
Copenhagen
Developers Festival
Securing your .NET application software supply-chain the practical approach! (workshop)
Niels Tanis
VERACODE

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

Agenda

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

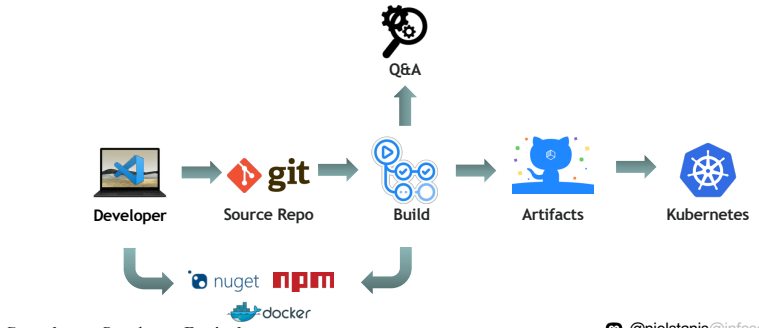
Agenda

- https://github.com/nielstanis/cphdevfest2023
- https://github.com/nielstanis/docgenerator

What is a Supply Chain?

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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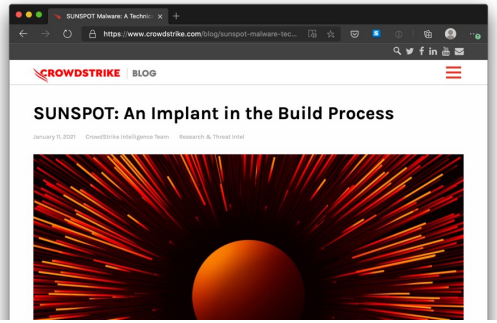
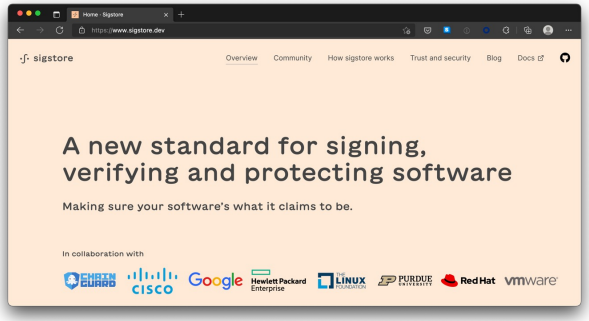
SolarWinds SunSpot



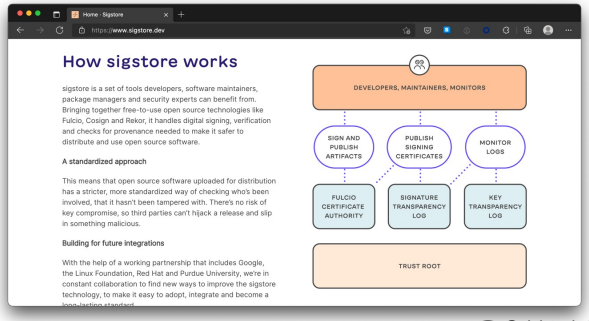
https://www.crowdstrike.com/blog/sunspot-malware-technical-analysis/
https://www.microsoft.com/security/blog/2020/12/18/analyzing-solorigate-the-compromised-dll-file-that-started-a-sophisticated-cyberattack-and-how-microsoft-defender-helps-protect/

Signing artifacts



https://sigstore.dev

Signing artifacts



https://sigstore.dev

Lab 1

Signing artfifacts with Sigstore

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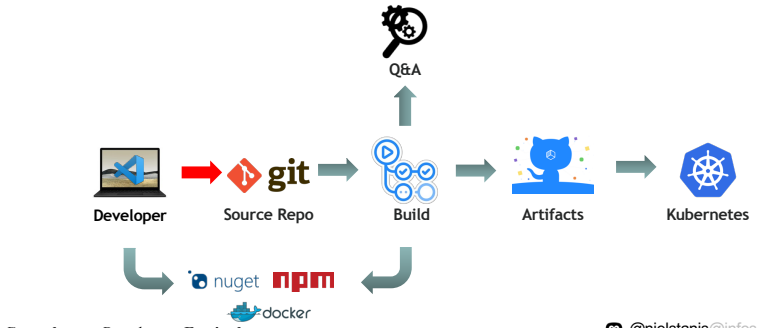
Software Supply Chain



