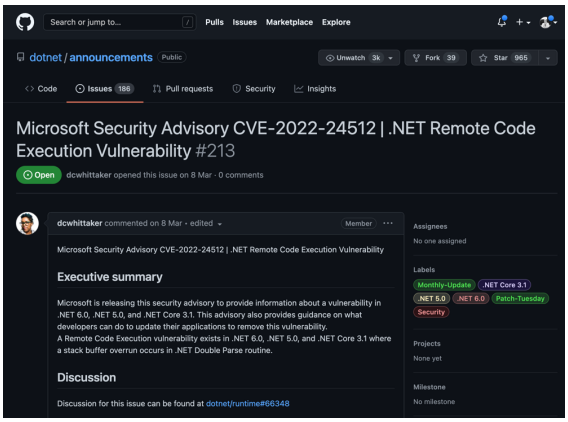
”Despite this dynamic landscape, 79 percent of the time, developers never update third-party libraries after including them in a codebase.”





https://info.veracode.com/fy22-state-of-software-security-v11-open-source-edition.html

Vulnerabilities in libraries



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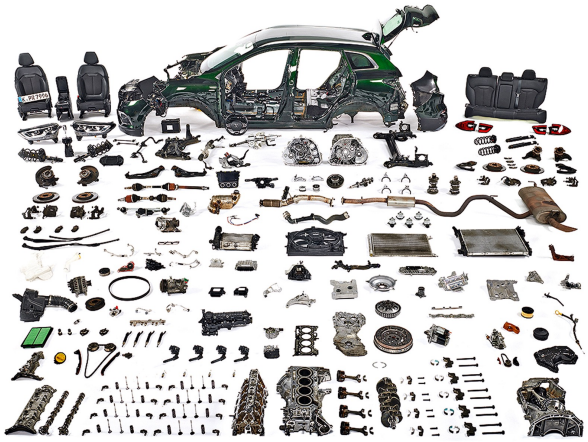
https://github.com/dotnet/announcements/issues/213

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

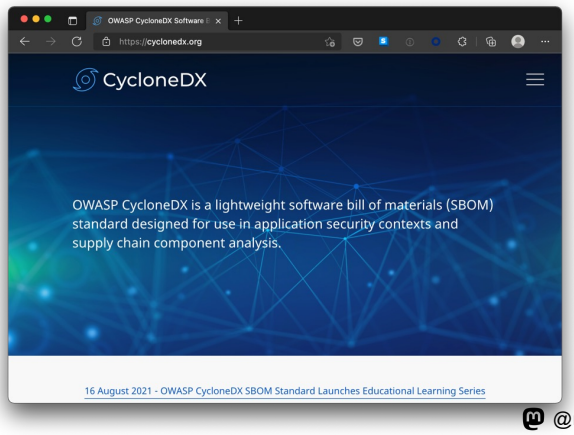
Renault Manufacturing

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

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?

Software Bill of Materials (SBOM)



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https://cyclonedx.org

Lab 4

CycloneDX .NET

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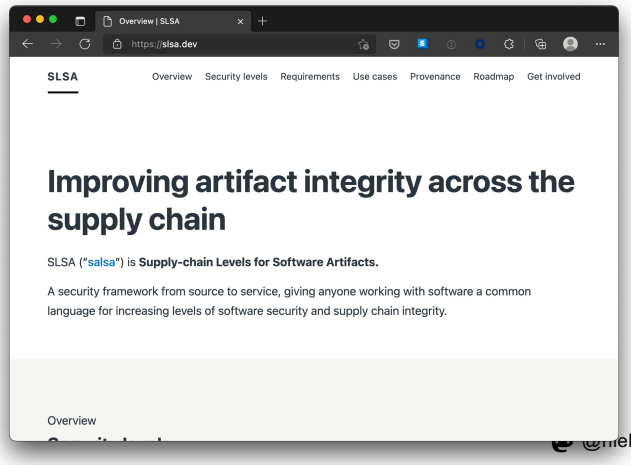
Google SLSA



https://slsa.dev

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

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https://slsa.dev

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.

