

True Git

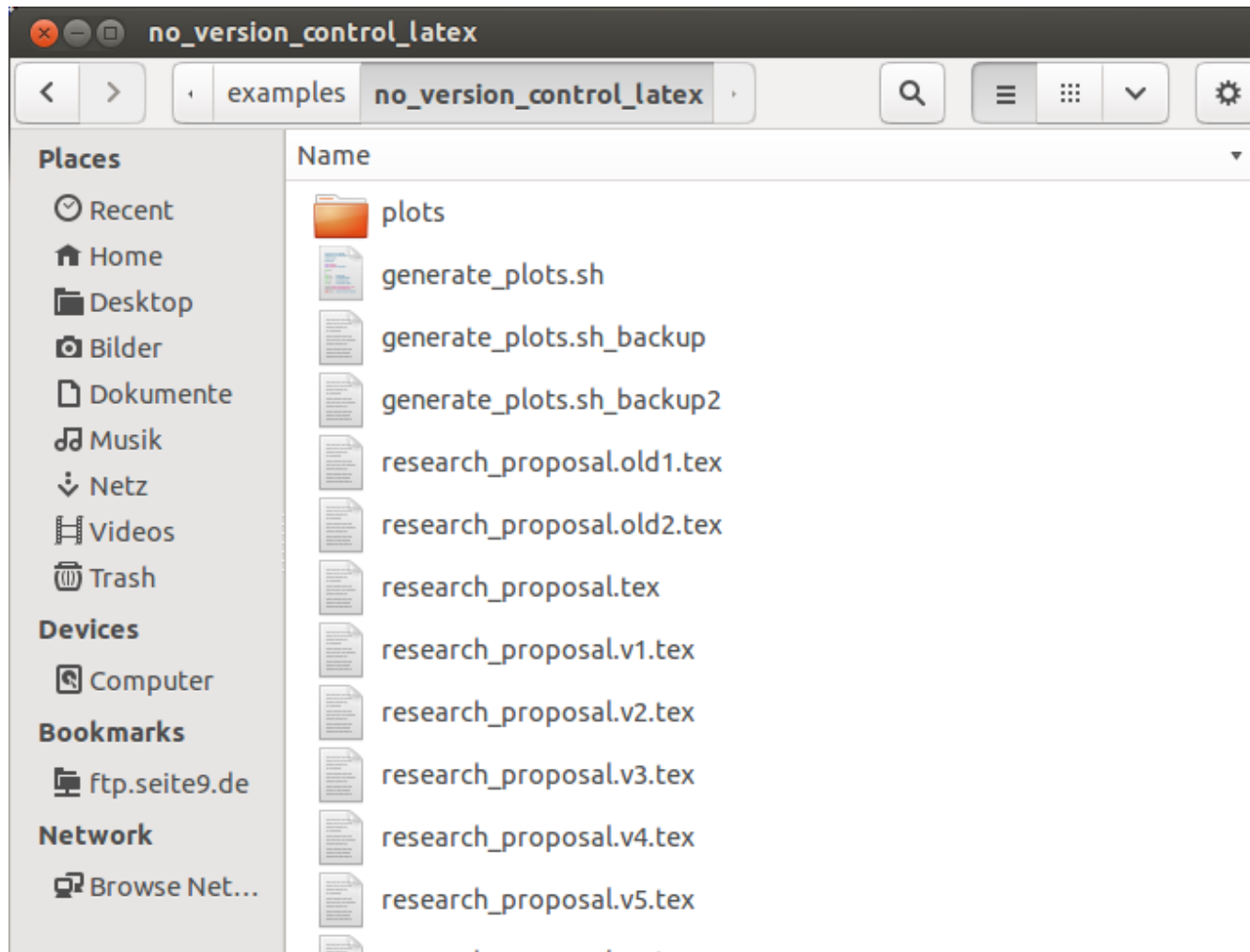
An introduction to revision control

Burkhard Ritter. August 1, 2013.

