Niels Tanis

The Rise of Software Supply-Chain Attacks

How Secure is your .NET Application?

CODECAMP_

Who am I?

- Niels Tanis
  - Security Researcher @ Veracode
  - Background in .NET Development
  - Application Security Consultancy
  - Pen-testing & Ethical Hacking
  - ISC^2 CSSLP

The Rise of Software Supply-Chain Attacks

How Secure is your .NET Application?

@nielstanis

Agenda

- Hacker History
- Definition Software Supply-Chain
  - Development of .NET application
  - Building / Releasing / Deploying
- Securing our Software Supply-Chain
- Conclusion and Q&A

Hacking History

- Started out with phreaking in late ‘50-’60.

Getting connected!

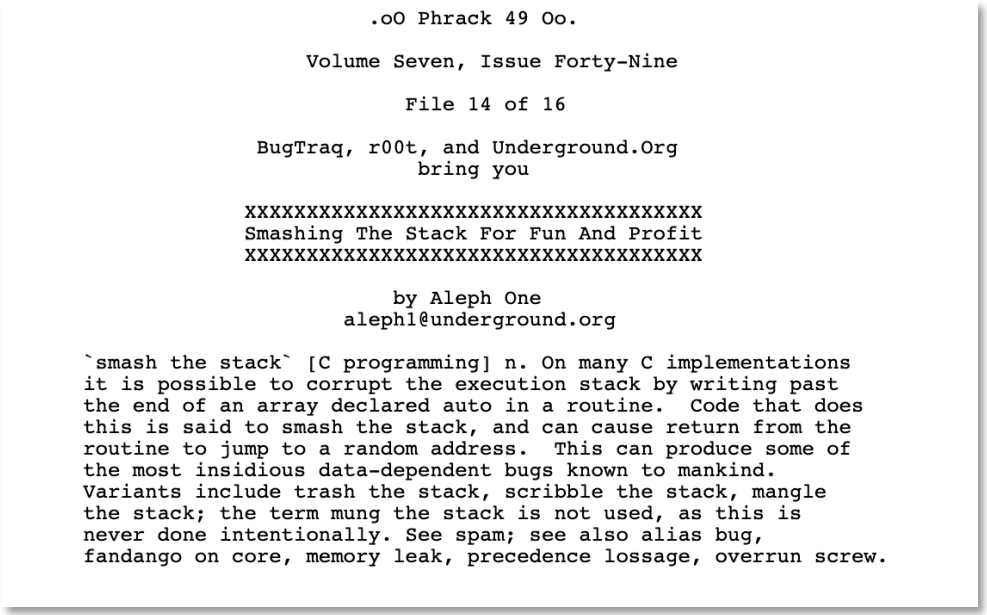
- SATAN (**S**ecurity **A**dministrator **T**ool for **A**nalyzing **N**etworks) by Wietse Venema and Dan Farmer released 1995.
- NMAP (Network Mapper) by Gordon Lyon released in 1997

```
Starting Nmap 7.60 ( https://nmap.org ) at 2018-01-14 11:05 CET
Nmap scan report for scanme.nmap.org (45.33.32.156)
Host is up (0.16s latency).
Other addresses for scanme.nmap.org (not scanned): 2600:3c01::f03c:91ff:fe18:bb2f
Not shown: 996 closed ports
PORT     STATE    SERVICE
22/tcp   open     ssh
25/tcp   filtered smtp
80/tcp   open     http
9929/tcp open     nping-echo
```

Smashing the Stack…

- Phrack #49 in November 1996

  Aleph One wrote about **buffer overflows**



.oO Phrack 49 Oo.

Volume Seven, Issue Forty-Nine

File 14 of 16

BugTraq, r00t, and Underground.Org
bring you

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Smashing The Stack For Fun And Profit
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

by Aleph One
aleph1@underground.org

`smash the stack` [C programming] n. On many C implementations it is possible to corrupt the execution stack by writing past the end of an array declared auto in a routine. Code that does this is said to smash the stack, and can cause return from the routine to jump to a random address. This can produce some of the most insidious data-dependent bugs known to mankind. Variants include trash the stack, scribble the stack, mangle the stack; the term mung the stack is not used, as this is never done intentionally. See spam; see also alias bug, fandango on core, memory leak, precedence lossage, overrun screw.

SQL Injection

- Phrack #54 in December 1998

  Rain Forest Puppy wrote about

  SQL injection

```
----[  ODBC and MS SQL server 6.5

Ok, topic change again.  Since we've hit on web service and database stuff,
let's roll with it.  Onto ODBC and MS SQL server 6.5.

I worked with a fellow WT'er on this problem.  He did the good thing and told
Microsoft, and their answer was, well, hilarious.  According to them,
what you're about to read is not a problem, so don't worry about doing
anything to stop it.

- WHAT'S THE PROBLEM?  MS SQL server allows batch commands.

- WHAT'S THAT MEAN?  I can do something like:

        SELECT * FROM table WHERE x=1 SELECT * FROM table WHERE y=5

Exactly like that, and it'll work.  It will return two record sets, with each
set containing the results of the individual SELECT.

- WHAT'S THAT REALLY MEAN?  People can possibly piggyback SQL commands into
your statements.  Let's say you have:

        SELECT * FROM table WHERE x=%%criteria from webpage user%%

Now, what if %%criteria from webpage user%% was equal to:

        SELECT * FROM sysobjects

It would translate to:

        SELECT * FROM table WHERE x=1 SELECT * FROM sysobjects
```

Code Red & SQL Slammer

- Microsoft Internet Information Server, July 2001

```
GET /default.ida?NNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNN
%u9090%u6858%ucbd3%u7801%u9090%u6858%ucbd3%u7801
%u9090%u6858%ucbd3%u7801%u9090%u9090%u8190%u00c3
%u0003%u8b00%u531b%u53ff%u0078%u0000%u00=a HTTP/1.0
```

Bill Gates – Email to all MS FTE

BILL GATES BUSINESS 01.17.02 12:00 PM

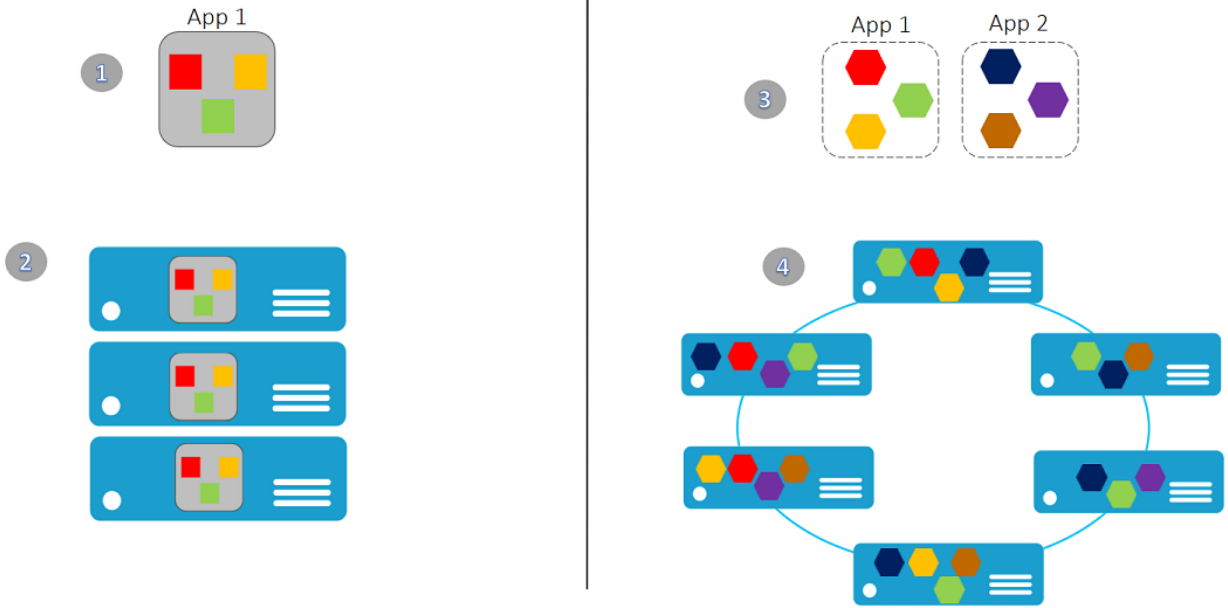
Bill Gates: Trustworthy Computing

*This is the e-mail Bill Gates sent to every full-time employee at Microsoft, in which he describes the company's new strategy emphasizing security in its products.*From: Bill Gates
Sent: Tuesday, January 15, 2002 5:22 PM
To: Microsoft and Subsidiaries: All FTE
Subject: Trustworthy computing

