Welcome to this Training Session with Theiagen Genomics

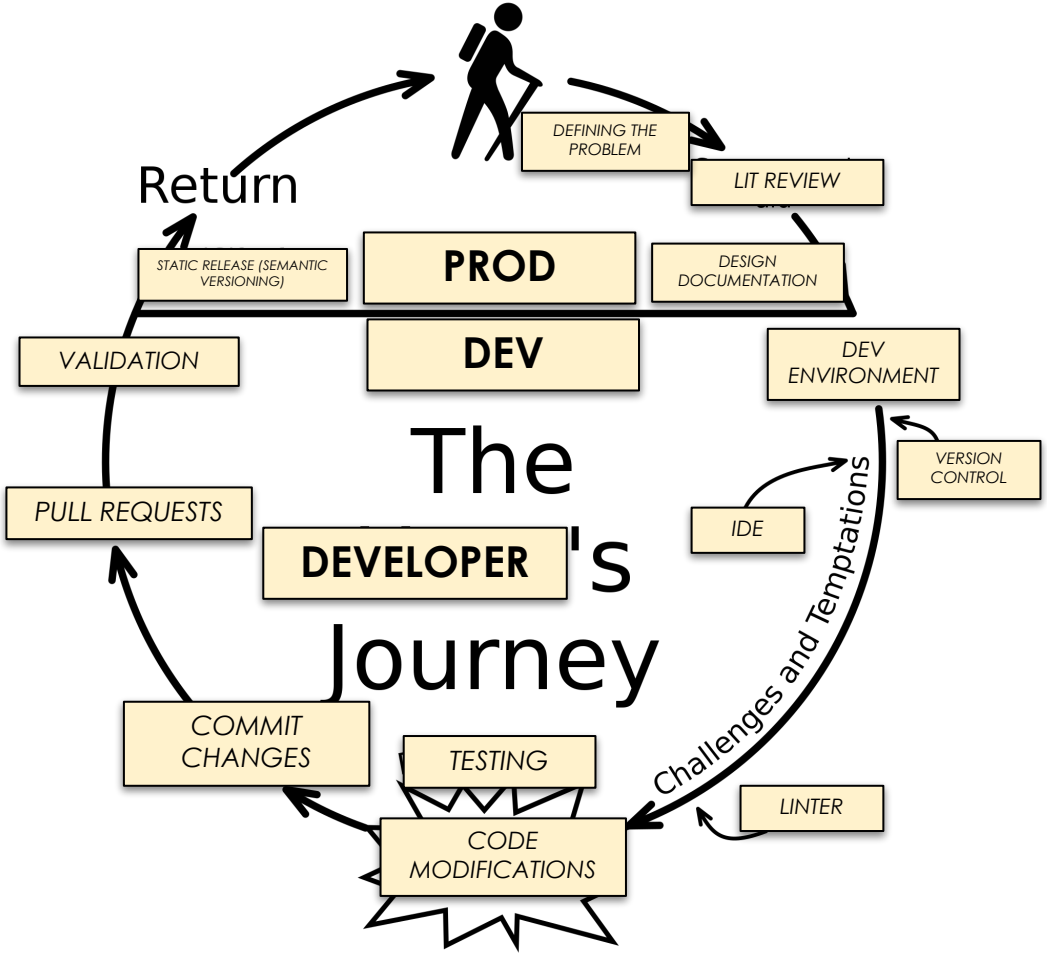
We will soon be getting started

Software Development Practices for Public Health Bioinformatics

Week 03: Bringing Changes into Production

Western Region WFD Offering Provided by the
Washington State Department of Health in Collaboration with Theiagen Genomics

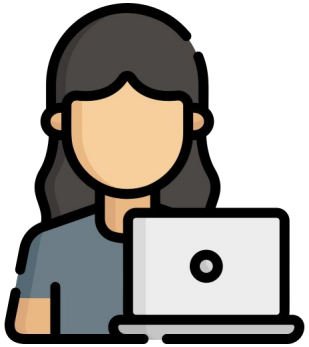
Week 1-2 Recap

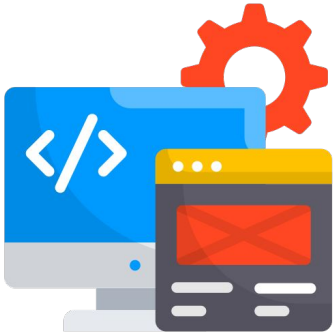


Byrne, C. (2017). The Hero's Journey. Wikipedia https://en.wikipedia.org/wiki/File:Heroesjourney.svg

The Developer's Journey

Framework where a protagonist **enters into their dev environment**, faces challenges, gains new wisdom, and **brings changes into production**.