https://slsa.dev

SLSA GitHub Action

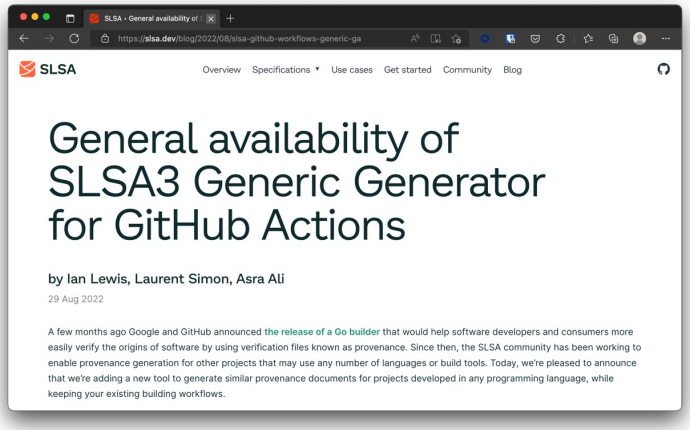
- Released April 2022

- 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

https://security.googleblog.com/2022/04/improving-software-supply-chain.html

SLSA3 Generator GitHub Actions



https://slsa.dev/blog/2022/08/slsa-github-workflows-generic-ga

Lab 5

SLSA Level 3 Provenance

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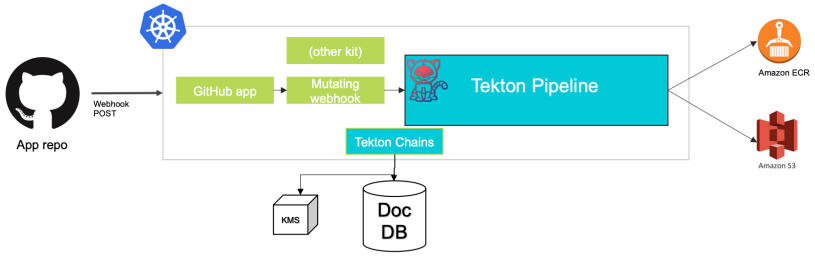
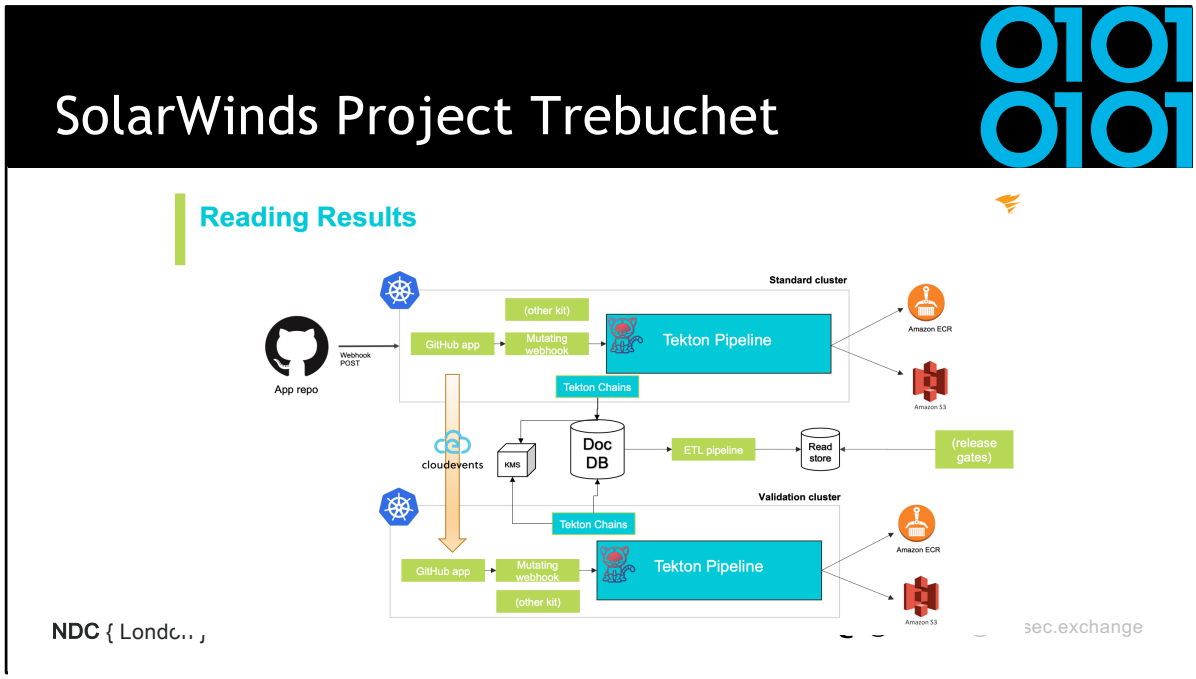
SolarWinds Project Trebuchet

Pipeline With Attestations



https://static.sched.com/hosted_files/supplychainsecurityconna21/df/SupplyChainCon-TrevorRosen-Keynote.pdf
https://www.youtube.com/watch?v=1-tMRxqMwTQ

SolarWinds Project Trebuchet



https://static.sched.com/hosted_files/supplychainsecurityconna21/df/SupplyChainCon-TrevorRosen-Keynote.pdf
https://www.youtube.com/watch?v=1-tMRxqMwTQ

