

Today's Objectives

- Using git
- Networking Layers
- End to End Argument discussion

Review

- What are some performance issues we need to consider with Web Servers (and servers in general)?
 - How can we solve those issues?
- What are some of the metrics we use for networks?

GIT

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Review: Subversion

- How did you use Subversion?

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Centralized vs Distributed VCS

- Centralized (CVS, Subversion)
 - One central repository – the gold standard
 - Must be capable of connecting to repo
 - No access, no updates
 - Need to solve issues with group members making different changes on the same files
- Distributed (git, mercurial, bazaar)
 - Everyone has a working repository
 - Faster
 - Connectionless
 - Still need to resolve issues, but it's not an argument against DVCS

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What to Put Under Version Control

- YES!
 - text based things made by humans
 - source code
 - Scripts
 - Documentation
- No!
 - large binary files that change often
 - Things automatically built
 - Temporary files
 - Sensitive data: passwords, private ssh keys
 - Ignore these things with `.gitignore`

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SVN → GIT

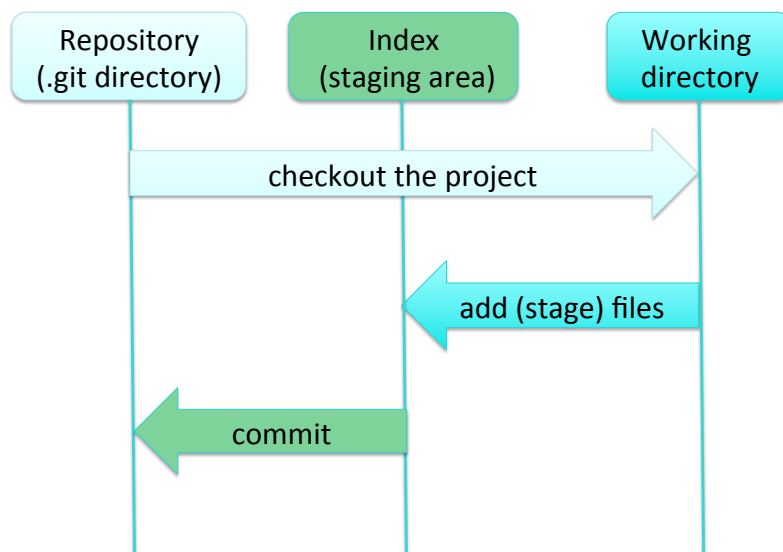
- Still use add, remove, and commit
 - BUT, commit is a local operation
- We're using GitHub
 - Host for git system

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Local Workflow

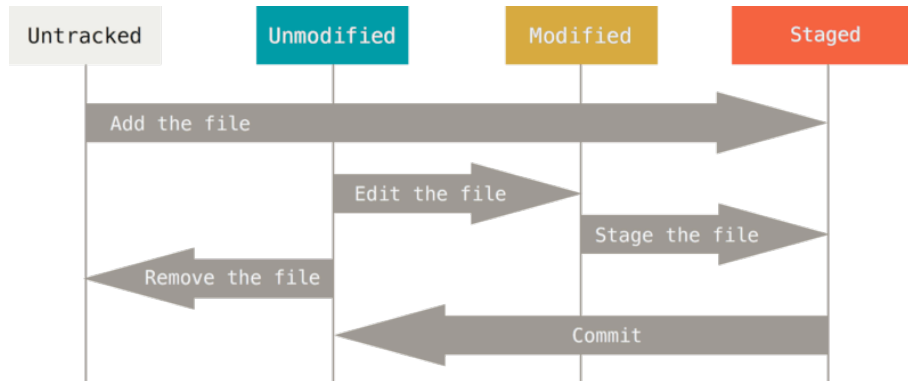


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Recording Changes to the Repository: File Level