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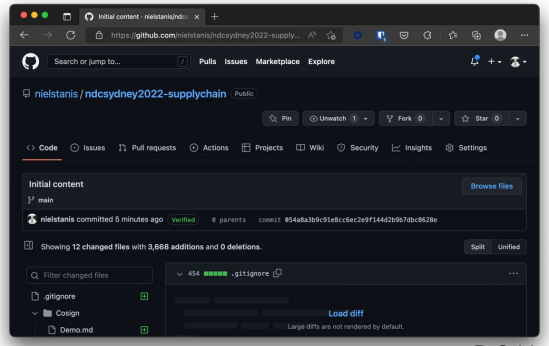
GIT Commit Signing



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

Lab 2

Setup repository, build and git signing with GitSign

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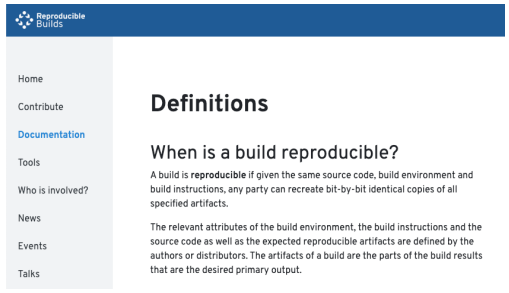
Reproducible/Deterministic Builds



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

Lab 3

.NET reproducibility

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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

Reproducible/Deterministic Builds

- DotNet.ReproducibleBuilds NuGet Package
  - MSBuild *ContinuousIntegrationBuild*
  - SourceLink
- Dotnet.ReproducibleBuilds.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 4

DotNet.Reproducible

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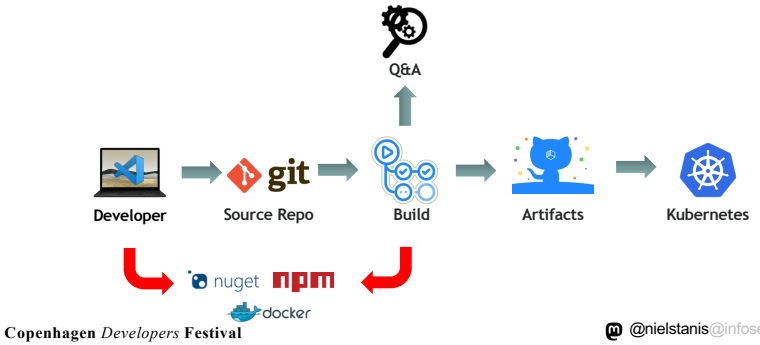
Reproducible Build Validation

- 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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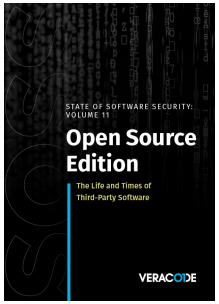
State Of Software Security v11 2021

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



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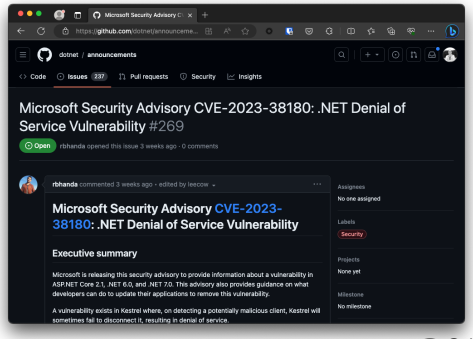
https://info.veracode.com/fy22-state-of-software-security-v11-open-source-edition.html

Vulnerabilities in libraries



https://github.com/dotnet/announcements/issues/269

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

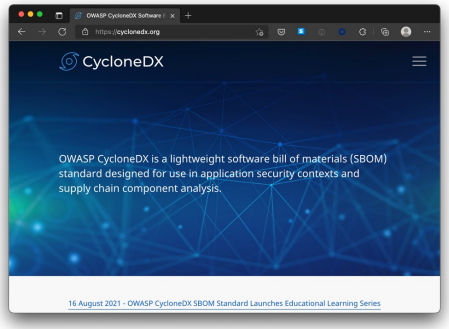
Renault Manufacturing

- 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 5

CycloneDX .NET
Any vulnerabilities?