Lab 6

DocGenerator on
ASP.NET Core MVC &
Docker

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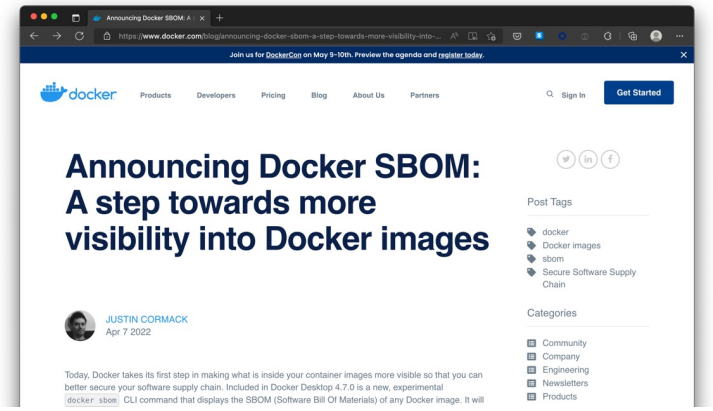
Docker SBOM



https://www.docker.com/blog/announcing-docker-sbom-a-step-towards-more-visibility-into-docker-images/

Lab 7

Docker SBOM with Anchor and Syft

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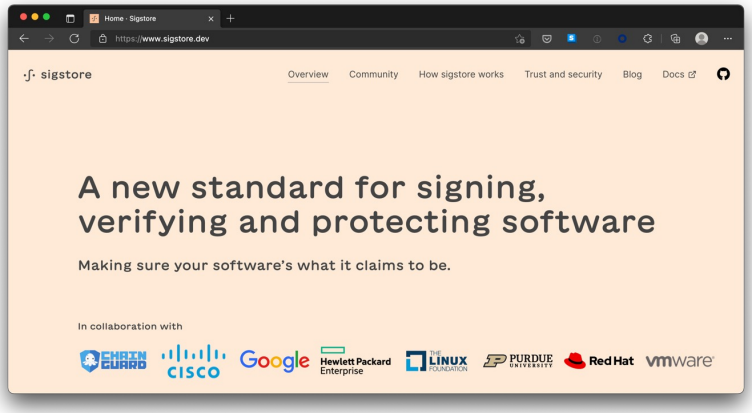
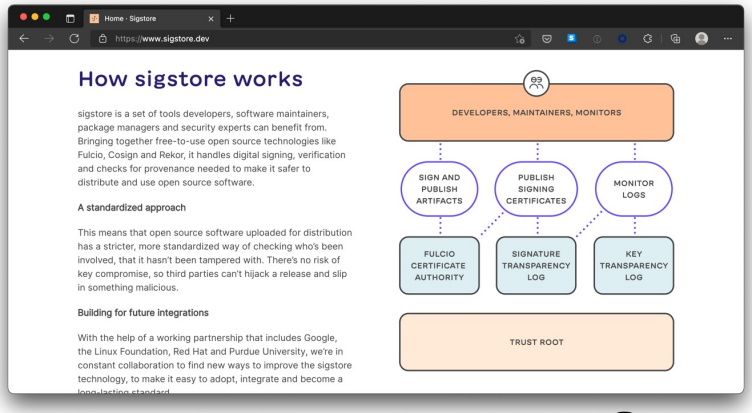
Signing artifacts



https://sigstore.dev

Signing artifacts



https://sigstore.dev

Lab 8

Keyless Signing artifact with cosign

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Signing artifacts

- Cosign can be used for signing files like binaries, packages and Docker images
- It can do keyless signing based on OpenID Connect
- GitHub Actions have released OpenID Connect support since end 2021

https://sigstore.dev

Lab 9

Cosign on Docker in GitHub Actions

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Lab 10

You got HACKED!

01

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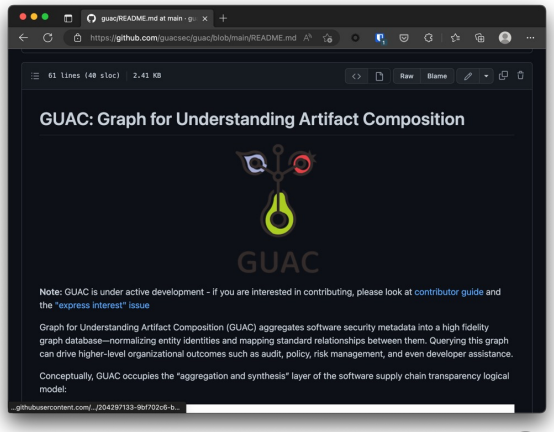
GUAC: Graph for Understanding Artifact Composition



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https://github.com/guacsec/guac

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.

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!


VERACODE
Thanks! Questions?
https://github.com/nielstanis/ndclondon2023-supplychainws
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