
HOPE
X V


Security
in Development
Security

Introduction to the workshop

MODUS CREATE

- Team Intro
  - Andy Dennis - VP Platform and Cloud
  - Bill Reyor - Director of Security
  - Sean Clayton - Security Architect
- What is Modus Create?
- Course structure
  - PART 1 (IDE / LOCAL SECURITY)
  - BREAK (15 Minutes)
  - PART 2 (PIPELINES SECURITY)

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A Quick Class Survey

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Have you ever?

> Cloned a repository with Git?
> Merged a pull request
> Exploited an SQL injection vulnerability? (or had to fix one)

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If you need help raise your hand


Getting
Setup

Getting setup - The tools

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You will need

- **Git**
  https://git-scm.com/book/en/v2/Getting-Started-Installing-Git
- **IDE (if you don't already)**
  https://code.visualstudio.com/
- **GitHub account**
  https://www.github.com
- **SonarLint/SonarCloud**
  https://docs.sonarsource.com/sonarcloud/improving/sonarlint/
- **CodeQL**
  https://codeql.github.com/
- **Optional: Copilot**
  https://github.com/features/copilot

During the course we will use

- **AWS git-secrets**
  https://github.com/awslabs/git-secrets
- **Talisman**
  https://github.com/thoughtworks/talisman
- **BFG**
  https://rtyley.github.io/bfg-repo-cleaner/

Getting setup - repository

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We've setup a repository for you to work with during this course.

> **Located at Modus Create OSPO (Tweag) repository**
> https://github.com/tweag/hope-sec-dev-workshop-2024

> **Fork it** 🍴
> https://docs.github.com/en/pull-requests/collaborating-with-pull-requests/working-with-forks/fork-a-repo

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Fork It!

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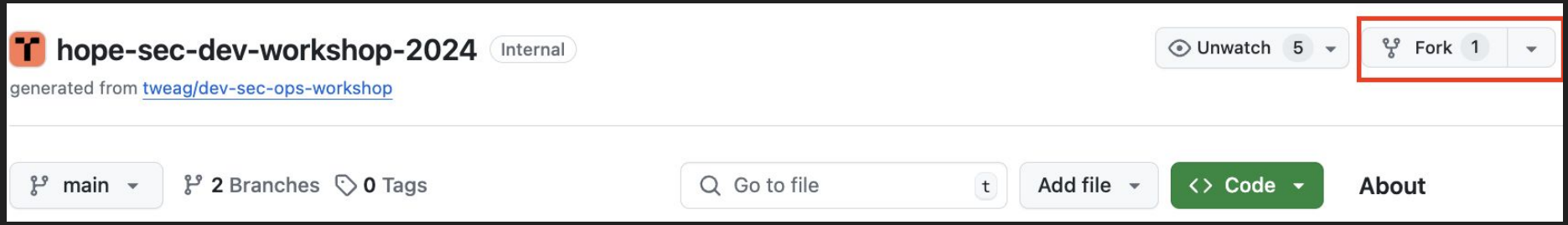