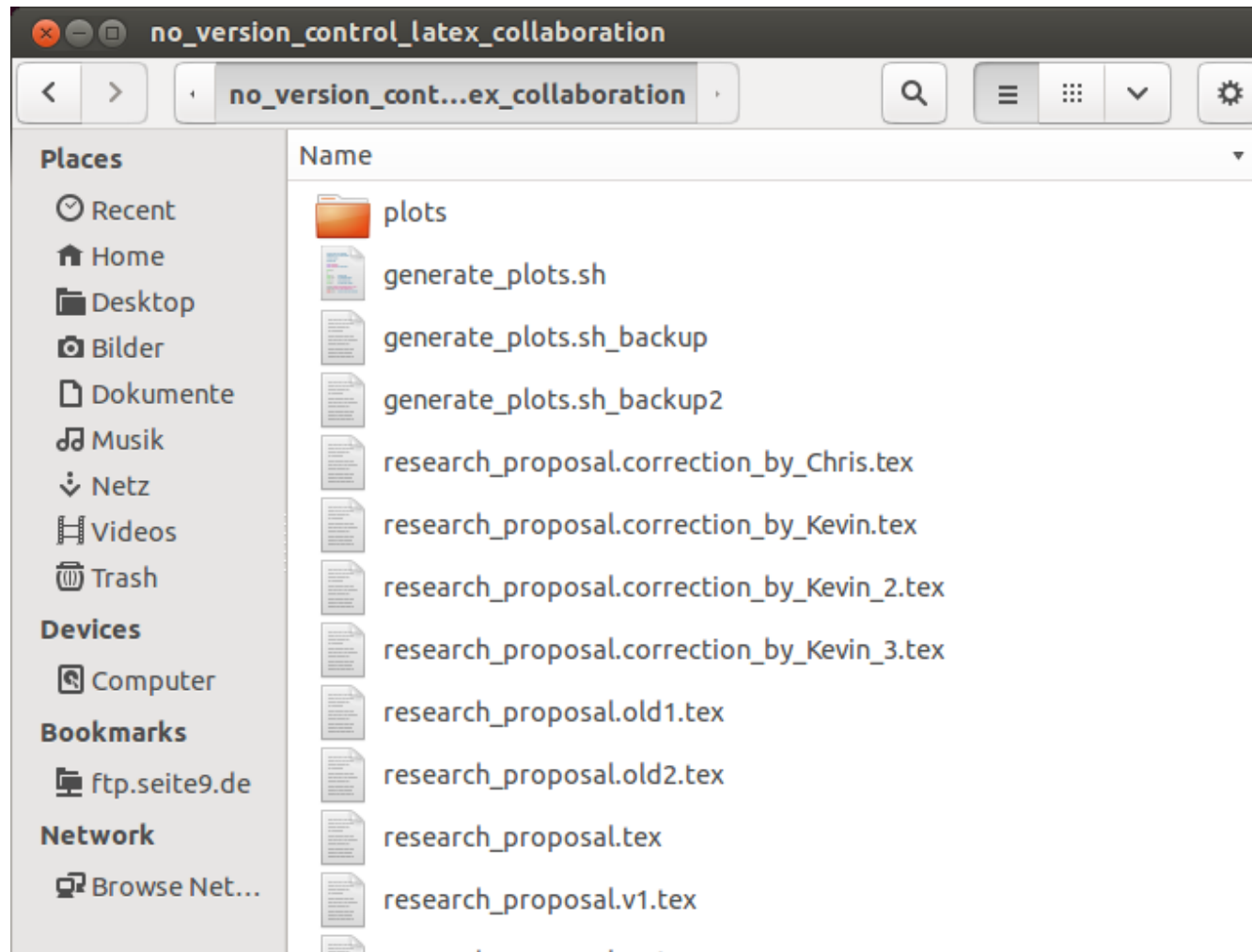
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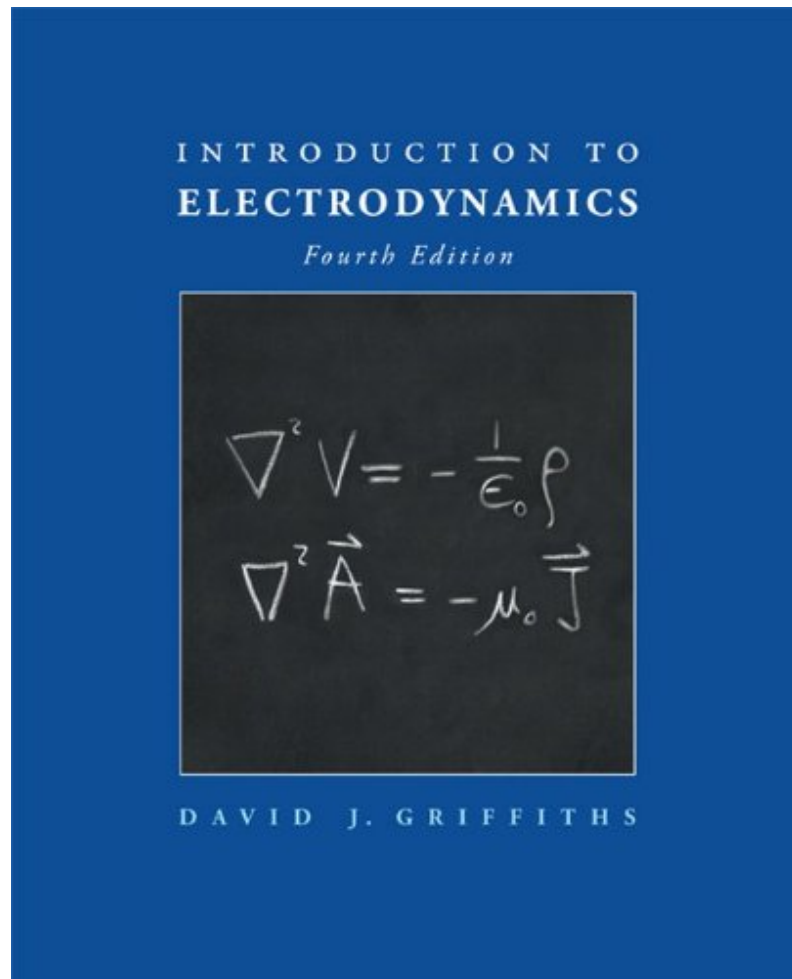
Why revision control