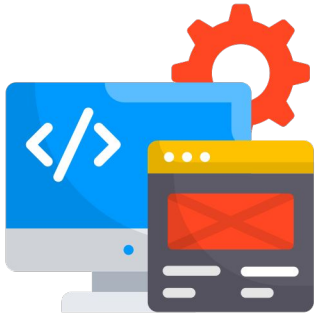




Software Development Practices

Developer's Journey

1. **Design Document**
   a. Clearly defining the problem and the proposed solution
2. **Development Environment**
   a. Separate from production
   b. Text editors and IDE's
3. **Making Source Code Modifications**
   a. Small interactive changes (version control)
4. **Peer Review**
   a. Collaborative development teams
5. **Bringing Changes into Production**
   a. Final testing
   b. Static version releases



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Git Fundamentals

Summary

- Git is **essential for managing code changes** and facilitating collaboration in software development
- Mastering Git fundamentals ensures efficient and effective version control; these include:
  - Git repositories, forks, branches, staging, commits, push, pull, and version releases

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Design Document

Summary

- The design document is a vital tool that **defines the project's problem and solution**, informed by literature review and community feedback.
  - It ensures **clear communication** and alignment among stakeholders.

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Development Environment

Summary

- Separating development and production environments is crucial to **mitigate risks**
  - Strategies such as using **separate compute environments**, **version control systems**, and **mimicking prod environment configurations** help achieve this separation effectively.
- IDEs **can enhance development productivity** with features like code navigation, active error catching, and version control integration

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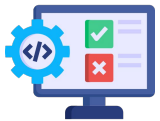
Making Source Code Modifications

Summary

- When making changes, always **refer to your design document**
  - Break objectives down into smaller tasks
  - Update as new insights are learned
- **Small iterative changes** help to reduce errors while developing
  - Test **early and often**!



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Peer Review

Summary

- Teamwork makes the dream work!
  - Dev teams help to **improve code quality** and promote reproducible, transparent, and interoperable software
- A Pull request (PR) is a **standard method to submit contributions** to a codebase
  - Standardizes the collaborative dev process

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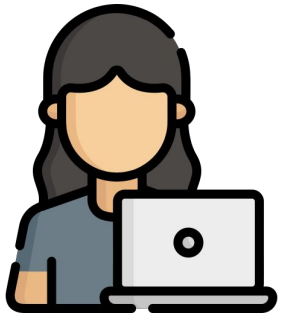

Week 3 Focus

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5. Bringing Changes into Production

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Bringing Changes into Production

Final Testing

- In addition to testing at the PR level, final tests prior to a release provide more **comprehensive checks** across the repo
  - Especially since final modifications could be **made up of multiple PRs**
- Modifications being brought into production may need either **functional or validation testing**

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Bringing Changes into Production

Final Testing

- **Functional Tests**: Verify that the software functions correctly in real-world scenarios

*Can automate these tests through **GitHub Actions***

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GitHub Actions for Automated Testing

What are GitHub Actions?

- **Automation tool integrated into GitHub** that allows you to create custom workflows for your software development lifecycle
  - These workflows can **automate a variety of tasks** such as building, testing, and deploying code

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GitHub Actions for Automated Testing

Utility for Testing

- GitHub Actions can **automatically run tests** on your code every time you push changes to your repository
  - Ensures that new code does not introduce errors or break existing functionality
  - Facilitates Continuous Integration (CI) by running tests **frequently and automatically**

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GitHub Actions for Automated Testing

Setting Up GitHub Actions

- GitHub uses **YAML files to define workflows** for tasks like testing, building, and deploying code: .github/workflows/{test}.yml
    - Developers can configure a GitHub repository to look for these YAML files and **automatically launch these workflows**

GitHub Actions for Automated Testing

Key components of a workflow YAML:

- **name** - name of the workflow
- **on** - triggering events, e.g. pull requests
- **jobs** - action of the workflow
  - **runs-on** - environment for the job to run, e.g. ubuntu-latest
  - **steps** - steps to execute the job itself, e.g. running an executable