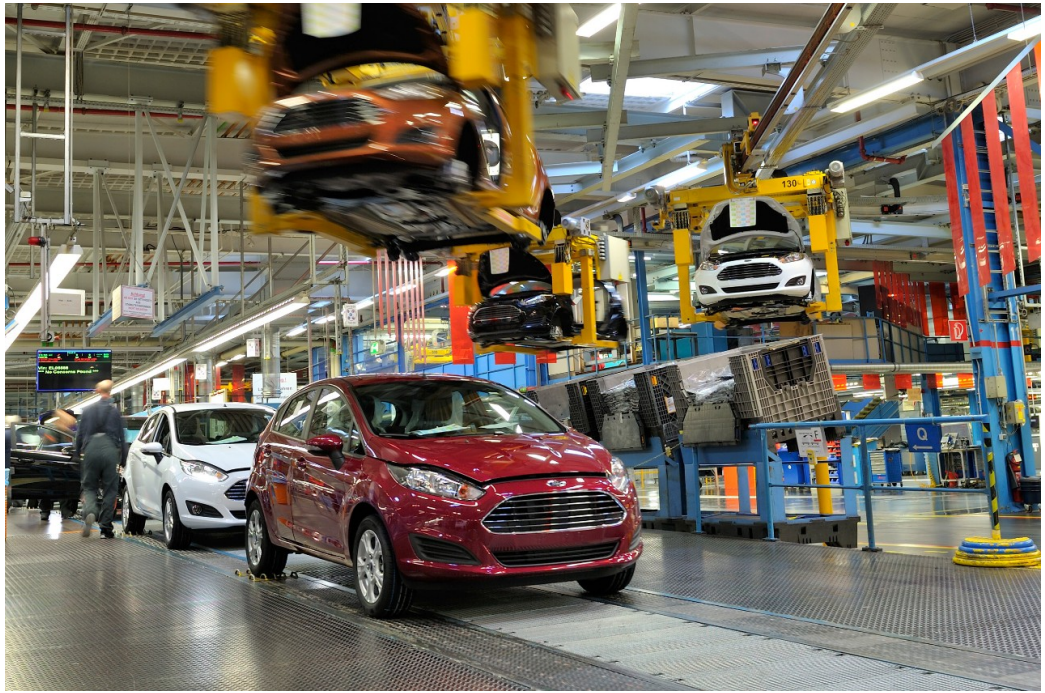
Every few years I have sent out a memo talking about the highest priority for Microsoft. Two years ago, it was the kickoff of our .NET strategy. Before that, it was several memos about the importance of the Internet to our future and the ways we could make the Internet truly useful for people. Over the last year it has become clear that

Changes in Software Architecture

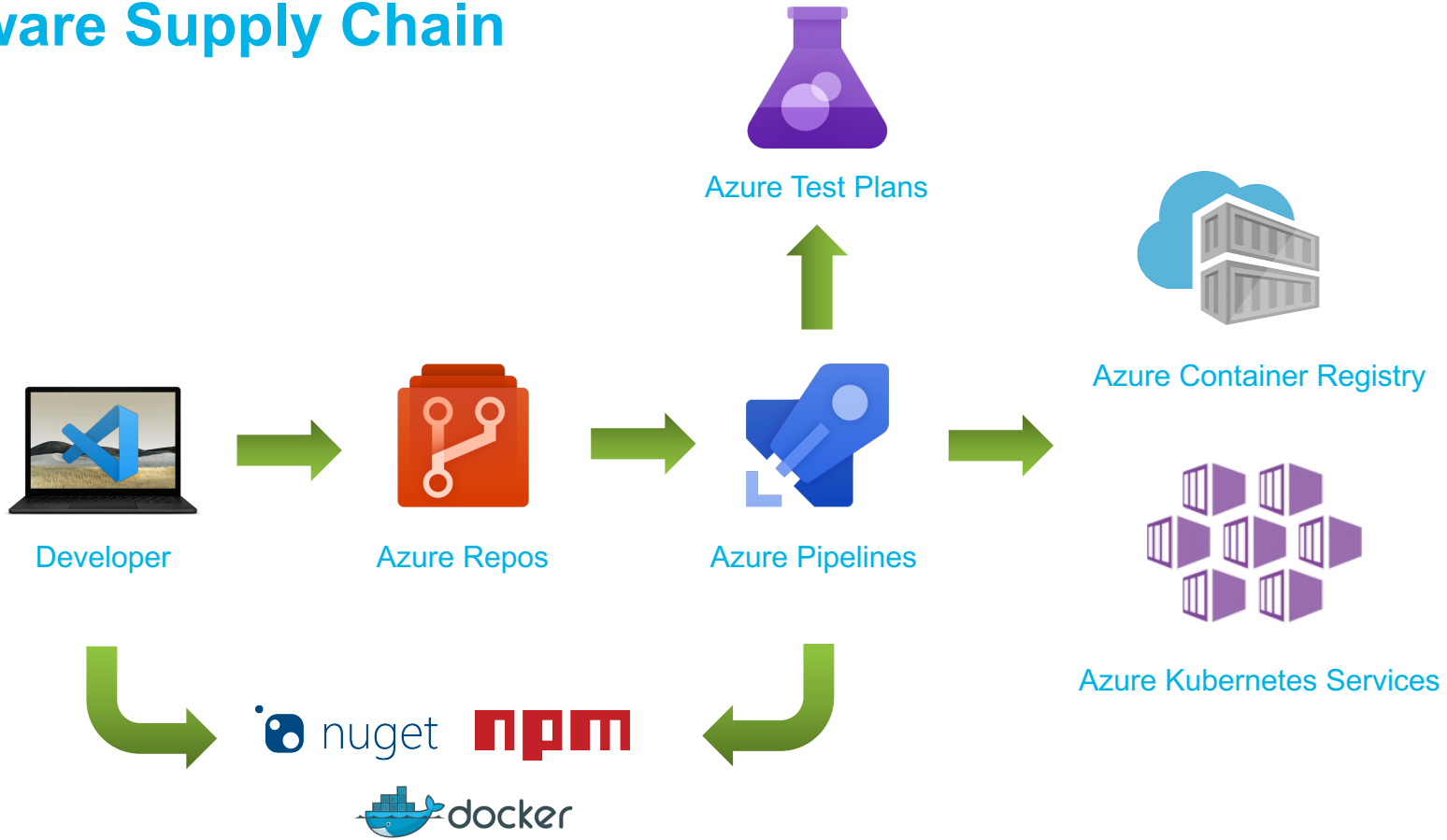
- Monolith → Microservices → Serverless



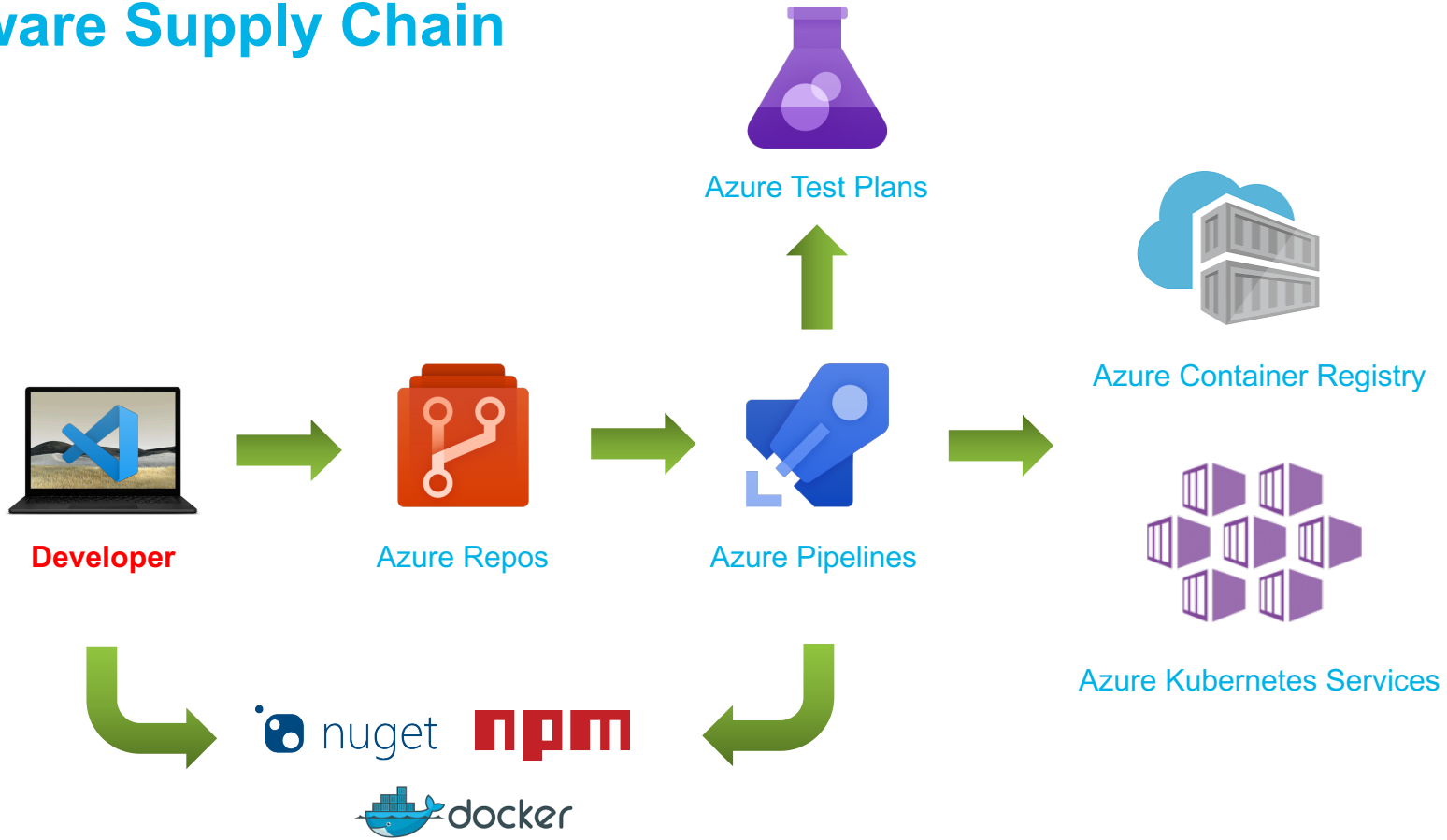
What's a Supply-Chain?