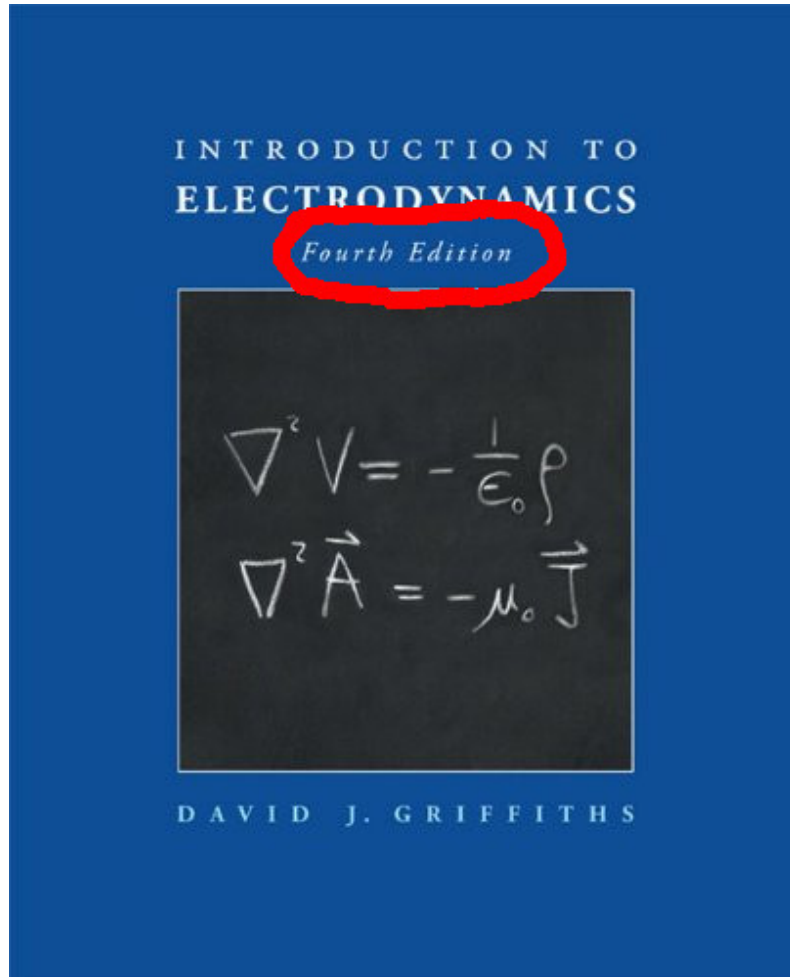
Why revision control



What is revision control



What is revision control



What is revision control

- Documents
 - Latex, C++, Bash scripts, SVG
 - Zip, PNG, DOC
- Keep track of changes: revisions
 - Revision 1
 - Revision 2
 - Revision 3
 - ...

What is revision control

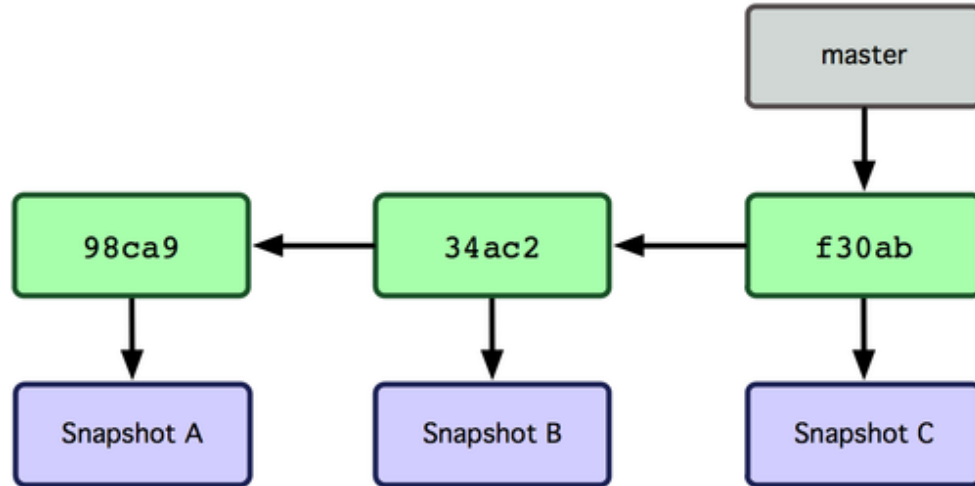


Image from: **Pro Git book**

What is revision control

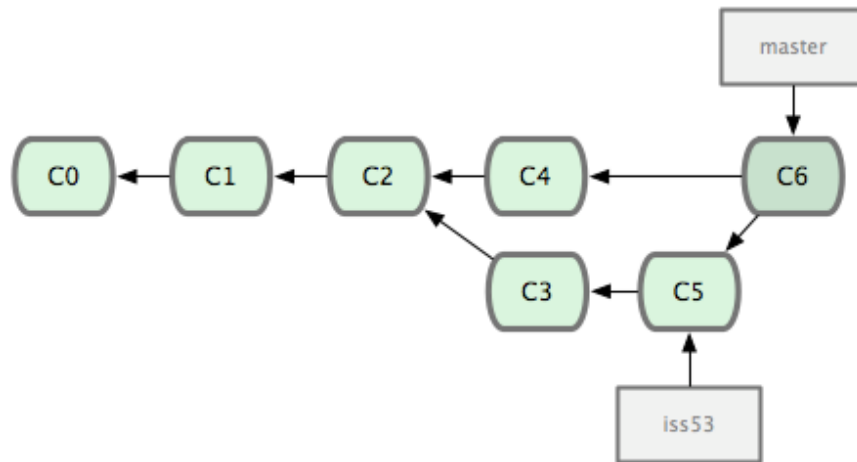


Image from: **Pro Git book**

What is revision control

- Revision / version control system (RCS / VCS)
- Examples
 - Google Docs
 - Subversion, CVS
 - Git, Mercurial
- Ubiquitous
- Indispensable when working in a team
- Version control can be complex and complicated
- Common use cases: very simple
- No reason not to use it

Git

- Originally developed for the Linux kernel
- Distributed RCS
- Made hugely popular by Github (<https://github.com/>)
- Supported by all major IDEs (Eclipse, Visual Studio)
- GUIs

Git example

```
$ ls
generate_plots.sh  plots  research_proposal.tex

$ git init
Initialized empty Git repository in /home/burkhard/examples/latex/.git

$ ls -a
.  ..  generate_plots.sh  .git  plots  research_proposal.tex
```

Git example

```
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       generate_plots.sh
#       research_proposal.tex
nothing added to commit but untracked files present (use "git add" to
track)

$ git add generate_plots.sh research_proposal.tex
```

Git example

```
$ git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   generate_plots.sh
#       new file:   research_proposal.tex
#

$ git commit -a -m "Initial commit."
[master (root-commit) fc578b1] Initial commit.
 2 files changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 generate_plots.sh
 create mode 100644 research_proposal.tex
```

Git example

```
$ git status
# On branch master
nothing to commit, working directory clean

$ vim research_proposal.tex

$ git status
# On branch master
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working
#   directory)
#
#       modified:   research_proposal.tex
#
no changes added to commit (use "git add" and/or "git commit -a")
```

Git example

```
$ git commit -a -m "Wrote new section"  
[master 220c05b] Wrote new section  
1 file changed, 3 insertions(+)
```

```
$ git log  
commit 220c05b883f21dda0291aed45b1eff46966b89c  
Author: Burkhard Ritter <burkhard@seite9.de>  
Date: Wed Jul 31 23:11:18 2013 -0600
```

Wrote new section

```
commit fc578b1a3dece474a78c34bd9a3a5a737516de71  
Author: Burkhard Ritter <burkhard@seite9.de>  
Date: Wed Jul 31 23:08:33 2013 -0600
```

Initial commit.