<https://git-scm.com/book/en/v2/Git-Basics-Recording-Changes-to-the-Repository>

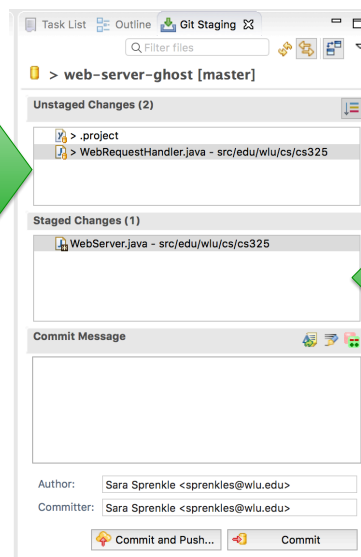
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Git Staging in Eclipse

These have been modified but not staged for committing



These are what will be committed

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Best practices for code collaboration: Committing

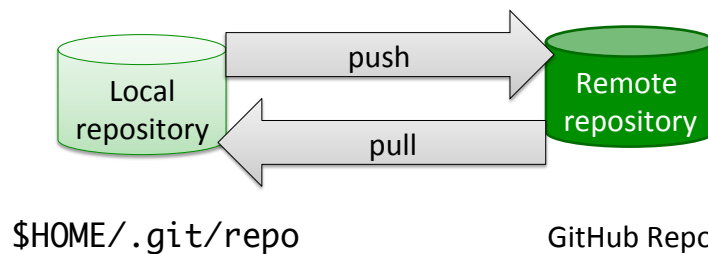
- Not a clear-cut answer
- Try not to break things (don't do a lot of work in one commit)
- Always use a clear, concise commit message
 - Put more details in lines below, but always make the first line short
- Describe the why; the what is clear in the change log
- When making giant changes, consider branches (we'll talk about these in a few slides)

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Git transport commands



- Remote Repository is where you'll collaborate

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Git Branches

- Like a copy of the code in the current branch
 - Creates a “sandbox”
 - Can edit/update code in your sandbox
- Use a branch to work on new features
- Allows you to test out new ideas, fix bugs, work on multiple features in parallel
- Do most of your development work in a branch

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Typical Workflow

1. I want to implement X
2. Create a branch, named “implementingX”
3. Implement X, adding files, **committing** whenever I do something that is “significant”
4. After testing to make sure my code works, **switch** to master branch
 1. **Merge** “implementingX” into master branch
5. **Push** master branch to remote (GitHub) repository

If it didn't work, can throw branch away.

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Tags

- Can tag versions you want to save in GitHub Repository

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Recommended (More Complicated) Organization

- Adds another layer/branch
- **Master** branch is the thoroughly tested, gold standard
- **Development** branch is where you coordinate with teammate
 - After teammate tests your work and you both sign off on it working, then merge into master

Web Server Project

- Follow GitHub Education set up instructions on project page.
- Create teams

NETWORKING

Formalizing Definitions

Term	Definition
Host	
Packet	
Link	
Switch	
Router	

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Formalizing Definitions

Term	Definition
Host	Computer, mobile device, ...
Packet	Unit of transmission across a network
Link	Used to transmit bits; pipe <ul style="list-style-type: none"> • Wired or wireless • Broadcast or switched (or both)
Switch	Used to move bits between links – Local Area Network (LAN) <ul style="list-style-type: none"> • Packet switching: stateless, store & forward • Circuit switching: stateful, cut through
Router	Connects networks across wide area (WAN)

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Review: Layering in Network Design



- Fundamental Question: What services do applications require from the bare hardware?
 - Don't make each app implement the same functionality
 - OSs should implement these services/abstractions
- Network links hand a *frame* to the operating system
- But what abstraction does the application desire?
- Do all applications need the same abstraction?
- What abstractions do intermediate hosts (routers) in the network need?

COMMUNICATION ABSTRACTION

End-to-End Argument

- What is the end to end argument?
- Do you believe it?
 - The paper was written in 1984...things have changed...
- Why are the tradeoffs in E2E?
 - What applications benefit?
 - Can you think of any applications that do not benefit from the E2E argument?
- Do you think the E2E argument will hold in the future?
- Does this change how you think about software development?

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TODO

- Work on web server project in team
 - Figure out what needs to be done
 - Design solution
 - Break into pieces
- Read and comment on Perusall for Friday:
[Lessons from Giant-Scale Internet Services](#)

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