Software Supply Chain



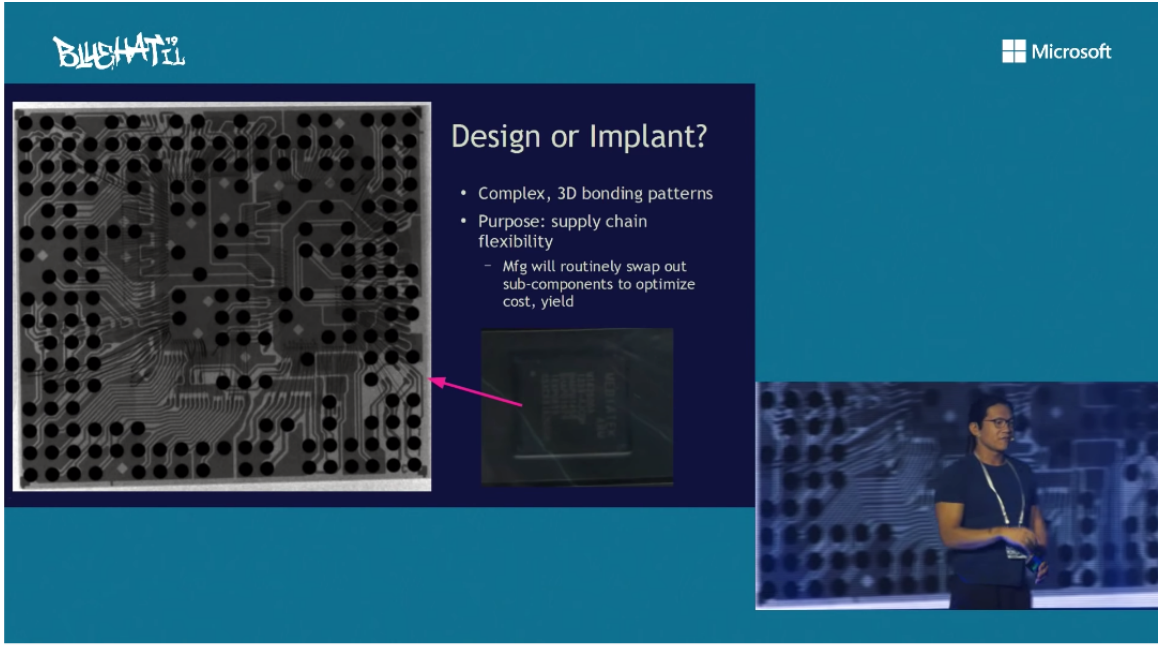
Software Supply Chain



Development Machine

- Secure Boot & Trusted Platform Module (TPM)
- Encrypt disk, harden operating system install updates
- But can you trust the hardware?

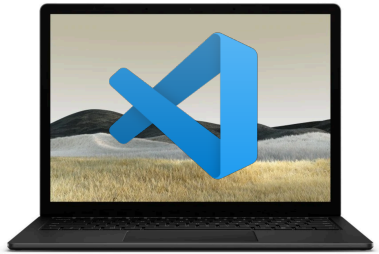
Hacking Hardware



Development Machine

- Installs on machine – HomeBrew on Mac
- `/bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/master/install.sh)"`

Development Machine



- Installs on machine – Chocolately on Windows

Chocolatey Install:

Individual | Organization

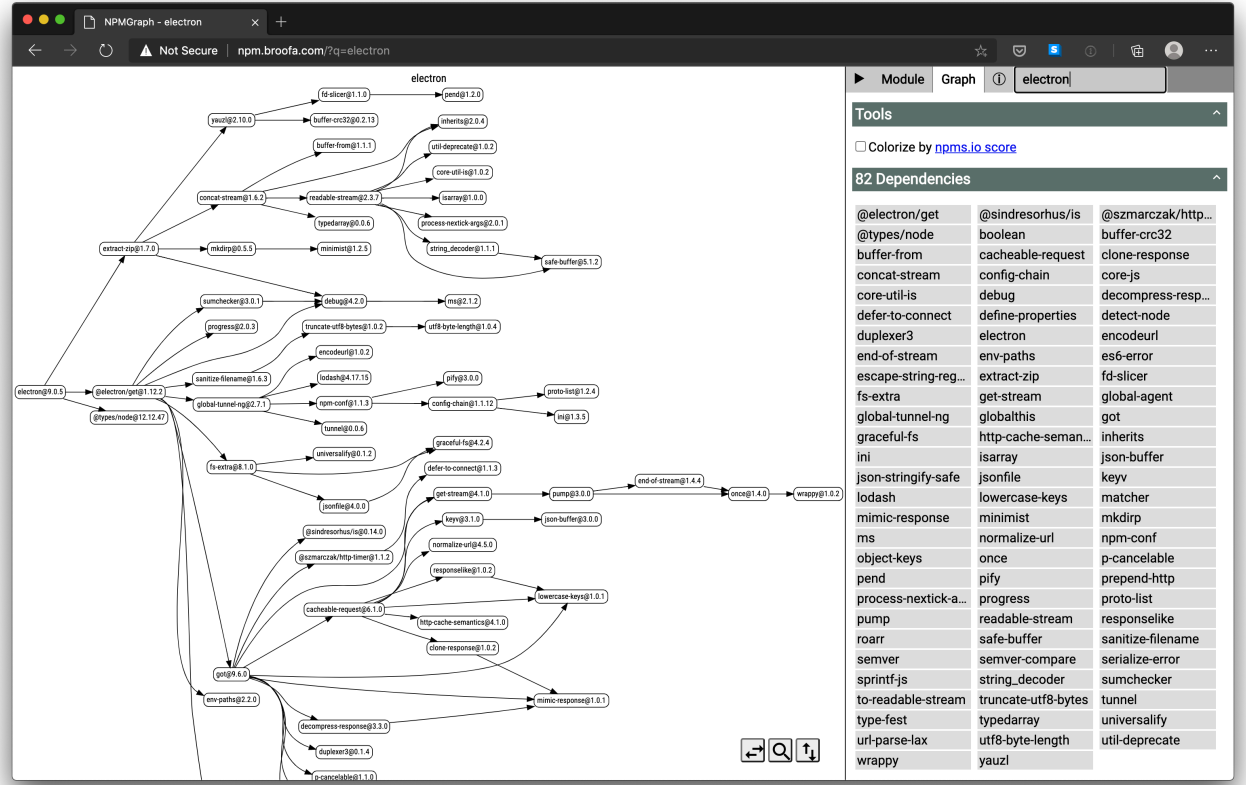
1. First, ensure that you are using an ***administrative shell*** - you can also install as a non-admin, check out **Non-Administrative Installation**.

