

Version Control with Git

Fundamentals and Best Practices

Advanced Software Engineering Course

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Course Objectives

- Understand the fundamental concepts of version control
- Master essential Git commands and workflows
- Learn collaborative development practices
- Implement branching strategies effectively
- Resolve common Git challenges

Basic Git Configuration

```
# Initial configuration
git config --global user.name "Your Name"
git config --global user.email "email@example.com"

# Create new repository
git init

# Check status
git status
```

Git Repository Structure

Working Directory

- Contains actual files
- Where you make changes
- Untracked/tracked files

Repository (.git)

- Stores all versions
- Contains metadata
- Manages branches

Basic Git Commands

Stage changes

```
git add <filename>
```

```
git add . # Stage all changes
```

Commit changes

```
git commit -m "Descriptive message"
```

View history

```
git log
```

The Git Workflow

- **Working Directory**

- Where you modify files
- Contains untracked changes

- **Staging Area (Index)**

- Prepares changes for commit
- Review before committing

- **Repository**

- Permanent storage
- Contains commit history

Branching and Merging

```
# Create and switch to new branch  
git branch feature-branch  
git checkout feature-branch
```

```
# Or in one command  
git checkout -b feature-branch
```

```
# Merge branches  
git checkout main  
git merge feature-branch
```

Best Practices

- Write clear, descriptive commit messages
- Commit early and often
- Use meaningful branch names
- Review changes before committing
- Keep repositories clean and organized
- Document important workflows

Remote Repositories

```
# Add remote repository  
git remote add origin <url>
```

```
# Push changes  
git push -u origin main
```

```
# Pull changes  
git pull origin main
```

```
# Clone repository  
git clone <url>
```

Push/Pull Workflow

- Regular pulls
- Feature branches
- Code review

Best Practices

- Pull before push
- Resolve conflicts
- Use pull requests

Additional Resources

- Official Git documentation: git-scm.com/doc
- Interactive Git learning: learngitbranching.js.org
- Git cheat sheet: github.github.com/training-kit
- Community forums and Stack Overflow