Git example

```
$ vim research_proposal.tex
```

```
$ git commit -a -m "Improved my new section."  
[master 3722773] Improved my new section.  
1 file changed, 1 insertion(+), 1 deletion(-)
```

```
$ git log --oneline  
3722773 Improved my new section.  
220c05b Wrote new section  
fc578b1 Initial commit.
```

Git example

```
$ git diff HEAD^..HEAD
diff --git a/research_proposal.tex b/research_proposal.tex
index a20467e..8fc0e1f 100644
--- a/research_proposal.tex
+++ b/research_proposal.tex
@@ -1,3 +1,3 @@
 \section{Why my research is great}

-My research is simply awesome.
+My research is simply awesome. Moo!
```

Git example

```
$ git help
$ git help checkout

$ git checkout HEAD^ research_proposal.tex

$ git commit -a -m "Undid last change. Adding moo was not a good idea"
[...]
```



```
$ git log --oneline
2e95fb9 Undid last change. Adding moo was not a good idea.
3722773 Improved my new section.
220c05b Wrote new section
fc578b1 Initial commit.
```

Immediate advantages

- Simple
- Keep track of changes
- Keep track of progress
- No copies of files floating around in directories
- Track down bugs
- Which code produces which result

Key concepts

- Repository
- Working directory
- Commit to create revisions
- Files: tracked, untracked, modified, or committed

Bitbucket

- Github
 - Extremely popular
 - Social coding
 - "Revolutionalized open source" (**Wired article**)
 - Focus on individuals, not projects
 - Trend: publish everything, everything is public
- Bitbucket
 - Similar, but not hip
 - Unlimited private repositories, 5 collaborators
 - Unlimited academic plan!

Bitbucket

- Why use Bitbucket?
 - Even easier to use Git
 - Web GUI
 - Backup
 - Sync between computers
 - Collaborate
 - Direct write access
 - Fork, create pull request
 - Teams

Bitbucket tour

The screenshot shows a Bitbucket user profile for Burkhard Ritter. The browser address bar shows the URL <https://bitbucket.org/meznom>. The profile header includes the user's name, a profile picture, and a 'Manage account' button. Below the header, statistics show 8 Repositories, 0 Followers, and 1 Following. A navigation bar contains tabs for 'Repositories', 'Followers', 'Following', and 'Activity'. The main content area lists five repositories:

- exactdiagonalization**: updated 2013-07-18, description: Exact diagonalization for QCA. Language: C++.
- stochastic_minimization**: updated 2013-07-10, description: Stochastic minimization. Language: C++.
- gpsa_constitution**: updated 2013-06-09, description: GPSA Constitution. Language: LaTeX.
- SSEMonteCarlo**: updated 2013-04-13, description: SSE Monte Carlo simulation. Language: Java.
- simscaffold**: description: Scaffold for simulation. Language: Python.

Each repository entry includes a language icon, the repository name, the last update date, a brief description, and a visibility control button (eye icon).

Bitbucket tour

The screenshot shows a Bitbucket repository page for 'gpsa_constitution' owned by 'meznom'. The page includes a navigation bar with 'Overview', 'Source', 'Commits', 'Pull requests', and 'Downloads'. The repository description states it is the Constitution of the Graduate Physics Student Association at the University of Alberta, maintained as a LaTeX document. It lists the owner as Burkhard Ritter and provides the repository URL. A 'Recent activity' section shows three commits pushed by Burkhard Ritter. A sidebar on the right displays repository statistics (1 Branch, 1 Tag, 0 Forks, 1 Watcher) and a table of repository details (Owner: Burkhard Ritter, Access level: Public, Type: Git, Language: LaTeX, Last updated: 2013-06-09, Created: 2013-03-06, Size: 1.6 MB). An 'Invite users to this repo' button is also visible.

meznom / gpsa_constitution x

Atlassian, Inc. [US] https://bitbucket.org/meznom/gpsa_constitution

Bitbucket Repositories Create

owner/repository

gpsa_constitution

meznom Share

Clone Fork Compare Pull request

Overview Source Commits Pull requests Downloads

GPSA Constitution

The Constitution of the [Graduate Physics Student Association](#) at the [University of Alberta](#). The Constitution is now maintained as a LaTeX document. The Git repository is at https://bitbucket.org/meznom/gpsa_constitution.

March 2013, Burkhard Ritter burkhard@ualberta.ca

Recent activity

- Burkhard Ritter pushed 1 commit to meznom/gpsa_constitution 2013-06-09
c23b19e - Fixed wording in section Approval Process.
- Burkhard Ritter pushed 1 commit to meznom/gpsa_constitution 2013-04-02
9a6189f - Updated Readme.
- Burkhard Ritter pushed 1 commit to meznom/gpsa_constitution 2013-03-22
32ddb6c - Added suggestions by Logan.
- Burkhard Ritter pushed 1 commit to meznom/gpsa_constitution

SSH git@bitbucket.org:meznom/gpsa_cor

1 Branch 1 Tag 0 Forks 1 Watcher

Owner	Burkhard Ritter
Access level	Public
Type	Git
Language	LaTeX
Last updated	2013-06-09
Created	2013-03-06
Size	1.6 MB (download)

Invite users to this repo

Send invitation

Bitbucket tour

The screenshot shows a Bitbucket repository page for 'gpsa_constitution' by user 'meznom'. The page includes a navigation bar with 'Overview', 'Source', 'Commits', 'Pull requests', and 'Downloads'. Below the navigation, there is a table of files in the 'master' branch. The files listed are:

File Name	Size	Date	Description
.gitignore	24 B	2013-03-06	Some smaller fixes. Two new sections.
2013-02-27Constitutionamendments.pdf	104.2 KB	2013-03-06	Updated Meetings and Elections section.
GPSA_Constitution.odt	15.2 KB	2013-03-05	Initial commit. Latex version of our constitution.
GPSA_Constitution_10_2011.pdf	68.7 KB	2013-03-05	Initial commit. Latex version of our constitution.
README.md	354 B	2013-04-02	Updated Readme.
gpsa_constitution.pdf	96.1 KB	2013-06-09	Fixed wording in section Approval Process.
gpsa_constitution.tex	19.2 KB	2013-06-09	Fixed wording in section Approval Process.

