The version control system git

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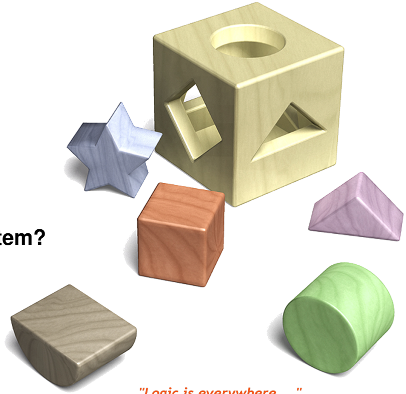

- **Why do we need a version control system?**
- **How to use it - step by step**
- **What makes git different?**

What is the problem?

- Assume: Peter and I write a paper
- Assume: Peter writes section 1,3 and 5, I write section 2 and 4

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▶ sets up the document	

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- receive file, merge

- This time: just copy a whole section

Is this it?

- **Copying a whole passage is simple, however:**
  - **Who told you which part has been changed?**
  - **What should Peter do if Peter finds a typo in my text?**
  - **What should I do while I am waiting for Peter to finish his section?**

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- Can we work at the same document concurrently?
- Can I work offline?
- How does it work?

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- Assume: Peter and I write a paper with the version control system git
- Assume: Peter and I both have a local copy

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starts section 1, adds references	
commit changes locally	clones repository, writes text

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▶ starts section 1, adds references	
▶ commit changes locally	▶ clones repository, writes text
▶ push changes to global repository	▶ commit changes locally

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push changes to global repository	commit changes locally
	pull changes (global repository)

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▶ continues writing	▶ merges automatically

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▶ push changes to global repository	▶ commit changes locally
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▶ continues writing	▶ merges automatically
▶ continues writing	▶ push changes (global repository)

How does it work?

- **Requirements:**
  - **A server where the global repository is stored**
  - **Access to this server for each participant**
- **What are the basic steps?**
  - **Set up the git repository**
  - **Create a local copy**
  - **Add files to the repository**
  - **Commit local changes**
  - **Pull changes from the global repository**
  - **Push changes to the global repository**
  - **In a conflict case: merge manually**
- **You can do much more, e.g. branch, roll back, . . .**

How to set up a git repository?

- Choose a server and create a directory
- Create a repository there

```
ssh peter@spock
mkdir git
cd git
git init --bare --shared=group .
```

- git init creates the repository
- –bare creates the repository as not-useable
- –shared=group the repository can be shared with others from the same UNIX group
- . create the repository here

How to create a local copy?

- Clone the global repository to your hard disk

```
mkdir paper
cd paper
git clone norbert@spock:~peter/git .
```

- git clone clones a repository to the specified place
- spock: peter/git is the link to the repository on the server
- norbert is my own user name on that server
- . create the repository here

How to add files to the repository?

- **Create files and adding them to the repository**

```
echo "hello" >> paper.tex
git add paper.tex
```

- **git add adds files to the current local repository**
- **from now on, any following git command cares about this file**

How to add files to the repository?

- **Create files and adding them to the repository**

```
echo "hello" >> paper.tex
git add paper.tex
git commit -am "added first file"
```

- **git add adds files to the current local repository**
- **from now on, any following git command cares about this file**
- **git commit records the changes locally**
- **-am ”added first file” tells git to record all modifications and all added files**
- **in the same way, file modifications can be recorded by the repository**

How to pull changes from the global repository?

- Recording everything locally does not share the data
- The global repository might contain new data from others
- To get their data, changes need to be pulled

```
git pull origin master
```

- git pull download changes from the global repository
- origin master tells git where to get the changes from
- origin is the cloned repository
- master is the main branch

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- git pull download changes from the global repository
- origin master tells git where to get the changes from
- origin is the cloned repository
- master is the main branch
- pulling changes might result in conflicts
- conflict files need to be merged manually
- in each conflict file, conflicts are surrounded by “<<<” and “>>>”
- after manual merging, the conflict file needs to be added and committed again

How to push changes to the global repository?

- Recording everything locally does not share the data
- To share your data, you need to push it into the global repository

```
git push origin master
```

- git pull download changes from the global repository
- origin master is the same as for git pull
- Note: good practice is to always pull before pushing

Some limits

- How does git work?
  - Basically, it is comparing altered lines
- What happens if both parties change the same line?
  - git will show a conflict
- What happens if both parties change the empty line below line X?
  - git will show a conflict
- One way to tackle this for LaTeX?
  - Brake lines frequently
- Still, the automatic merging is very powerful!

Working on your thesis

- You can also use the local repository only
  - Set up the repository (you want to use it and not share it)

    git init .
  - You can use this repository as backup/history
  - As usual, you can add files

    git add
  - You can commit changes

    git commit -am “comment”
- Of course, you could also use a global repository alone

To sum up

- **In the extreme case, first one user . . .**
  - **sets up the repository git init –bare –shared=group .**
  - **clones the repository git clone me@server:∼me/pathToGit .**
  - **adds all files git add and git commit -am “comment”**
  - **prepares the global repository git push origin master**
  - **and shares the link to the repository, e.g. server:∼me/pathToGit**

  . . . and all users do
  - **Clone the repository git clone you@server:∼me/pathToGit .**
  - **Change files**
  - **Record changes locally git commit -am “comment”**
  - **Get the latest global changes git pull origin master (and sometime merge)**
  - **Share local changes git push origin master**

  and repeat the last four steps until the document is final

Conclusion

- **Working on a shared document concurrently is easy**
- **Why should you use git and not svn or cvs?**
  - **You have a local repository**
  - **You can jump back to old versions locally (also in the plane)**
- **Is there a nice GUI?**
  - **Linux: gitg or gitk**
  - **Mac: sourcetree or gitx**
- **Still, its only four command line commands to know . . .**

- **Further information:** `http://schacon.github.com/git/user-manual.html`