2. Install with powershell.exe

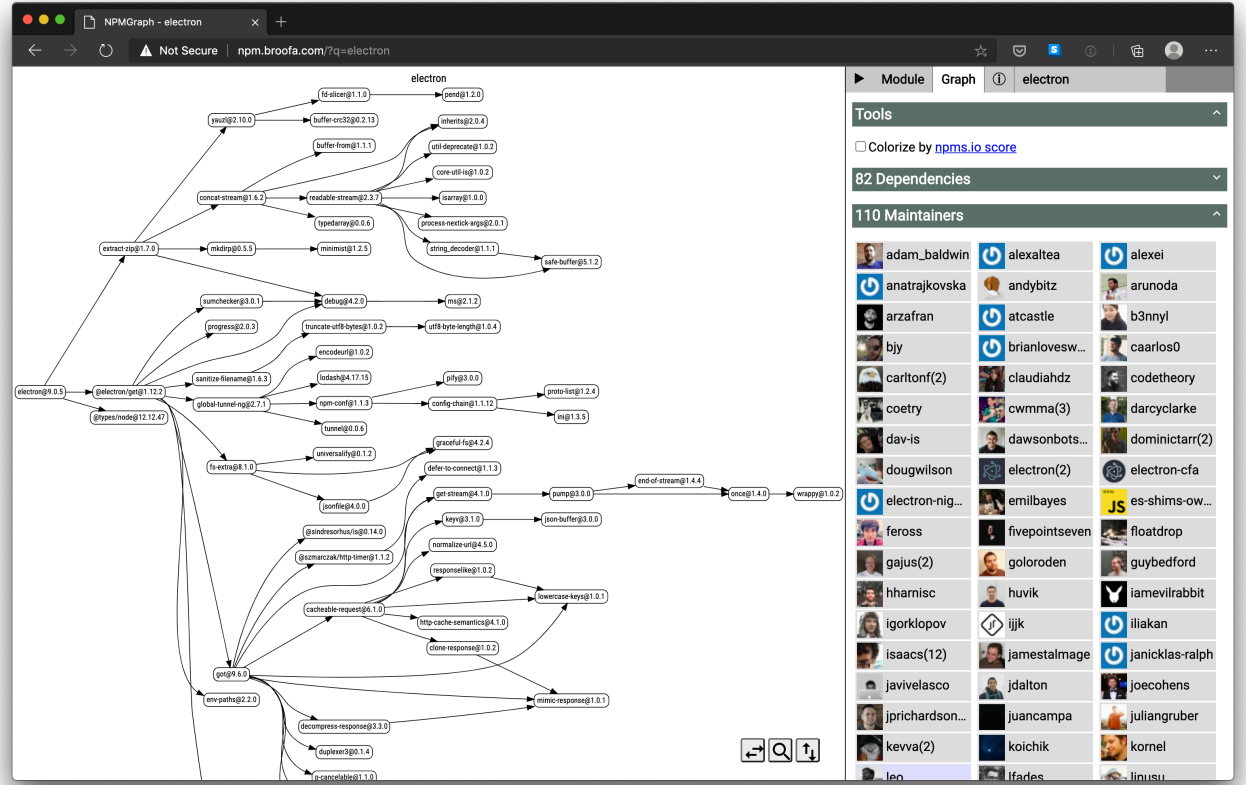
> **NOTE:** Please inspect **https://chocolatey.org/install.ps1** prior to running any of these scripts to ensure safety. We already know it's safe, but you should verify the security and contents of ***any*** script from the internet you are not familiar with. All of these scripts download a remote PowerShell script and execute it on your machine. We take security very seriously. **Learn more about our security protocols**.