GPSA Constitution

The Constitution of the [Graduate Physics Student Association](#) at the [University of Alberta](#). The Constitution is now maintained as a Latex document. The Git repository is at https://bitbucket.org/meznom/gpsa_constitution.

March 2013, Burkhard Ritter burkhard@ualberta.ca

Bitbucket tour

The screenshot shows the Bitbucket web interface for the repository 'gpsa_constitution' by user 'meznom'. The page is viewed in a browser with the URL 'https://bitbucket.org/meznom/gpsa_constitution/commits/all'. The repository name and user are displayed at the top, along with icons for cloning, forking, comparing, and pulling requests. Below this, there are navigation tabs for 'Overview', 'Source', 'Commits', 'Pull requests', and 'Downloads', with 'Commits' being the active tab. Under the 'Commits' tab, there are sub-tabs for 'Commit history' and 'Feature branches', with 'Commit history' selected. A search box labeled 'Find commits' is present. The main content is a table of commit history with columns for Author, Commit ID, Message, and Date. The table lists 11 commits, all by Burkhard Ritter, with messages ranging from 'First complete draft for revised constitution.' to 'Fixed wording in section Approval Process.'

Author	Commit	Message	Date
Burkhard Ritter	c23b19e	Fixed wording in section Approval Process.	2013-06-09
Burkhard Ritter	9a6189f	Updated Readme.	2013-04-02
Burkhard Ritter	32ddb6c	Added suggestions by Logan.	2013-03-22
Burkhard Ritter	10e5bad	Removed the draft status. This is revision 1.4.	2013-03-20
Burkhard Ritter	dc83235	Added suggestions for future changes as comment.	2013-03-19
Burkhard Ritter	378ea00	Reordered sections.	2013-03-19
Burkhard Ritter	d2c01a6	Incorporated some more small fixes.	2013-03-19
Burkhard Ritter	efb8c99	Simplified and moved some sections.	2013-03-19
Burkhard Ritter	6703f0e	Clarified. Improved English.	2013-03-18
Burkhard Ritter	19c8584	First complete draft for revised constitution.	2013-03-15

Bitbucket tour

The screenshot shows a Bitbucket commit page for the repository 'meznom/gpsa_constit'. The commit hash is 378ea009bb1ed713c554504cba4abf263289df43. Under 'Files changed (2)', two files are listed: 'gpsa_constitution.pdf' (0 lines added, 0 lines removed) and 'gpsa_constitution.tex' (123 lines added, 124 lines removed). A 'Binary file modified' notification is shown for the PDF file. The 'gpsa_constitution.tex' file is shown in a diff view, with 'Side-by-side diff' and 'View file' buttons. The diff highlights several changes in red (deletions) and green (additions). The visible code includes a header section and a section for 'Financial Review'.

Files changed (2)

- +0 -0 gpsa_constitution.pdf
- +123 -124 gpsa_constitution.tex

gpsa_constitution.pdf [View file](#)

📘 Binary file modified.

gpsa_constitution.tex [Side-by-side diff](#) [View file](#)

```
1 1  % The Constitution of the Graduate Physics Student Association at the University
2 2  % of Alberta.
3 3  %
4 4  -% Edited by Burkhard Ritter <burkhard@ualberta.ca>, March 2013.
5 5  +% Edited by Burkhard Ritter <burkhard@ualberta.ca>, March 2013. A big thank you
6 6  +% to Daniel Laycock, Colin More and Roshan Achal for help, feedback and support.
7 7
8 8  \documentclass[11pt]{article}
...
101 102
102 103
103 104
104  -\section{Financial Review}
105  -\label{sec:Financial Review}
106  -A review of the GPSA's finances will be conducted following the end of the
107  -fiscal year, which is defined as December 31, and will be performed by the
108  -outgoing Vice President Finance and one additional GPSA member, as appointed by
109  -Council. The purpose of the review is to ensure that all transactions carried
110  -out over the past year during the outgoing Vice President Finance's tenure are
```

Bitbucket example

Create a repository — Bit x

Atlassian, Inc. [US] <https://bitbucket.org/repo/create>

Bitbucket Repositories Create owner/repository

Create a new repository

You can also [import a repository](#)

Name*

Description

Access level This is a private repository

Repository type Git Mercurial

Project management Issue tracking Wiki

Language

New to Bitbucket?

Learn the basics of using Git and Mercurial by exploring the Bitbucket 101.

Working in a team?

Create a team account to consolidate your repos and organize your team's work

[Blog](#) · [Support](#) · [Plans & pricing](#) · [Documentation](#) · [API](#) · [Server status](#) · [Version info](#) · [Terms of service](#) · [Privacy policy](#)

[JIRA](#) · [Confluence](#) · [Bamboo](#) · [Stash](#) · [SourceTree](#)

Bitbucket example

The screenshot shows the Bitbucket web interface for a repository named 'research_proposal' owned by 'meznom'. The browser address bar shows the URL 'https://bitbucket.org/meznom/research_proposal'. The repository page includes a navigation bar with 'Overview', 'Source', 'Commits', 'Pull requests', and 'Downloads'. The main content area features a 'Get started' sidebar with options like 'Make changes and push', 'Invite your friends', and 'Get to work'. The central focus is a 'Push up an existing repository' guide, which includes a terminal code block for adding a remote and pushing, and a 'Next' button. The footer contains various links such as 'Blog', 'Support', 'Plans & pricing', 'Documentation', 'API', 'Server status', 'Version info', 'Terms of service', 'Privacy policy', 'JIRA', 'Confluence', 'Bamboo', 'Stash', and 'SourceTree'.