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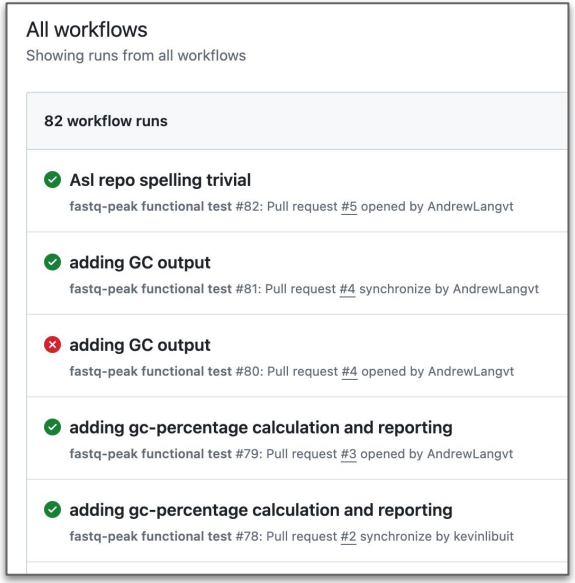
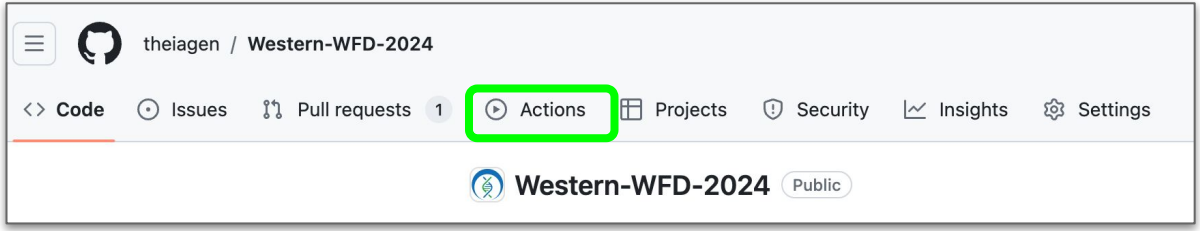
GitHub Actions for Automated Testing

Monitoring and Debugging

- Can assess the status of a workflow from the "**Actions**" tab of a repository





Detailed logs available regarding each workflow launched

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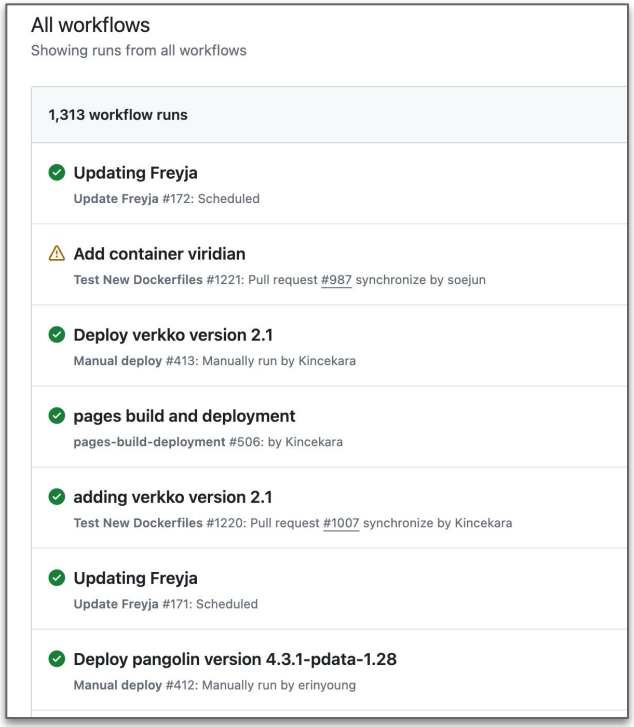
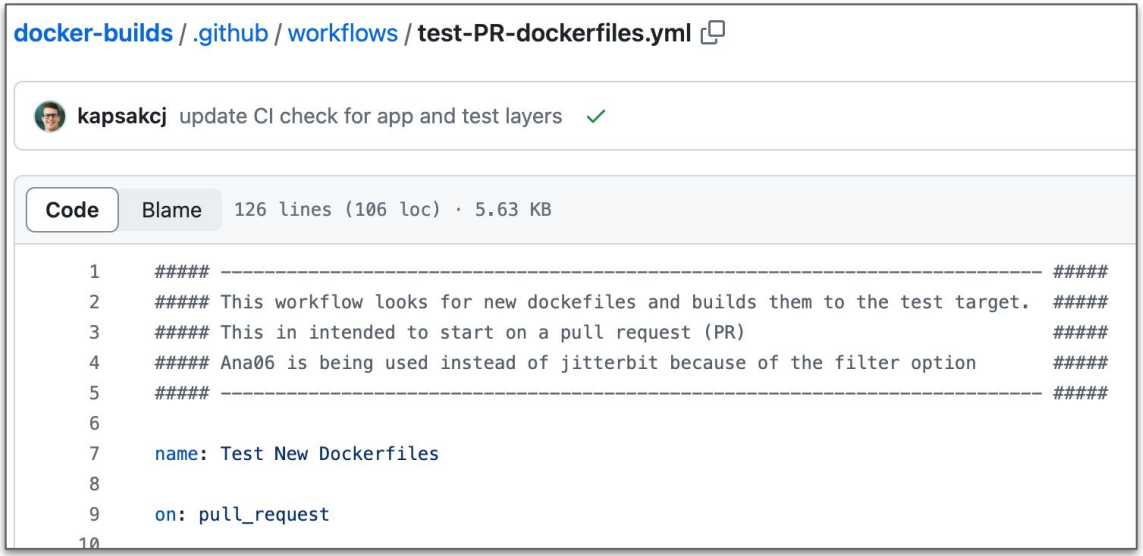
GitHub Actions for Automated Testing