Octopus Scanner - NetBeans

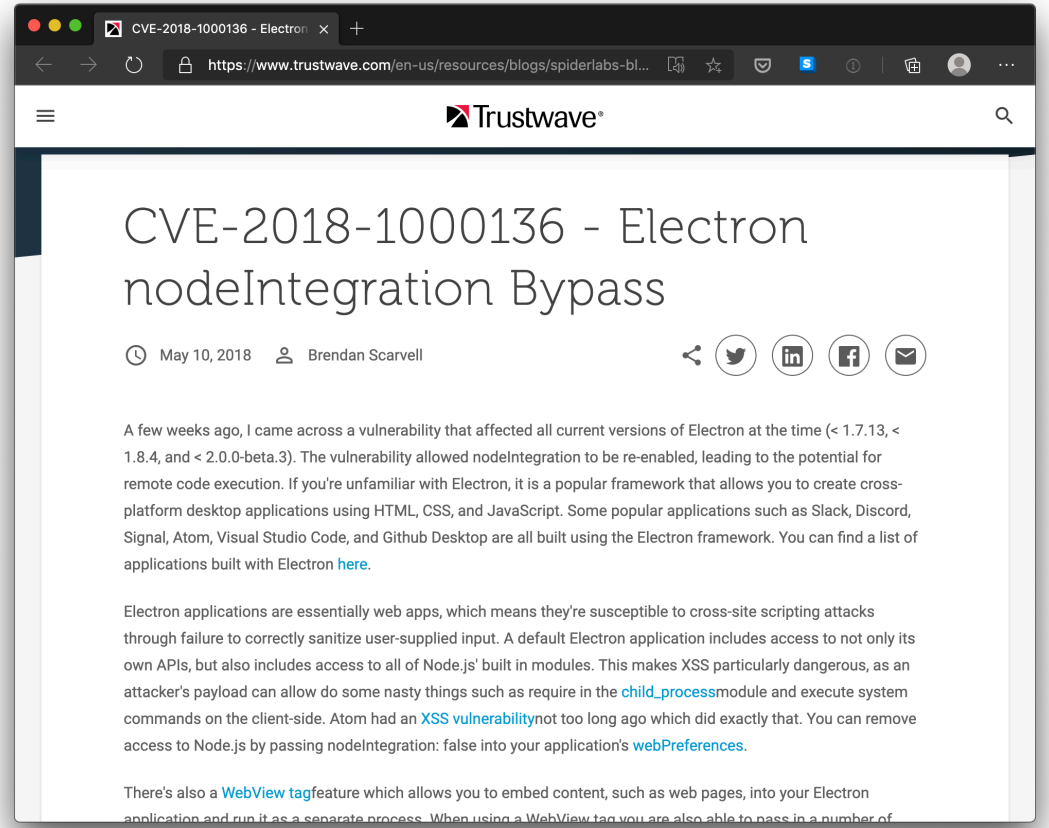
Visual Studio Code



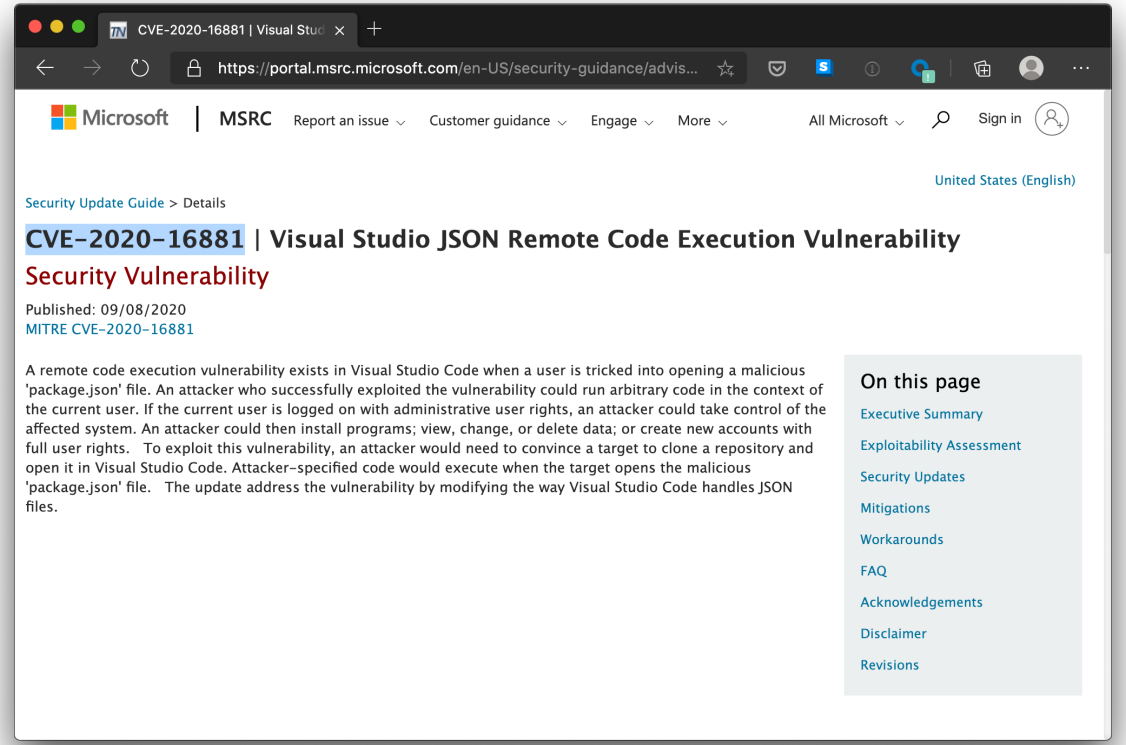
Visual Studio Code



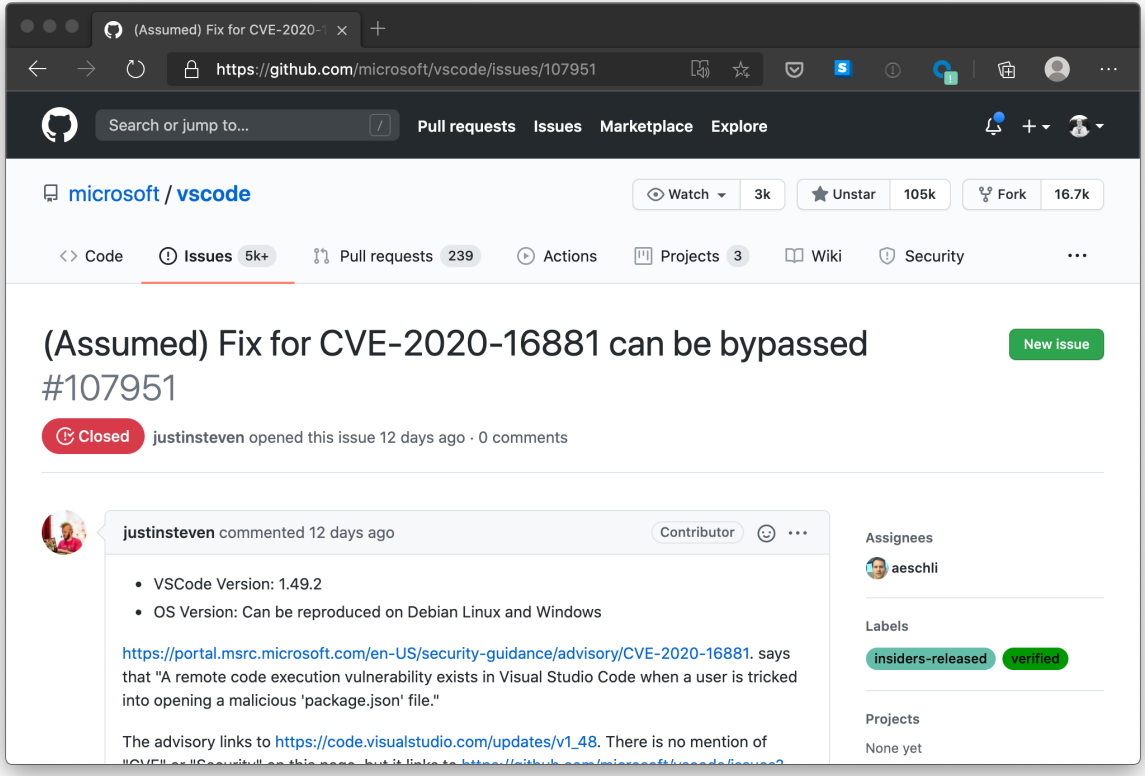
Visual Studio Code



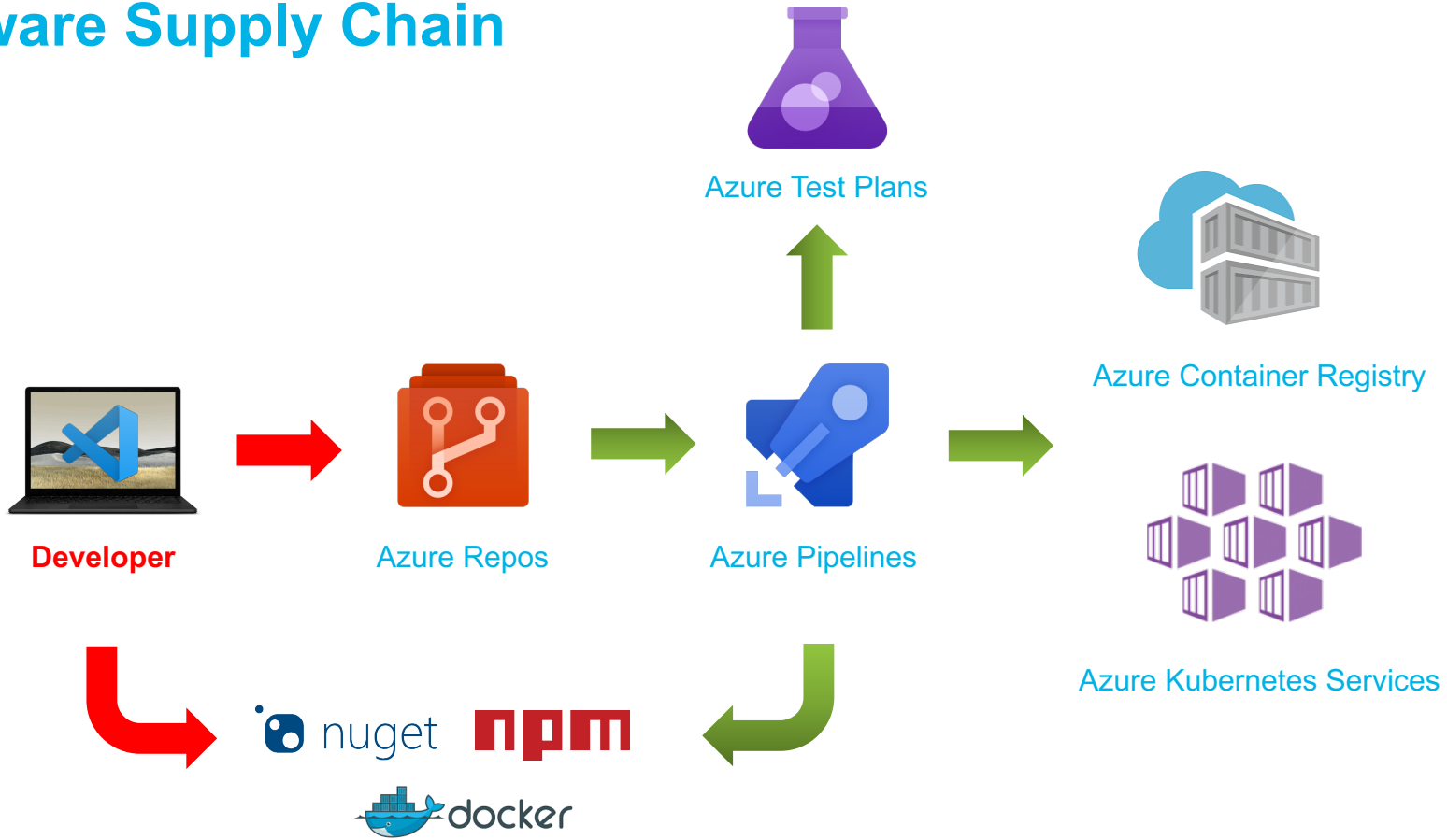
Visual Studio Code



Visual Studio Code



Software Supply Chain



Development Machine

- Package manager e.g. NuGet / NPM
- Transport-Layer Security (TLS)
  - Root Authority Trust
  - Downgrade, TLS 1.0 – 1.1 deprecated on NuGet
- Domain Name Service (DNS)
  - DNSSEC → NuGet.org and GitHub.com don’t support it

Canonical GitHub Account

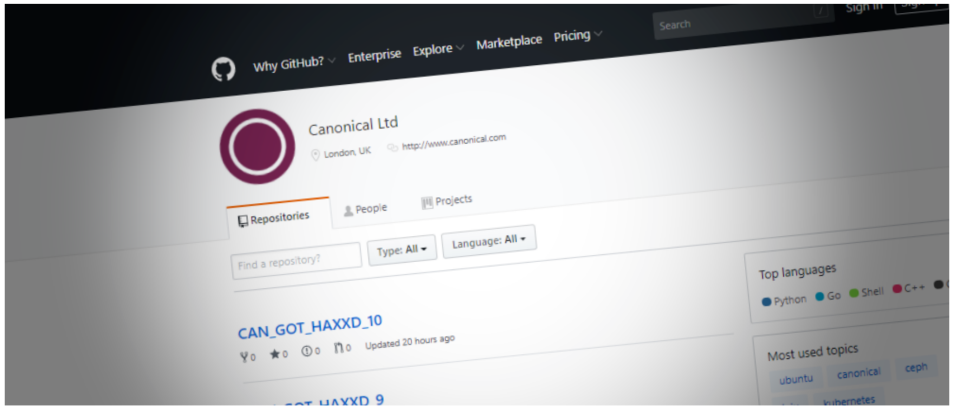
ZDNet | MENU | EU

MUST READ: Windows 10 critical process failure: Microsoft admits June updates are triggering reboots

Canonical GitHub account hacked, Ubuntu source code safe

Ubuntu source code appears to be safe; however Canonical is investigating.