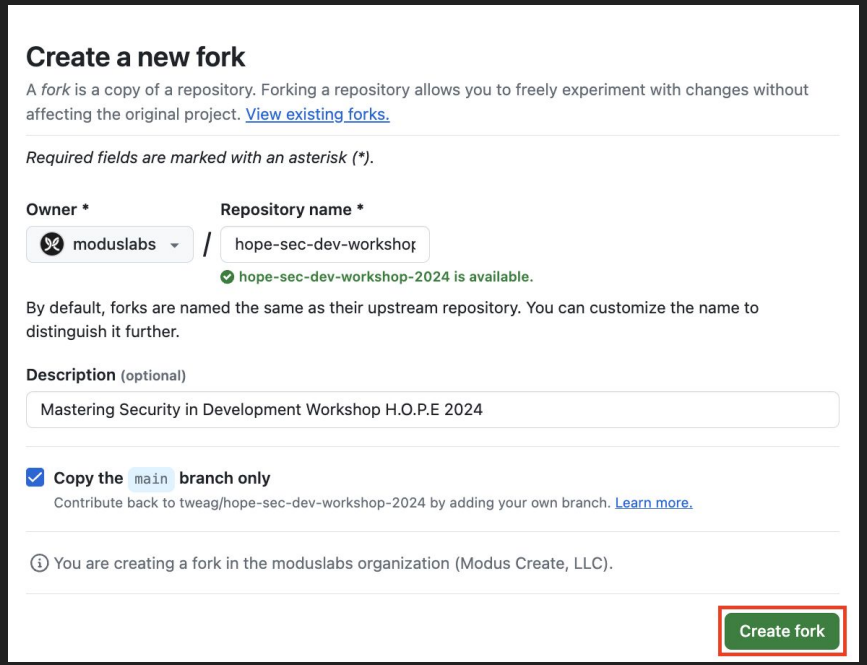

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A few words about Code Spaces

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Add an SSH key to your Github account

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1. **Generate a new SSH key pair on your local machine if you don't have one**

```
> ssh-keygen -t ed25519 -C "your_email@example.com"
```

2. **Copy the public key file (e.g. id_ed25519.pub) to your clipboard**

```
> clip < ~/.ssh/id_ed25519.pub     # On Windows

> pbcopy < ~/.ssh/id_ed25519.pub   # On macOS

> cat ~/.ssh/id_ed25519.pub        # On Linux, then manually copy
```

3. **Login to your github account and goto**

   A. Settings -> Access -> SSH & GPG keys -> New SSH key

   B. Enter a title for the key, then paste the public key we generated in step 2.

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Follow Along with the Demos

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The lab instructions are divided into two parts, each with its own README file:

Part 1

1. Navigate to the **part1** directory in the main repository
2. Open the README.md file
3. Follow the step-by-step instructions to complete the Part 1 demo

Part 2

1. Navigate to the **part2** directory in the main repository
2. Open the README.md file
3. Follow the step-by-step instructions to complete the Part 2 demo

The **README** files contain detailed guidance, code snippets, and examples to help you follow along with the live demos during the workshop.

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What is DevSecOps?

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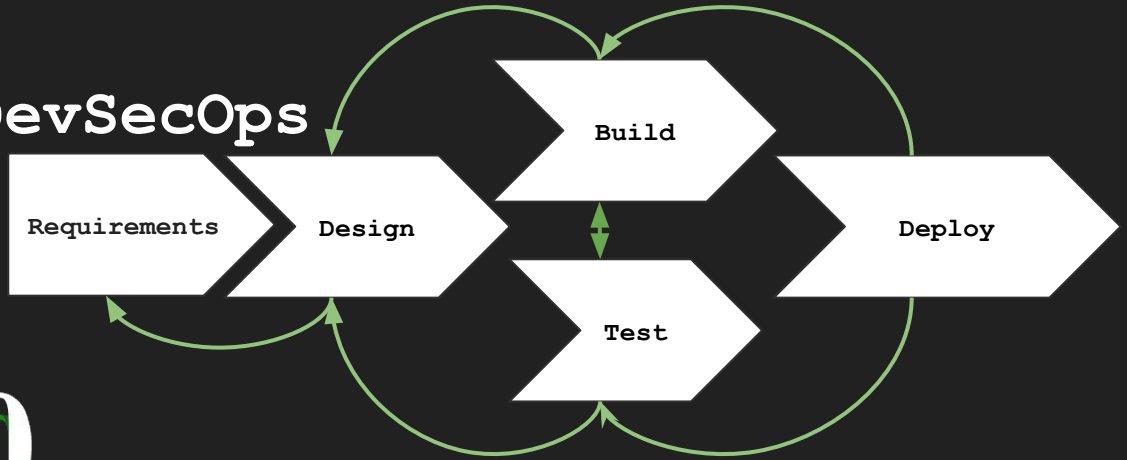
Traditional

DevSecOps



Security feedback loops

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What is Shifting Left?

