

# Introduction to Version Control

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# Outline

- 1 General Remarks about Version Control
- 2 Distributed Version Control System Git



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## Old Style

- Files are in a directory
- lots of backup files
- ordered by manual version number or manual date or ???

```
/home/hemmecke/myproject/  
    myproject/myproject-1.0/  
    myproject/myproject-1.2/  
    myproject/myproject-20061014.tar.gz  
    myproject/myproject-20061117.tar.gz  
    myproject/myproject-20061122.tar.gz
```

- generated files like .dvi, .ps etc. are also stored
- HD space is cheap, but manual administration costs time



# New Style

## Source Code Management systems

Use an SCM system to store versioned files and history in a **repository**.



# Backup vs. Version Control

- backup = save a snapshot
  - automatically (daily, monthly, etc.)
  - manually (at release of a program, article, book)
- version control is not versioning of software
  - several commit between two releases of a program
- version control = save snapshots with meaning
  - task/idea driven
  - more fine grained than backups
  - can reconstruct development history of the product



# Common use cases for SCM systems

Source Code Management can be beneficial for

- single user
  - keeping history and evolution of files
  - doing work on different machines
  - developing a program with several releases
- multiple user
  - writing a joint article with other authors
  - developing a program in a group



# Free Source Code Management Systems

- for central development
  - RCS
  - CVS
  - Subversion (SVN)
- for distributed development
  - SVK (uses SVN as backend)
  - GNU Arch, Bazaar-NG
  - Git (used for Linux kernel)
  - Mercurial
  - Darcs





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# Repository

A **Repository** can be considered as a collection of snapshots of a directory in the file system together with dates and log information.



## Creating a repository in a directory

The following creates a subdirectory `.git` with all the relevant information.

```
cd SOMEDIRECTORY  
git init  
git add . # ((Note the dot.))  
git commit -m 'initial version'
```



# Adding new files to a repository

```
git add FILEA FILEB  
git commit
```



# Updating files in a Repository

```
# edit files FILEA and FILEB  
git add FILEA FILEB  
git commit
```

or simply

```
# edit files FILEA and FILEB  
git commit -a
```

to commit all modified files



# Removing files from a repository

```
git rm FILEB  
git commit
```

Since git records the history, the file can still be recovered in any previous version.



# Getting Information

Help

git **help**

History

git **log**

What is the Current Situation

git **status**

Graphically investigate the history

gitk -a



# Simplified Storage Picture

- content is addressed by its hash value (sha-1, a 40 digits hex number)
- commits are stored as a directed acyclic graph (DAG)
- initial commit is the root of the DAG
- leaves of the DAG are called **branches**
- creating a new leaf is called **branching**
- there is usually a **master** branch
- **HEAD** points to the current branch
- joining two branches is called a **merge**





# The real Start

## Make yourself known to git

```
git config -global user.name 'John Doe'  
git config -global user.email doe@example.com
```



# Creation of a Git Repository

- Create a directory and a file.

```
cd magicrings  
emacs magicrings.tex ForgingOfTheRings.tex  
emacs MagicOverMagic.tex Introduction.tex
```

- Put this data under version control.

```
git init  
git add .  
git commit -m 'initial commit'
```

- Check that everything is fine.

```
git log  
git show  
gitk
```



# Simple Workflow

- Create a Makefile

```
emacs Makefile
git status
git diff
git add Makefile
git status
git diff --cached
git commit -m 'add automatic compilation'
```

- Set *log message editor* and add Forging section

```
GIT_EDITOR='emacs -nw'
emacs magicrings.tex
git status
git diff
gitk
git rm ForgingOfTheRings.tex
git commit -a
git log --stat
```



## Simple Workflow 2

- Add MagicOverMagic section

```
emacs magicrings.tex  
git commit -a  
git log --stat
```

- Oops. Commits should be logically connected.  
MagicOverMagic.tex should have been deleted in the previous commit, i.e. undo last commit and do it right.

```
git rm MagicOverMagic.tex  
git commit --amend -C HEAD
```



# Simple Workflow (checking history)

- What was the situation 2 commits ago?

```
git checkout HEAD~2  
gitk
```

- Go back to the master branch.

```
git checkout master  
gitk
```



# Go on travel and don't stop with your work

- Clone the repository to your laptop via ssh.

```
git clone git@git.risc.jku.at:\
    private/hemmecke/cbwe/magicrings
```

- or (equivalently)

```
U=git; H=git.risc.jku.at
D=private/hemmecke/cbwe/magicrings
git clone $U@$H:$D
```

- or put the lines

```
Host gitserver
  IdentityFile ~/.ssh/gitolite
  HostName git.risc.jku.at
  User git
  HostbasedAuthentication no
```

into `~/.ssh/config` and clone via

```
git clone gitserver:private/hemmecke/cbwe/magicrings
```



# Work on your laptop

- Add introduction during travel

```
cd magicrings  
emacs magicrings.tex  
git rm Introduction.tex  
git commit -a -m 'add introduction'
```



## Back at the office

- On your laptop you could say

```
git push origin master
```

but you have to take care if the “origin” was not a bare repository.