By Catalin Cimpanu for Zero Day | July 7, 2019 -- 10:38 GMT (11:38 BST) | Topic: Security



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Microsoft GitHub Account

threatpost

Search

Podcast: Shifting Cloud Security Left With Infrastructure-as-C

Hackers Breach 3.5 Million MobiFriends Dating App Credentials

Report: Microsoft's GitHub Account Gets Hacked

The Shiny Hunters hacking group said it stole 500 GB of data from the tech giant's repositories on the developer platform, which it owns.

Author:
Elizabeth Montalbano
May 8, 2020 / 11:36 am

INFOSEC INSIDER

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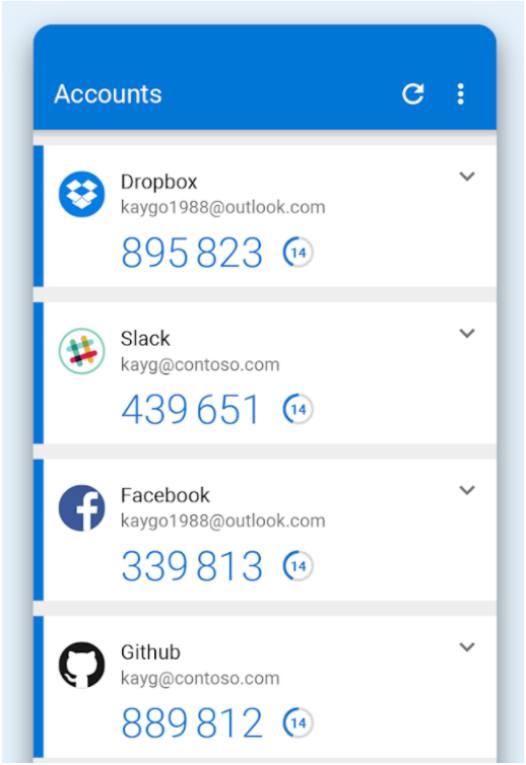
Use MFA on source-repository



GIT Commit Signing

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Code Issues 5,000+ Pull requests 271 Discussions Projects 46 Wiki Security ...

Branch: master

Commits on May 20, 2020

Merge pull request #44257 from 333fred/test ...
jaredpar committed on 21 May ✗ Verified 64d1878

Commits on May 5, 2020

Merge pull request #43954 from jaredpar/maintain-perf ...
jaredpar committed on 5 May ✗ Verified ca0a72f

This commit was created on GitHub.com and signed with a verified signature using GitHub's key.

GPG key ID: 4AEE18F83AFDEB23
Learn about signing commits

Commits on May 4, 2020

Enforce analyzer consistency in our builds ...
jaredpar committed on 4 May ✓ 8c74

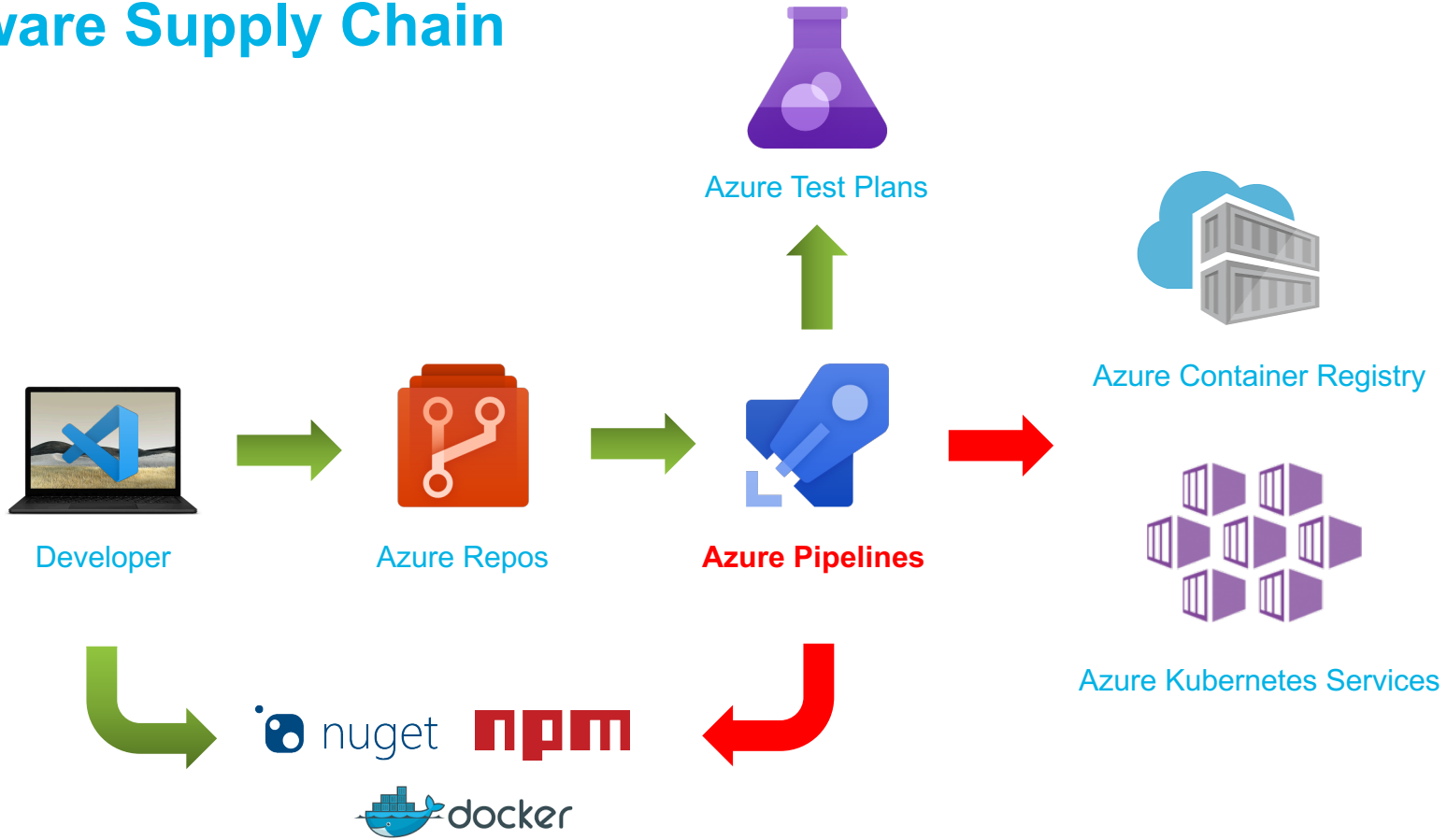
Commits on Apr 30, 2020

Move MS.CA.VisualBasic to be multi-targeted (#43805) ...
jaredpar committed on 30 Apr ✗ Verified f77d925

EvenStream NPM

- November 2018
- Is transitive dependency of 2000 other libraries

Software Supply Chain



Build / Deployment

- What about hardware? Vendor trust?
- TLS issues?
- Compromised Docker Images
    - Two-Factor authentication in beta
- Build Server can be compromised