Examples in the Field: StaPH-B Docker Builds





https://github.com/StaPH-B/docker-builds

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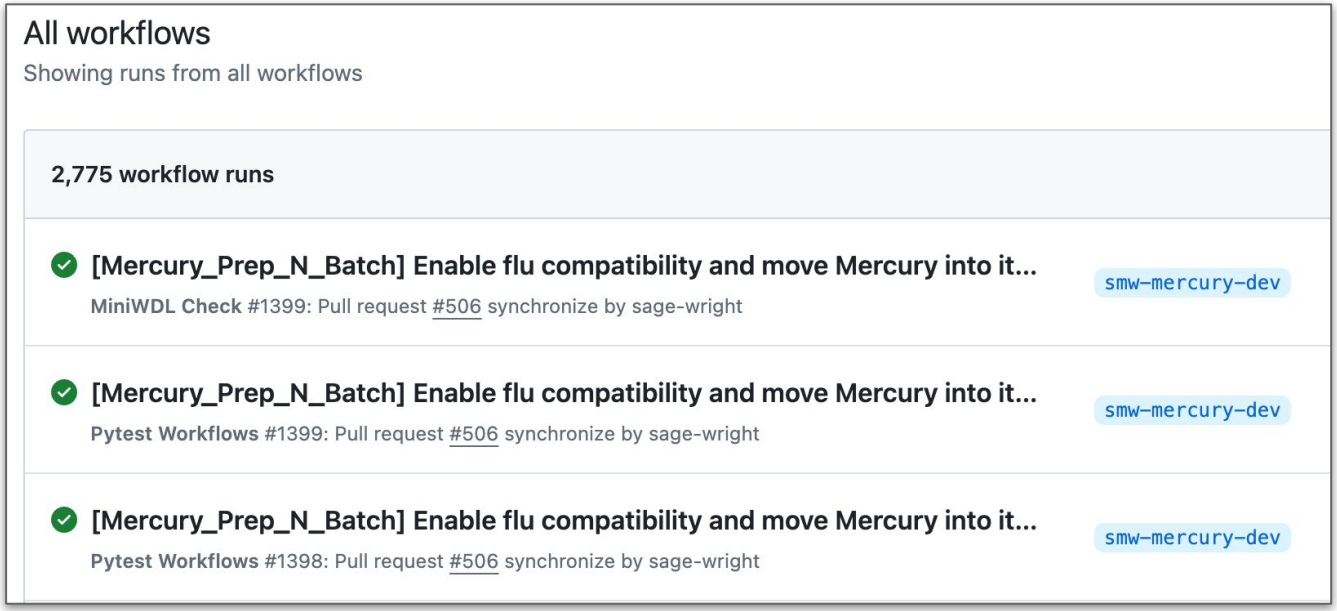
GitHub Actions for Automated Testing