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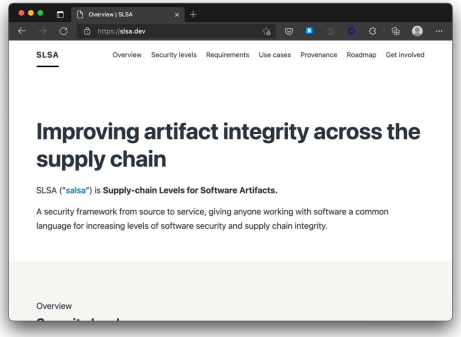
Google SLSA



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.

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https://slsa.dev

SLSA GitHub Action

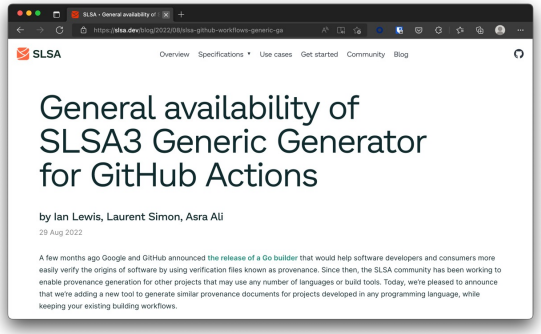
- Released April 2022

- 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



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

Lab 6

SLSA Level 3 Provenance

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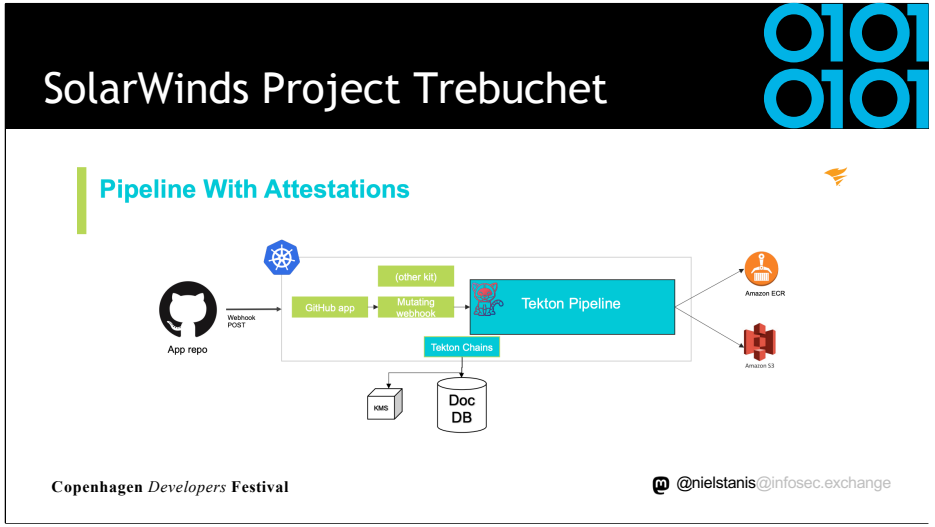
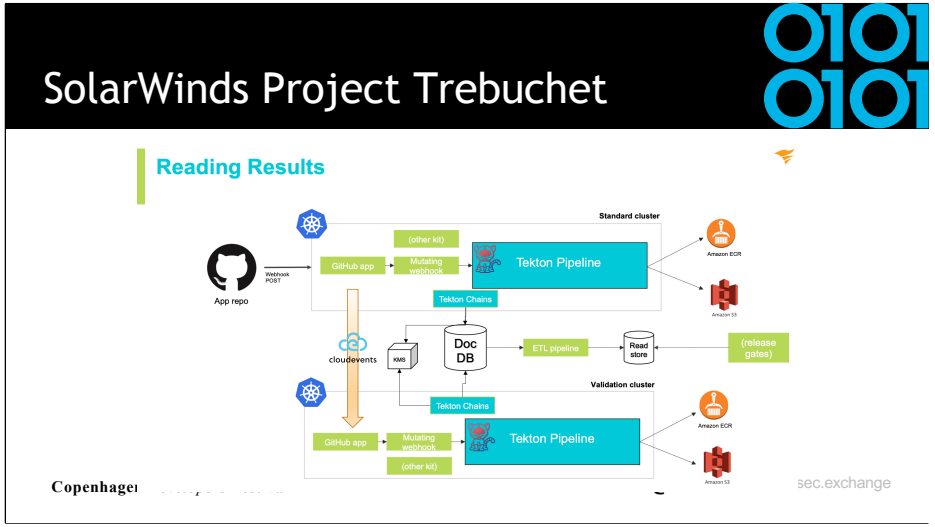
SolarWinds Project Trebuchet