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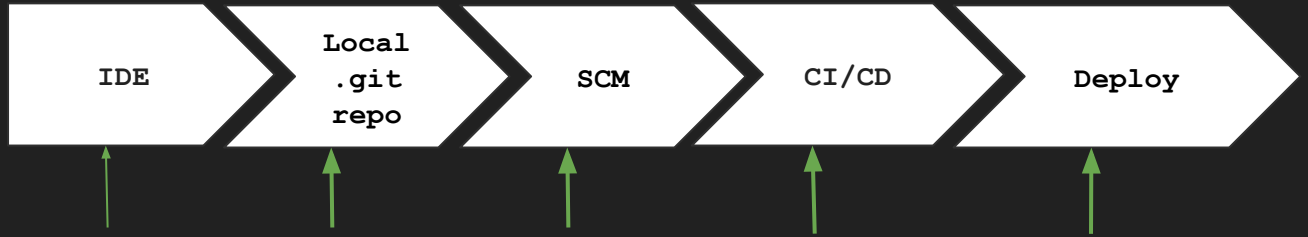

Security is constantly pushed further left in SDLC

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Part 1

Local Security
IDEs and CodeSpace

Introduction

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The first part of the course is dedicated to integrating security into your local development environment.

This covers:

> Security integration into the IDE
> Ignore files and clean up
> Pre-commit hooks

Security in the IDE

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IDE plugins

- Acts as a first line of defense
- Catch errors in the code
- Detect secrets in the code e.g. passwords and API keys
- Uncover vulnerabilities like XSS and code that allows for SQL Injections

SonarLint

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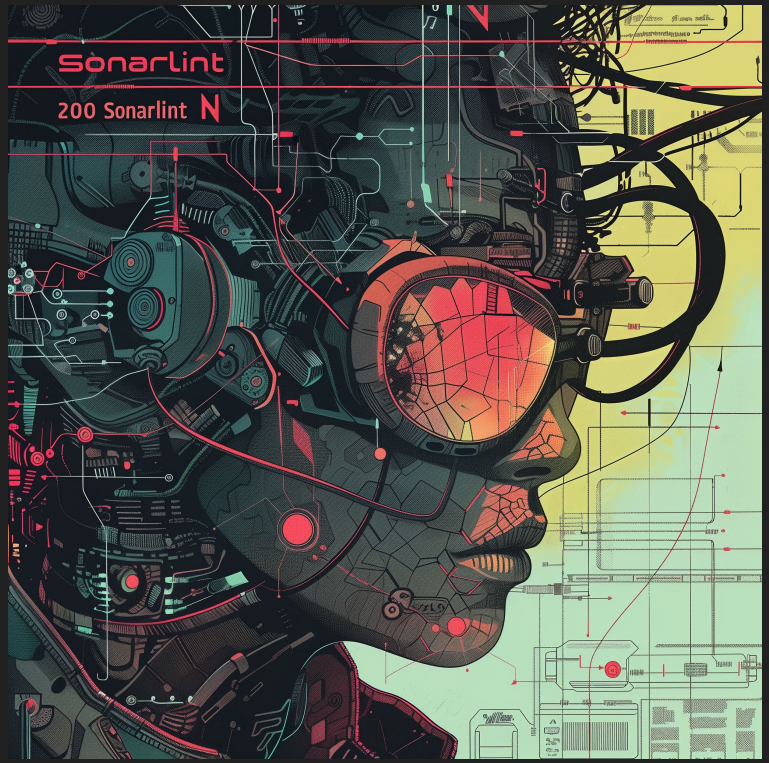

Setup instructions

SonarLint works with a number of popular IDEs.

1. Follow the steps for your IDE to install it.
2. Setup a SonarCloud account via your GitHub user if you don't have one

(See README in REPO)