meznom / research_proposal x

Atlassian, Inc. [US] https://bitbucket.org/meznom/research_proposal

Bitbucket Repositories Create

owner/repository

research_proposal

meznom Share

Clone Fork Compare Pull request

Overview Source Commits Pull requests Downloads

Get started

Make changes and push

Invite your friends

Get to work

Push up an existing repository

You already have a Git repository on your computer. Let's push it up to Bitbucket.

```
$ cd /path/to/my/repo
$ git remote add origin ssh://git@bitbucket.org/meznom/research_proposal.git
$ git push -u origin --all # to push up the repo for the first time
```

Do you want to grab a repo from another site? Try our [importer!](#)

Next

Blog · Support · Plans & pricing · Documentation · API · Server status · Version info · Terms of service · Privacy policy

JIRA · Confluence · Bamboo · Stash · SourceTree

Bitbucket example

Lise

```
burkhard@lise:~/research_proposal$ git remote add origin \  
ssh://git@bitbucket.org/meznom/research_proposal.git  
  
burkhard@lise:~/research_proposal$ git push -u origin --all  
[...]  
To ssh://git@bitbucket.org/meznom/research_proposal.git  
* [new branch]      master -> master  
Branch master set up to track remote branch master from origin.
```

Bitbucket example

Lise

```
burkhard@lise:~/research_proposal$ vim README.md

burkhard@lise:~/research_proposal$ git add README.md

burkhard@lise:~/research_proposal$ git commit -a -m "Added a README."
[...]
```

```
burkhard@lise:~/research_proposal$ git push -u origin master
[...]
```

Bitbucket example

Macheath

```
burkhard@macheath:~$ git clone \
  git@bitbucket.org:meznom/research_proposal.git

Cloning into 'research_proposal'...
[...]

burkhard@macheath:~$ cd research_proposal/
burkhard@macheath:~/research_proposal$ vim README.md
burkhard@macheath:~/research_proposal$ git commit -a \
  -m "Added contact info to README."
[...]

burkhard@macheath:~/research_proposal$ git push
[...]
```

Bitbucket example

The screenshot shows a Bitbucket repository page for 'research_proposal' owned by 'meznom'. The page includes a navigation bar with 'Overview', 'Source', 'Commits', 'Pull requests', and 'Downloads'. The main content area features a description of the repository, a list of recent activity (commits), and a sidebar with repository statistics and an 'Invite users to this repo' button.

Bitbucket Repositories [Create](#)

research_proposal
meznom [Share](#) [Clone](#) [Fork](#) [Compare](#) [Pull request](#)

Overview Source Commits Pull requests Downloads

My research proposal

Describing my cool research project.
Burkhard Ritter, burkhard@ualberta.ca, August 2013.

Recent activity

- Burkhard Ritter** pushed 1 commit to meznom/research_proposal 50 seconds ago
08f6c5c - Added contact info to README.
- Burkhard Ritter** pushed 1 commit to meznom/research_proposal 6 minutes ago
ae5cd46 - Added a README.
- Burkhard Ritter** pushed 4 commits to meznom/research_proposal 9 minutes ago
 - 2e95fb9 - Undid last change. Adding moo was not a good idea.
 - 3722773 - Improved my new section.
 - 228c05b - Wrote new section

SSH `git@bitbucket.org:meznom/researchcl`

1 Branch 0 Tags 0 Forks 1 Watcher

Owner	Burkhard Ritter
Access level	Private
Type	Git
Language	LaTeX
Last updated	48 seconds ago
Created	14 minutes ago
Size	3.6 KB (download)

Invite users to this repo [Send invitation](#)

Bitbucket example

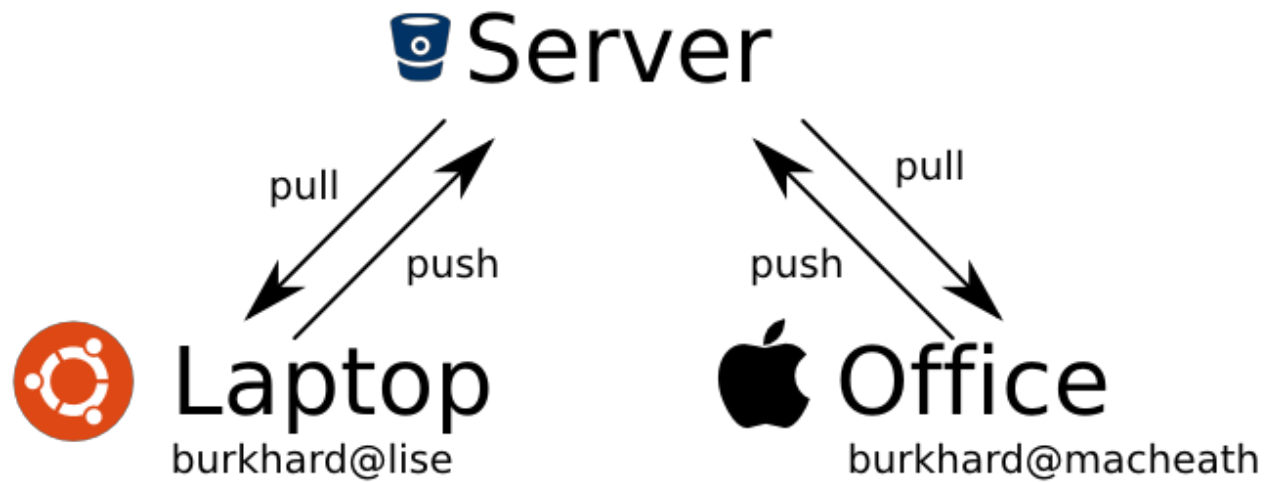
Lise

```
burkhard@lise:~/research_proposal$ git pull
[...]
From ssh://bitbucket.org/meznom/research_proposal
   ae5cd46..08f6c5c master    -> origin/master
Updating ae5cd46..08f6c5c
Fast-forward
 README.md | 4 ++++
 1 file changed, 4 insertions(+)
```

```
burkhard@lise:~/research_proposal$ git log --oneline
08f6c5c Added contact info to README.
ae5cd46 Added a README.
2e95fb9 Undid last change. Adding moo was not a good idea.
3722773 Improved my new section.
220c05b Wrote new section
fc578b1 Initial commit.
```