Twilio SDK

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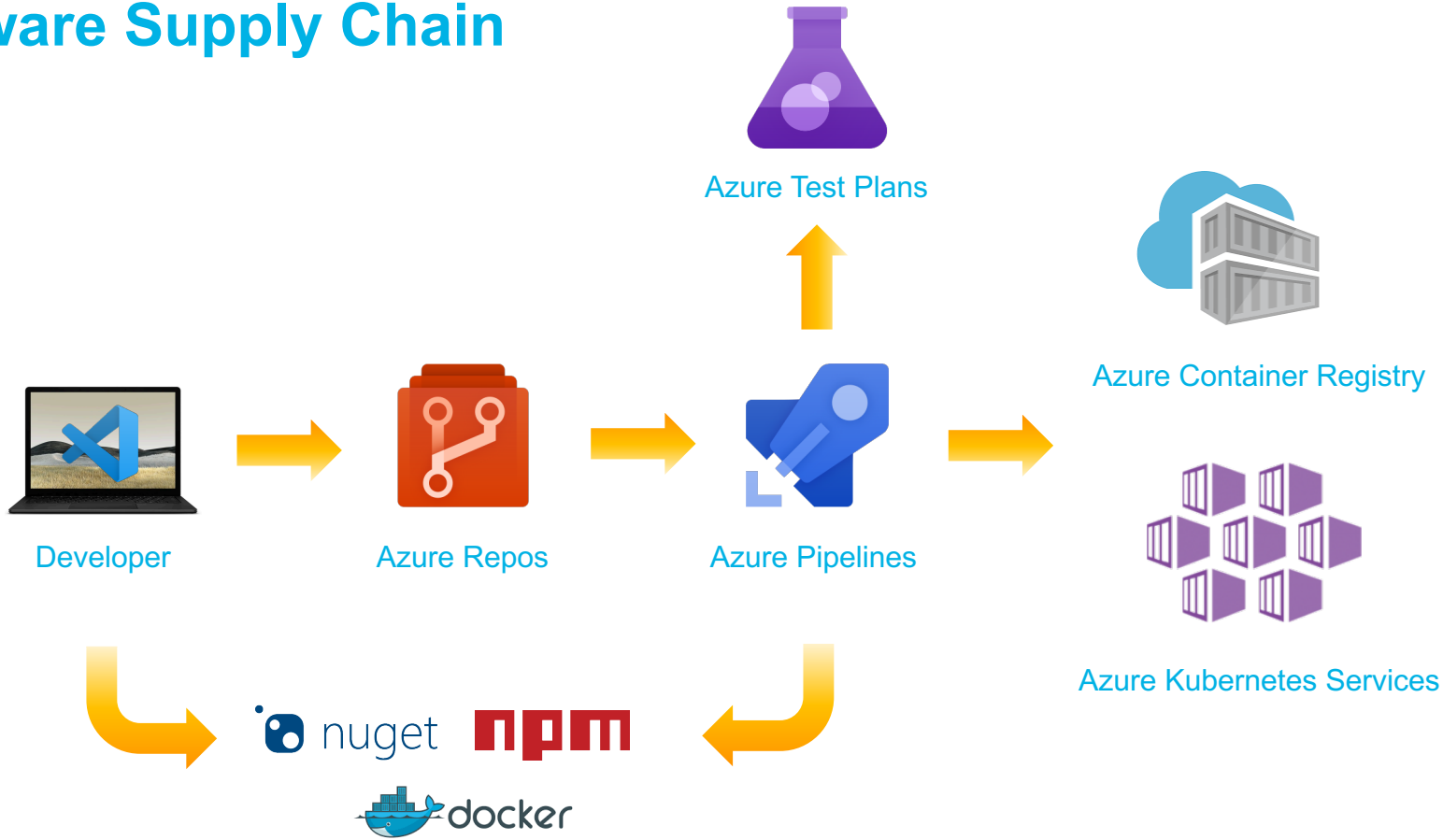
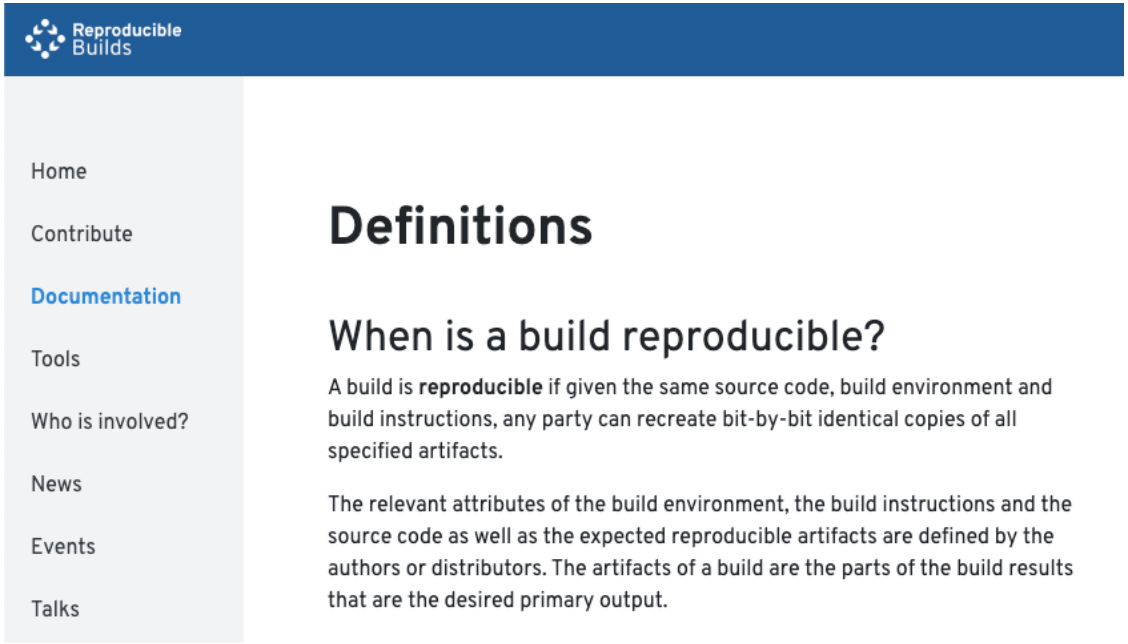
Webmin Backdoor

Software Supply Chain



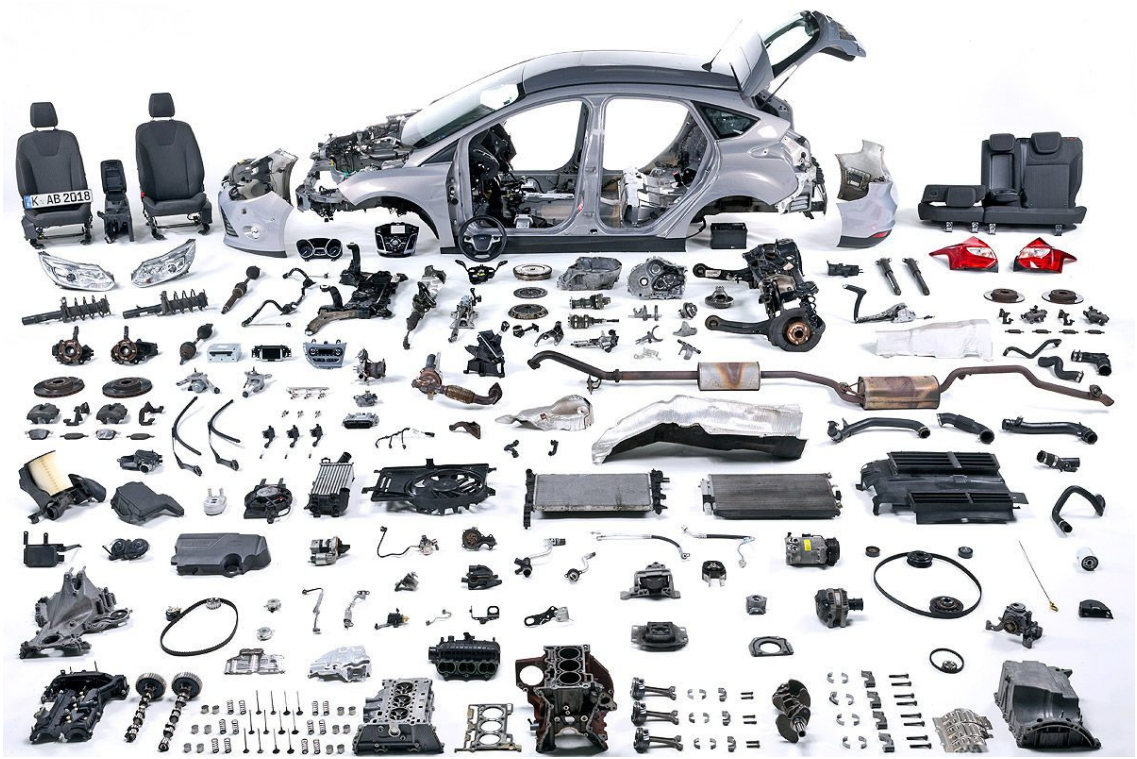
Reproducible/Deterministic Builds



Reproducable/Deterministic Builds

- Roslyn v1.1 started supporting some kind of determinism on how items are emited
- Given same inputs, the compiled output will always be deterministic
- Inputs can be found in Roslyn compiler docs ‘Deterministic Inputs’
  - Current full directory path influences PDB location embedded in PE Header
- PE Header has values that need MSBuild **`/deterministic`** flag set (default .NET Core)
  - MVID: GUID identifying the PE which will be generated by compiler
  - PDB ID: GUID identifying the generated PDB matching PDB generated on each build
  - Date / Time stamp: Seconds since epoch, calculated on every build