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SonarLint - Rules

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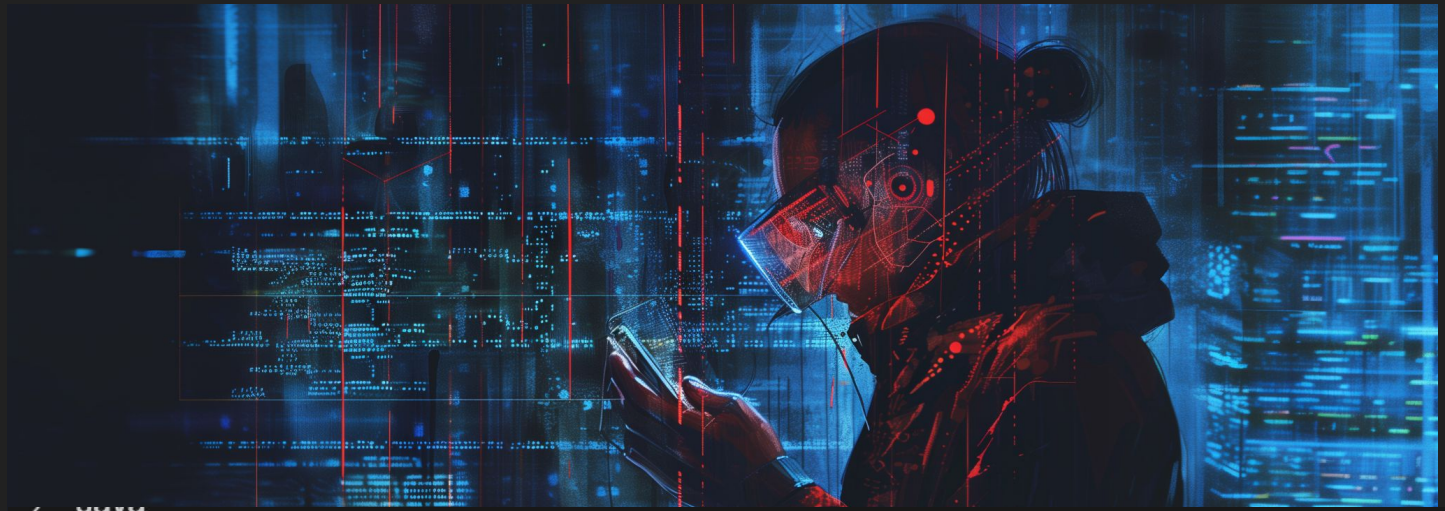

JavaScript

__proto__ property should not be used on

"===" and "!==" should be used instead of "==" and "!=" on

"alert(...)" should not be used on

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Demo 1 - Sonarlint

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SonarLint

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We can see the plugin identified:

- Use of the alert statement
- Useless variable assignments
- Use of the debugger statement
- Use of var

Some of these have security implications!

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Install the plugin now into your IDE:

https://marketplace.visualstudio.com/items?itemName=github.vscode-codeql

Or if you would prefer to use it from the CLI follow the instructions here:

https://docs.github.com/en/code-security/codeql-cli/getting-started-with-the-codeql-cli/setting-up-the-codeql-cli

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Demo 2 - CodeQL

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CodeQL

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- Execute CodeQL IDE
- Detects Coding Issues
- You can write custom detections
- Deploy at scale (used in research)

How is it different from a typical SAST tool?

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GitHub Copilot

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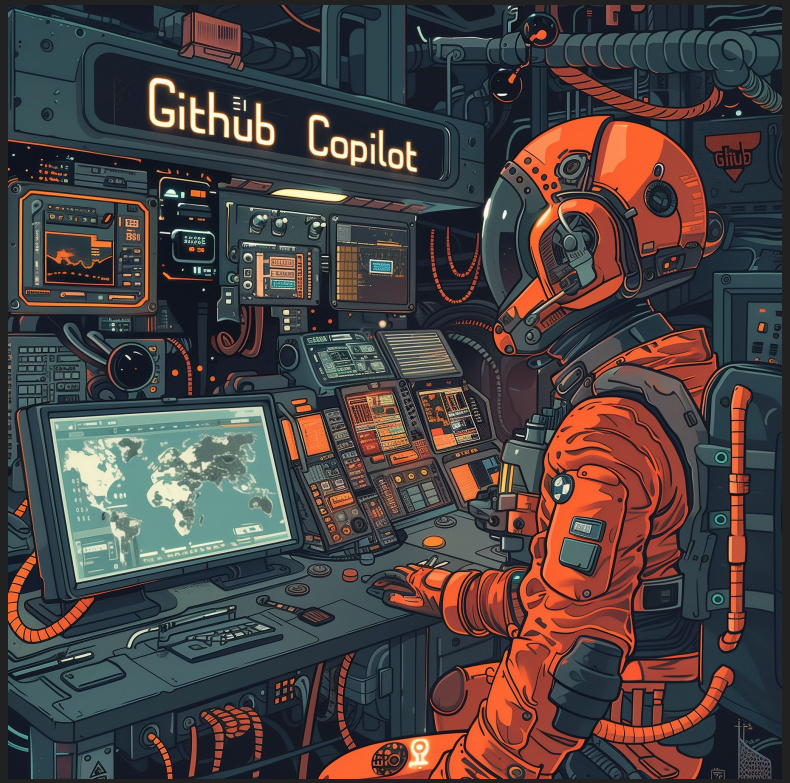