Examples in the Field: Theiagen's PHB



https://github.com/theiagen/public_health_bioinformatics

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GitHub Actions for Automated Testing

Summary

- GitHub Actions **can automate workflows for testing and deployment**, enhancing code quality with CI/CD integration directly within GitHub repositories
  - Can be specifically helpful for routine functional and validation tests

Bringing Changes into Production

Final Testing

- **Functional Tests**: Verify that the software functions correctly in real-world scenarios

*Can automate these tests through **GitHub Actions***

- **Validation Tests**: Ensure the software meets the specified requirements
  - Performed against a benchmark or
  - predefined criteria

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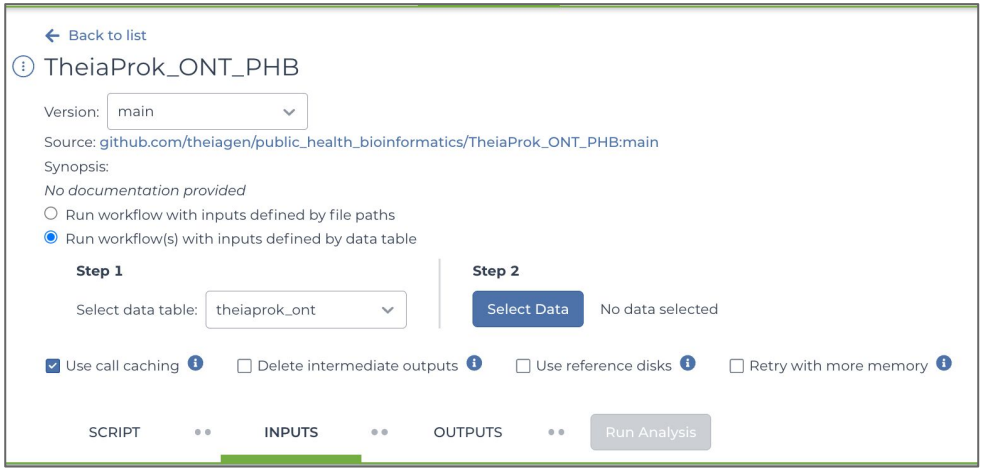
Bringing Changes into Production

Final Testing

- **User Acceptance Testing (UAT)**: Have end-users test the software to ensure it meets their needs and expectations



*For Terra users, you can have **end-users test your main branch** in a workspace prior to a release*

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Bringing Changes into Production

Static Releases

- Deploying a fixed version of the software
  - Provides clear versioning history
  - Facilitates dependency management and updates

Semantic Versioning

- Versioning scheme that reflects changes

v1.3.0

MAJOR MINOR PATCH

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Example Releases: PHB v2.0.0

v2.0.0

Compare

sage-wright released this Apr 22 · 52 commits to main since this release v2.0.0 880a66c

Public Health Bioinformatics v2.0.0 Release Notes

This major release simplifies the usage of the TheiaCoV workflows and does major restructuring on all inputs and outputs on several workflows, including TheiaCoV, TheiaProk, TheiaEuk, and TheiaMeta. Additionally, it introduces three new workflows, improves on several workflows, and resolves various bugs.

Full release notes can be found here.

All inputs and outputs have been standardized across all of PHB. More information can be found here.

Find our documentation here!

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Bringing Changes into Production

Summary

- **Final testing** should be performed prior to bringing in changes into production
  - **Comprehensive tests**, especially important when modification is made up of multiple small changes
- **Static releases** help provide clear versioning
  - **Semantic versioning** helps to reflect changes from version to version

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Hands-On Exercise

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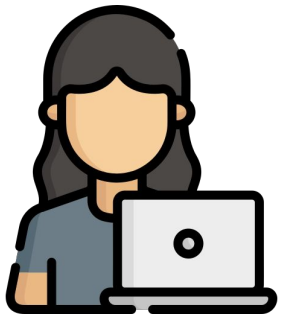
Exercise 03: GitHub Actions & Static Releases

Exercise Goal

1. **Use GitHub and your dev environment to:**
    a. Troubleshoot a failed GitHub action
    b. Modify the codebase to resolve the failed action



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Final Thoughts

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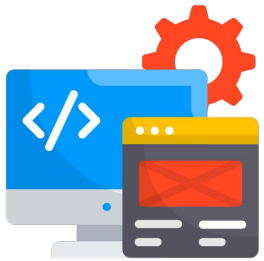
4. **Peer Review**
   a. Standards for review, testing, etc.
5. **Bringing Changes into Production**
   a. Merging to main
   b. Static version releases

DOCUMENT
ALL THE THINGS!