Automotive Industry



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 KIA

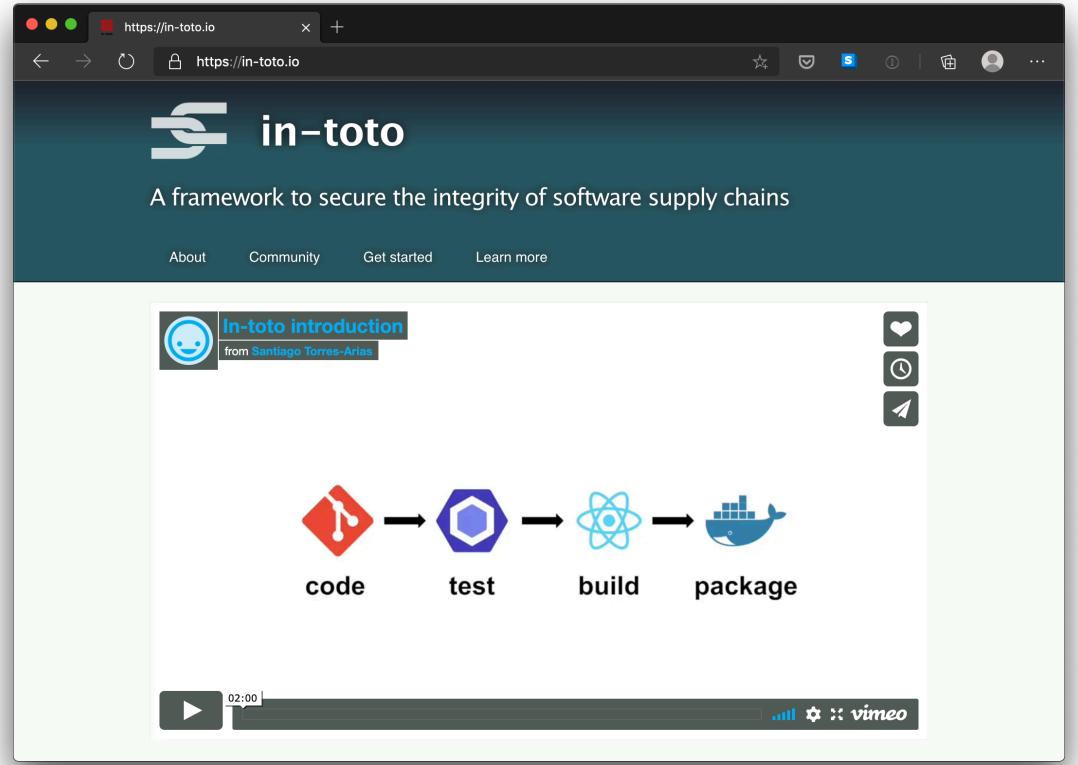
Ford Manufacturing

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

Software Bill of Materials (SBOM) & Policy

- 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?
- CycloneDX – Lightweight SBOM with dependency graph
- National Telecommunications and Information Administration https://www.ntia.gov/SBOM

In-Toto



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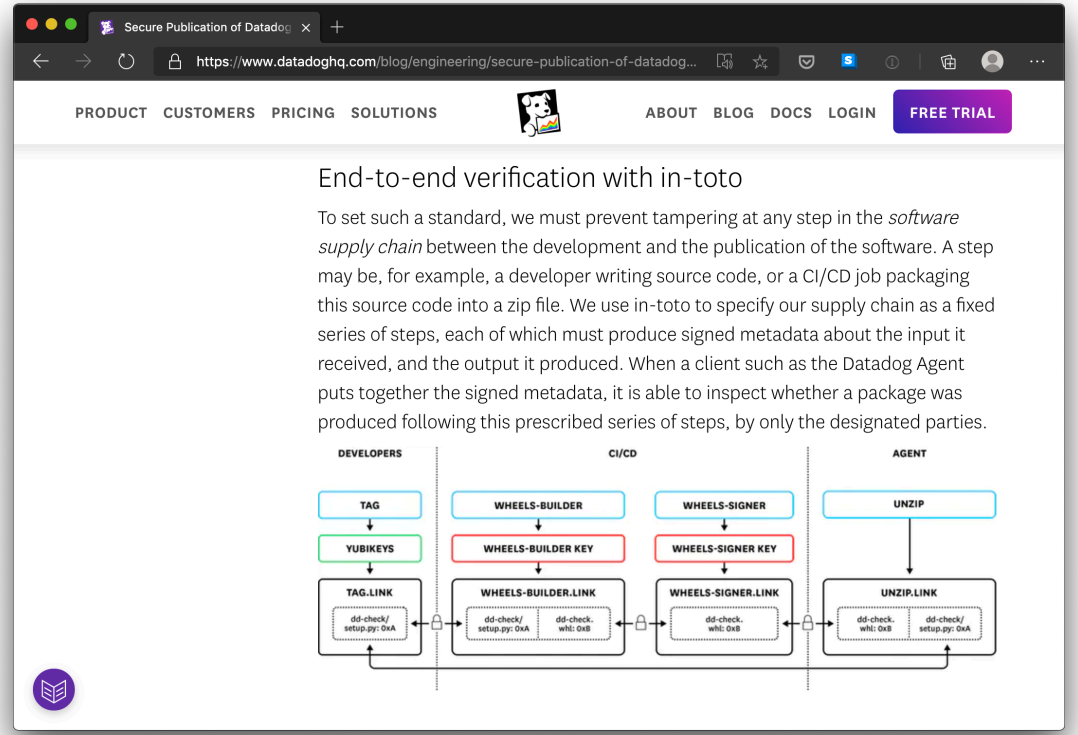
In-Toto – Demo - Terminology

- **Functionaries** that are identified by public key our supply chain.
  Niels (Project-Owner), Aimee (Developer) and Noud (Packager)
- **Project-Owner** defines a (**Supply Chain) Layout** that describes **what** happens and by **who** and what the produced **Materials** and **Byproducts** are.
- **Link** metadata is output of executed step in the **Layout**
  Materials are input, **Products** are output and can be used as **Materials** in later steps
- With executing the **Verification** all end-products and associated **Link** metadata will be verified

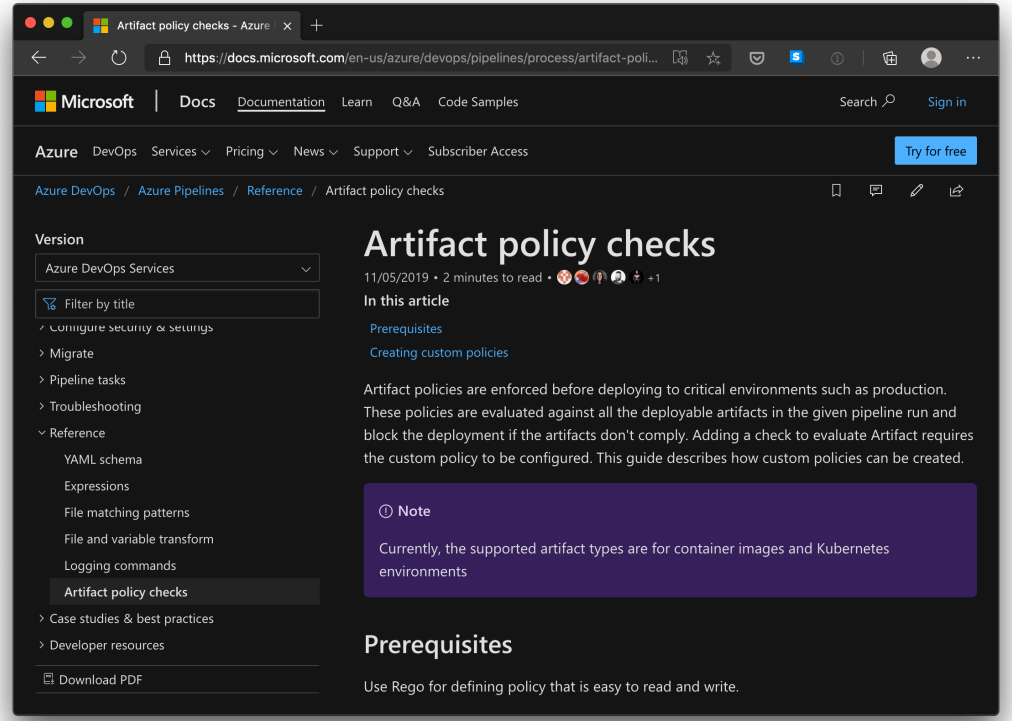
DataDog & In-Toto



Grafeas and Kritis by Google

- Grafeas – Component Metadata API
  - Container Analysis API on Google Cloud Platform
- Kritis – Deployment Authorization for Kubernetes Applications
  - Binary Authorization on Google Cloud Platform

Azure Pipelines Artifact Policy



Conclusion

- Be aware of your own (and other used) software supply chain(s).
- Know what you're consuming and pulling into software projects.
- Use MFA on all accounts!
- Integrate security into your software lifecycle.
- Learn more on Software Bill of Materials (SBOM).

Thanks! Questions?

VERACODE

You change the world, we'll secure it.

https://github.com/nielstanis/codecamp2020

ntanis at veracode.com

@nielstanis on Twitter