GitHub Copilot

Used 1 reference >

To prevent SQL injection, you should use parameterized queries or prepared statements. This ensures that user input is always treated as literal data and not part of the SQL command. Here's how you can modify your `saveToDatabase` method to use parameterized queries:

```
static saveToDatabase(blogPost) {
    const sql = `INSERT INTO blog_posts (title, content, author) VALUES (?, ?, ?
    // Pretend database call
    console.log(`Executing SQL: ${sql}`);
    var db = window.openDatabase("sqlcachedb", "1.0", "Cache result", 200000);
    db.transaction(function(tx){
        tx.executeSql(sql, [blogPost.title, blogPost.content, blogPost.author],
            console.log("Data inserted successfully");
        }, function(tx, error){
            console.log("Error occurred while inserting data");
        });
    });
}
```

In this code, the `?` are placeholders for the actual values. The values are passed in as an array in the second argument to `executeSql`. This ensures that the values are properly escaped, preventing SQL injection attacks.

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Demo 3 - Github Copilot vs DuckDuckGo

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Pre-commit Hooks

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Pre-commit hooks

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- Scripts run before commiting
- Enforce code quality, catch issues
- Customizable, but can be skipped

One of the best ways to prevent secrets from being committed.

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Pre-commit hooks - key features

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Used to perform tasks like

- Quality enforcement
- Prevent commits with problems e.g. security vulnerabilities

Key features include

- Exist in the .git/hooks https://git-scm.com/docs/githooks
- Not transferred with the repo
- Can be bypassed (--no-verify flag)

AWS Git Secrets

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Let's open the readme, and follow along. We are now going to:

- Install the hook in the repo
- Register some patterns to block
- Run a manual scan
- Explore what blocking a commit looks like

Fire up your command line!

https://github.com/awslabs/git-secrets

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Demo 4 - Pre-commit hook

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Demo 5 - Talisman

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Talisman

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Suite of pre-commit hooks w/security

- **Download** https://github.com/thoughtworks/talisman

Features of Talisman

- **Overview of key features**

Exploring Talisman

- Switch to the **README** file
- Command line experiments

Talisman

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.gitignore

Using .gitignore files

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Pre-commit hooks are very handy for catching secrets and other code we do not want to push up to our repository.

How about if there are whole classes of file we want to avoid adding?

Well we can add an extra layer of defense using the **.gitignore** file.

The **.gitignore** file allows us to:

- Create an exclusion list of file types and directories so these are not tracked
- Apply fine grained controls over this exclusion list by adding to each repository
- Can be version controlled so every user inherits it. This is unlike the hooks we just explored

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Using .gitignore files

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Demo 6 - .gitignore

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Future project: Cleaning up secrets and files

BFG can be obtained from:

https://rtyley.github.io/bfg-repo-cleaner/

Remember to rename the file to bfg.jar (drop the version from it).

The bfg.jar is pre-installed in your workspace

The readme provides an example of how we can use BFG to:

- Remove certificates
- Remove files with passwords
- Remove specific strings (passwords, API keys) from files

Feel free to try this out in your own time.

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Part 1 wrap up

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Congratulations, you've now reached the end of **Part 1** and have a basic understanding of IDE plugins, pre-commit hooks and .gitignore files.

Some of the tools such as Talisman have many features we couldn't cover today. You may be interested in taking the time to dig into these after the course.

Let's take a short break, then we will move onto **Part 2**.

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Minute Break

Part 2

Security in the CI/CD pipeline

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Welcome to Part 2

In this section of the workshop we will cover:

- Secrets scanning
- Handling secrets in GitHub
- Detecting security vulnerabilities in the repository
- Vulnerable dependencies
- Static Analysis (SAST)
- Branch protection rules

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Secrets Scanning

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Secrets Scanning

We saw how we can detect secrets locally using git-secrets and Talisman.