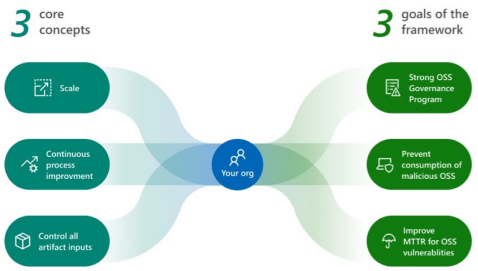
https://static.sched.com/hosted_files/supplychainsecurityconna21/df/SupplyChainCon-TrevorRosen-Keynote.pdf
https://www.youtube.com/watch?v=1-tMRxqMwTQ

SolarWinds Project Trebuchet



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

Secure Supply Chain Consumption Framework (S2C2F)



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https://www.microsoft.com/en-us/securityengineering/opensource/ossscframeworkguide

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.

https://www.microsoft.com/en-us/securityengineering/opensource/ossscframeworkguide

Lab 7

DocGenerator on
ASP.NET Core MVC &
Docker

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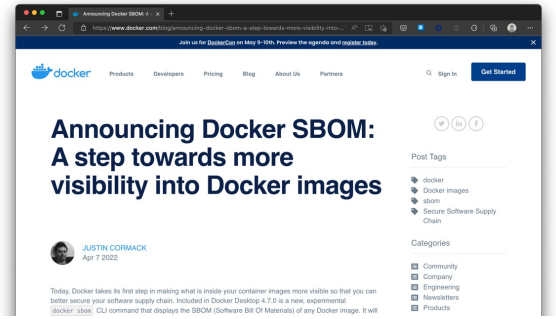
Docker SBOM



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

Lab 8

Docker SBOM with
Anchore Syft

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Lab 9

Cosign on Docker in GitHub Actions

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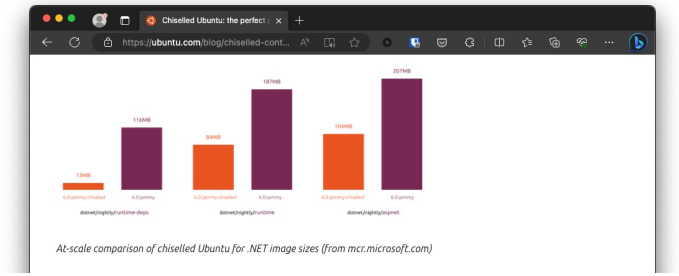
Ubuntu Chiseled – Distroless Linux



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

https://ubuntu.com/blog/chiselled-containers-perfect-gift-cloud-applications

Lab 10

You got HACKED!

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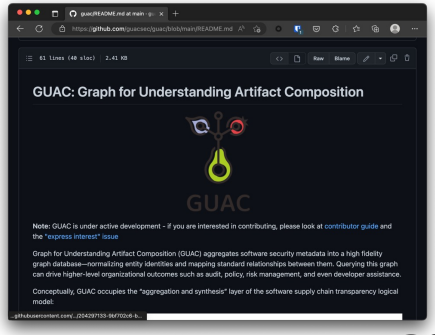
GUAC: Graph for Understanding Artifact Composition



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!
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