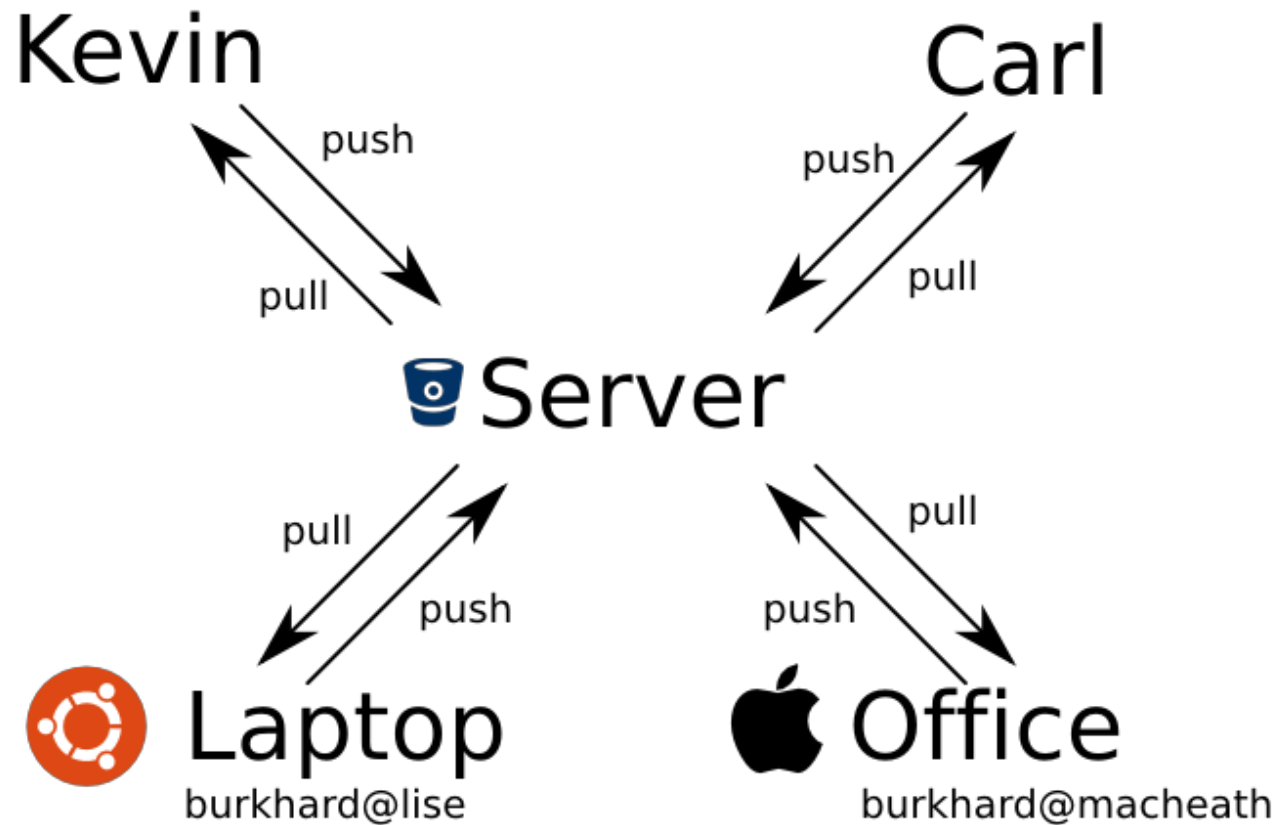
Collaborating

Shared repository



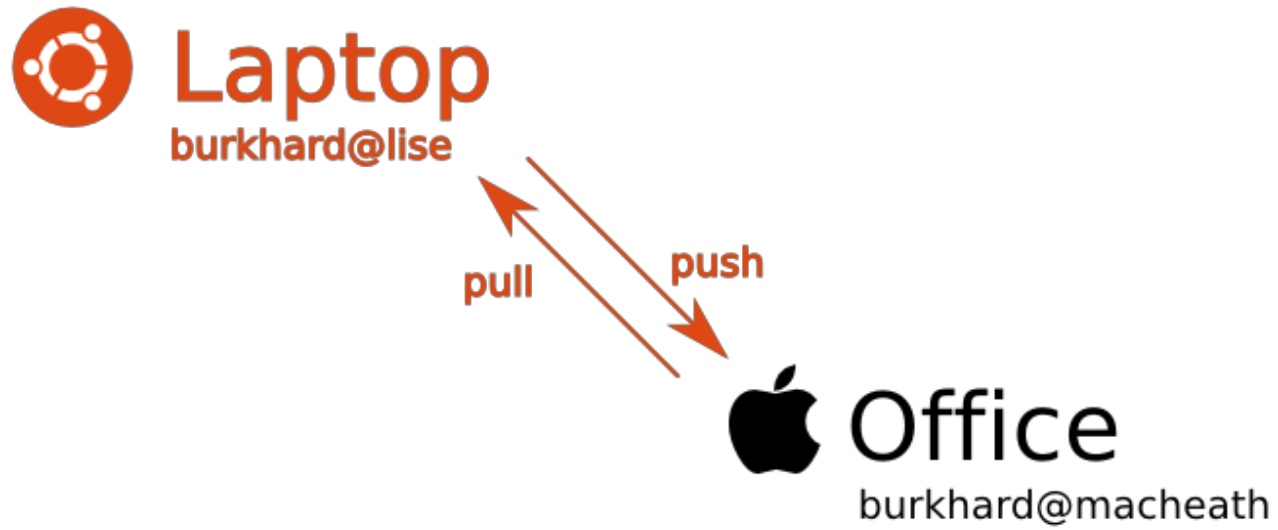
Collaborating

Shared repository



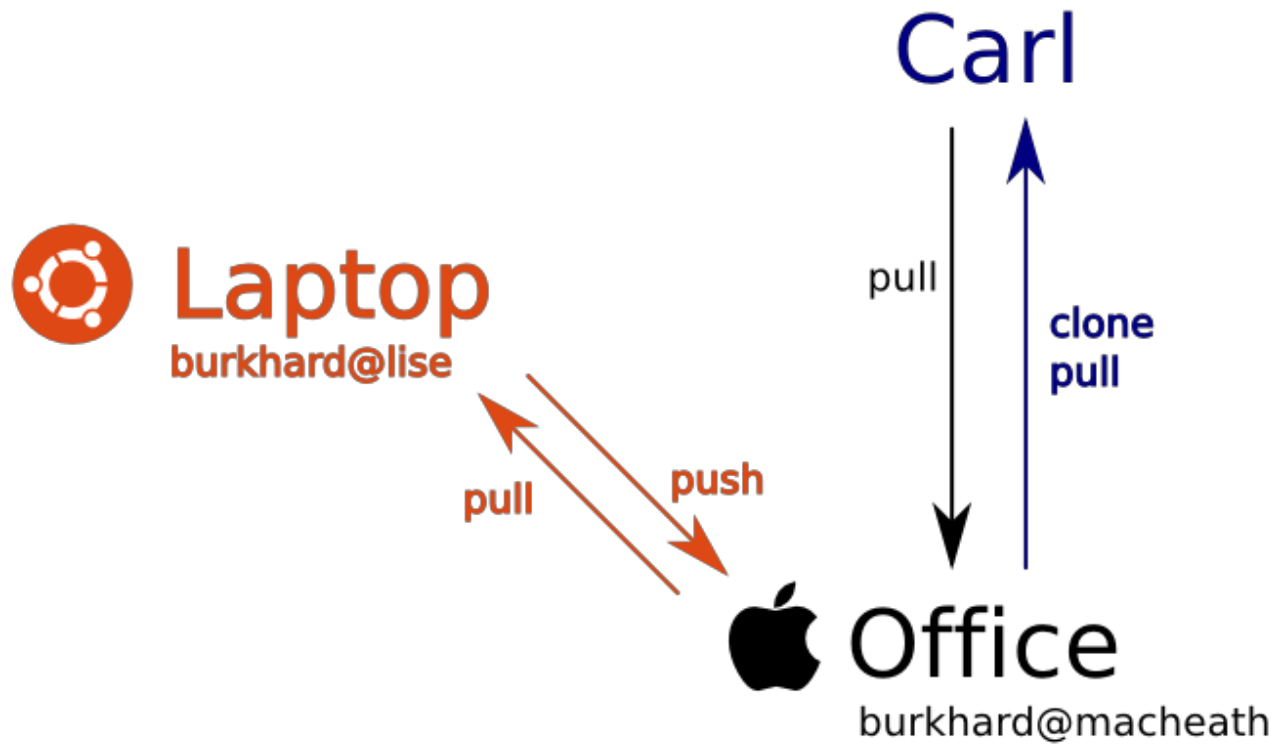
Collaborating

Directly



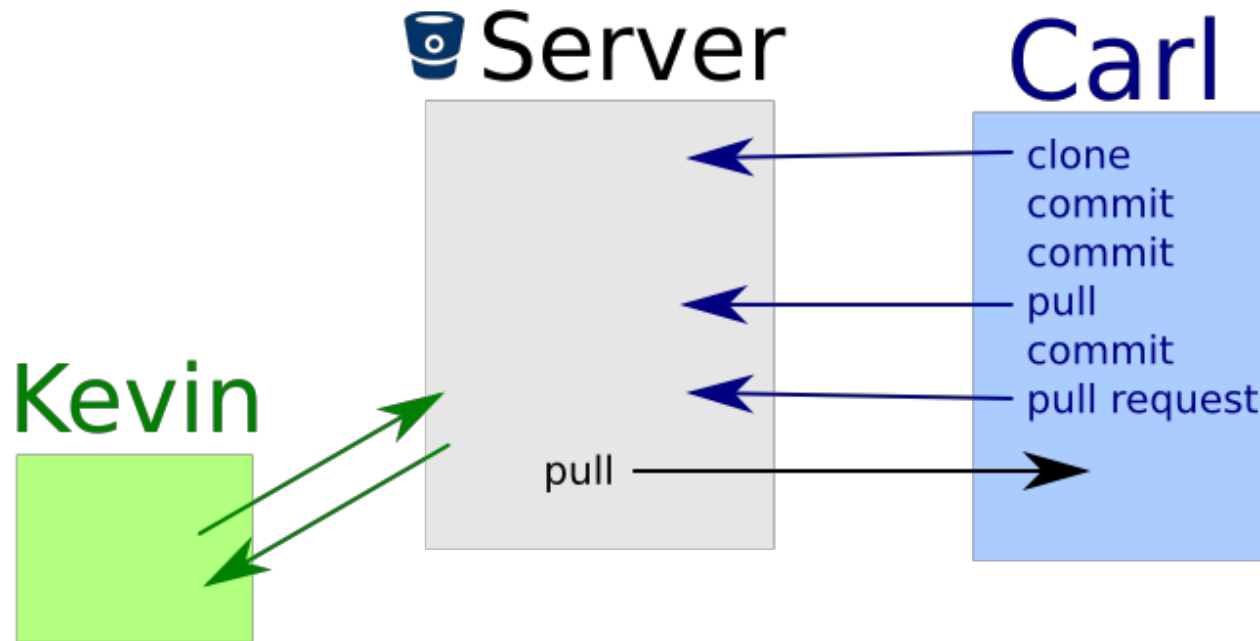
Collaborating

Directly



Collaborating

Fork and pull



The End

- Take away message
Just use it
- Resources
 - Scott Chacon: "Pro Git"
<http://git-scm.com/book>
 - `git help`
 - GitHub help
 - Bitbucket help
 - Stackoverflow
<http://stackoverflow.com/questions/tagged/git>