- Better go to your office computer pull in the changes made on the laptop

```
git pull mylaptop.risc.jku.at:/path/to/magicrings
```

or (equivalently)

```
git remote add origin \  
    mylaptop.risc.jku.at:/path/to/magicrings  
git pull origin master
```





# Use Git as a backup machine

- Create a **bare** repository on a USB stick or an external hard drive.

```
cd ~/USB  
mkdir MagicRings.git  
cd MagicRings.git  
git init --bare
```

- push your work to the backup repository

```
cd ~/magicrings  
git remote -v  
git remote add backup ~/USB/MagicRings.git  
git push backup master
```



## Use Git as a backup machine 2

- Make more changes.

```
cd ~/magicrings  
emacs magicrings.tex  
git commit -a -m 'fix typo'
```

- physically connect your backup storage and push again

```
git push backup master
```

- The whole history that leads to *master* is now in a safe place.
- You can now throw away all you working copies and are still able to reconstruct all files including their history from `MagicRings.git`.



# Git branching and merging

- Create a new branch.

```
git branch mybranch
```

- Add new commit on “master” branch.

```
emacs magicrings.tex  
git commit -am 'weird magic'
```

- Switch to “mybranch”.

```
git checkout mybranch  
emacs magicrings.tex  
git commit -am 'new feature'
```

- Merge “mybranch” back into master.

```
git checkout master  
git merge mybranch
```



# Other important commands

```
git gc  
git whatchanged  
git branch  
git tag  
git merge  
git fetch  
git reset  
git blame  
git gui blame  
git stash
```



# Git Documentation

- Git books

`http://git-scm.com/book`

`http://www.csc.kth.se/utbildning/\`

`kth/kurser/DD2385/material/gitmagic.pdf`

- Git can read and write SVN (Subversion) repositories

`google: git svn`

- git cheat sheet

`http://cheat.errtheblog.com/s/git`



# Git Hosting

- Public git hosting

`https://git.wiki.kernel.org/index.php/GitHosting`

`http://github.com/`

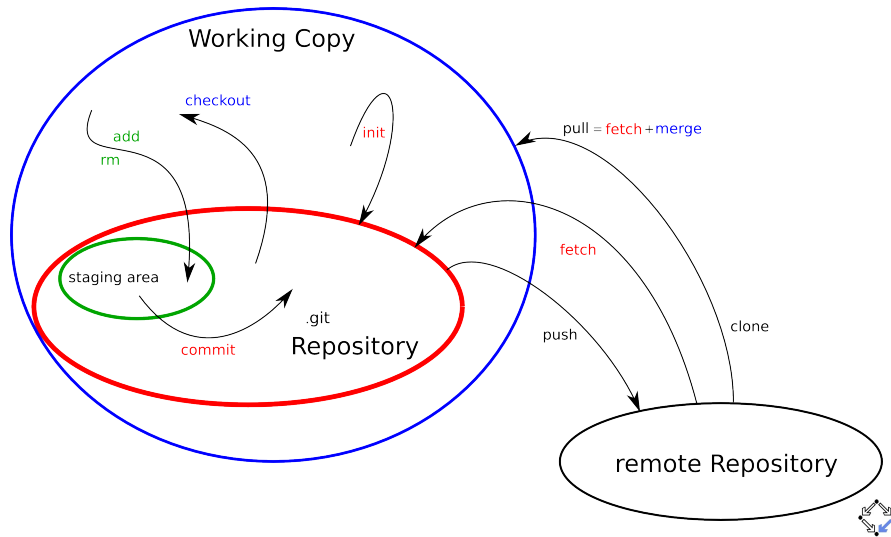
`http://repo.or.cz/`

- Privately shareing git repositories

`https://portal.risc.jku.at/search?SearchableText=gitserver`



# Git Commands



# Git DAG

directed acyclic graph of commits