We also saw how we can prevent them being committed via pre-commit hooks and .gitignore files.

We are now going to look how we can do this in GitHub, before looking more broadly at how to handle vulnerabilities.

Useful Documentation

- TruffleHog: https://github.com/trufflesecurity/trufflehog
- GitHub Secrets Scanning: https://docs.github.com/en/code-security/secret-scanning/about-secret-scanning
- Horusec: https://horusec.io/site/

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Demo 7 - Secrets Scanning

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Handling Secrets in GitHub

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Secrets in GitHub

So in summary some best practices for handling secrets in GitHub include:

- **Prepare** - use a secret manager (GitHub has one)
- **Prevent** - git-secrets, and the other tools we saw with the IDE/Pre-commit hooks
- **Detect** - pipeline checks, we can also use TruffleHog
- **Respond** - BFG / Git-filter

Let’s look at secrets storage in GitHub quickly

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Demo 8 - Handling Secrets

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Detecting Security Vulnerabilities

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Detecting security vulnerabilities

Multiple tools for detecting vulnerabilities.

Secrets scanning - pattern/entropy detection

SAST - Static Analysis Security Testing

SCA - Software Composition Analysis

SBOMs - Software Bills of Materials

GitHub has the following features:

> SECURITY.md (Provide instructions for how to report a security vulnerability)
> Secrets scanning (which we just saw)
> Dependency analysis (Dependabot)
> CodeQL(SAST)via Actions
> GitHub SBOM

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Dependency Vulnerabilities

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Dependency vulnerabilities

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GitHub supports detection of vulnerable dependencies through **Dependabot**.

This tool allows us to check files such as package.json and pom.xml to understand if our application is including vulnerable components

Features include:

- Detect vulnerable and out of date packages
- Create automatic pull requests to remediate issues
- List vulnerabilities associated with the packages

Let's take a look at an example of it in action.

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Demo 9 - Dependencies

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Static Analysis

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Static Analysis (SAST)

GitHub comes integrated with CodeQL which we experimented with in Part 1. This supports static analysis security testing of a number of programming languages via Actions.

CodeQL is free to use for public repositories.

You can learn more here:

https://docs.github.com/en/code-security/code-scanning/introduction-to-code-scanning/about-code-scanning

Features:

- Multiple language support (Java, JS, Ruby etc.)
- Highlights security vulnerabilities
- Allows for custom queries/query packs
- Execute as a gating mechanism in your CI/CD pipeline

Demo time!

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Demo 10 - SAST

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Branch Protection Rules

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Branch protection rules

Branch protection rules can be used to prevent code being merged until it passess all the relevant tests.

It also allows us to lock down who can commit to the branch.

Features include:

- Block merges until security checks are passed
- Lockdown branch ownership via **CODEOWNERS** files
- Require multiple individuals to approved a pull request before it can be merged

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Demo 11 - Branch Protection

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SBOMs

SBOM stands for Software Bill of Materials.

It’s a great way of getting a snapshot of all the components in your application.

GitHub supports SBOMs out of the box for repositories stored there.

Features of SBOM include:

- CycloneDX format https://cyclonedx.org/
- SPDX format https://spdx.dev/
- VEX https://www.cisa.gov/sites/default/files/2023-01/VEX_Use_Cases_Aprill2022.pdf

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Demo 12 - SBOMS

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Conclusion

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Recap

In this workshop we covered a number of areas related to mastering security in development.

- Security in the IDE
- Pre-commit hooks
- Secrets scanning
- SAST
- Dependency scanning
- Branch protection rules
- SBOMS

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Next Steps

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After this workshop you can take the repository you forked and use it as a starting to point for your own projects.

Some ideas for other areas to explore are listed on the right.

- Try integrating with Infrastructure-as-Code. Check out Checkov: https://www.checkov.io/
- Experiment with other third party tooling for SAST. For example, the open source Horusec: https://github.com/ZupIT/horusec
- Look into container scanning: https://github.com/quay/clair

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Thanks for attending!

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Thank you for attending the workshop today. A big thank you to the HOPE Staff and volunteers as well.

Questions?

andy.dennis@moduscreate.com

Remember to check out:

https://moduscreate.com/careers/

For our latest job posts!

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