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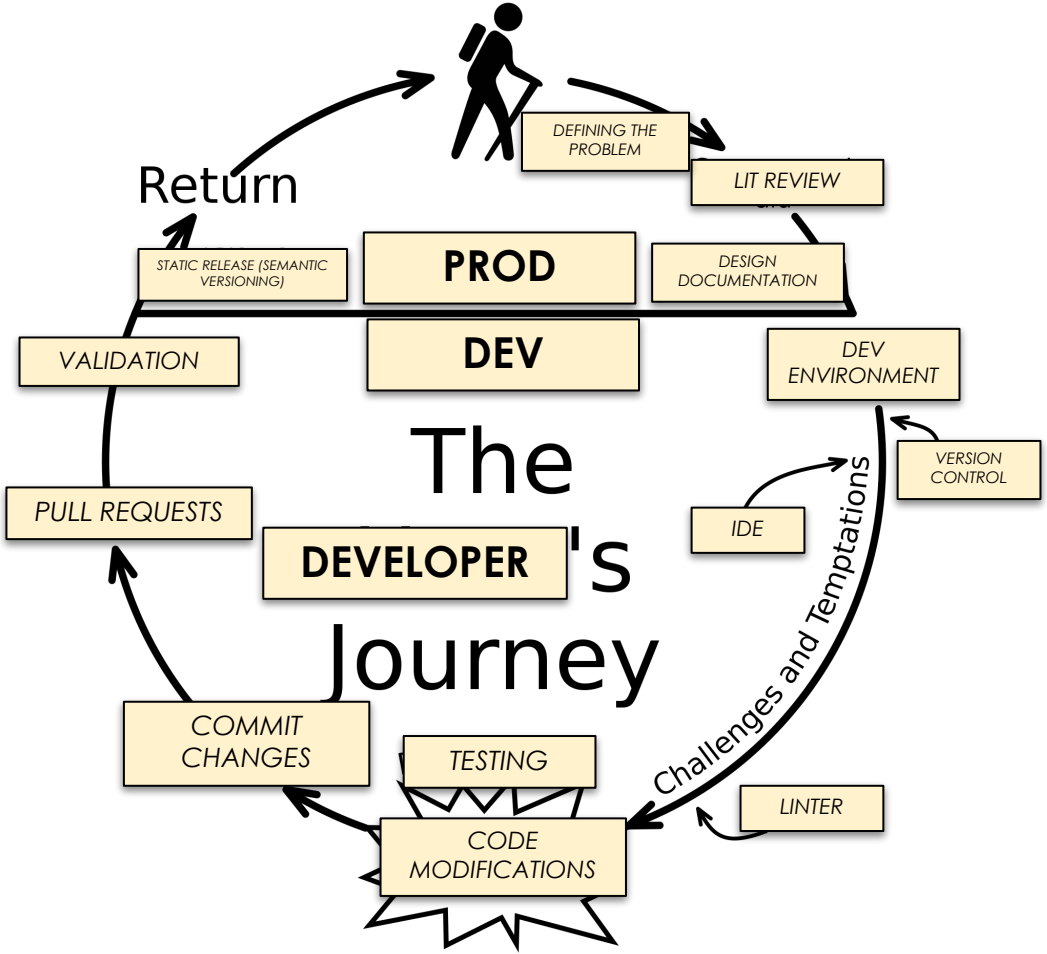

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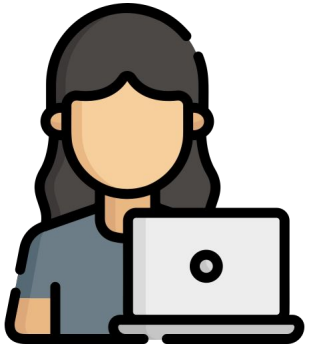

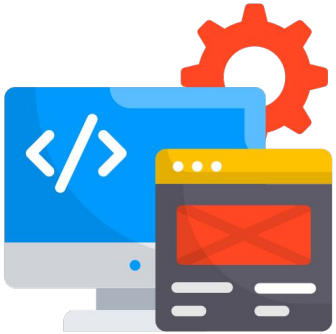

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