

Open Source Programming

Lecture-04
Version Control System / Git

Contents

- ◆ **Version Control System**
 - CVS, SVN, Git, ...
- ◆ **Git / Github**

Dealing with Change

◆ How do you manage your coursework?

- Modifying existing code (using Q1 for a basis for Q2)
- Backing up working code
- Checking if an idea works (Do I use a Hashtable or a HashMap?)
- Sharing code in group projects

◆ (Bad) Solutions

- Copying (ex: file_main.java, file_tmp.java)
- Copy & Paste code snippets
- Copy entire directories
- Emailing code to people

Open Source Software

◆ Management of OSS

- Linux kernel has thousands of regular developers, millions of files.
- Developers spread over the globe across multiple time zones
- The Linux kernel runs on different processors (ARM, x86, MIPS). These can require significant differences in low level parts of the code base
- Many different modules
- Old versions are required for legacy systems
- Because it is open source, any one can download and suggest changes.

Control the process automatically

- ◆ Manage these things using a **version control system (VCS)**
- ◆ A version control system is a system which allows for the management of a code base.
 - A *Code Base* does not just mean code!
 - Also includes: documentations, build tools(i.e.Makefiles), configuration files, etc.

Version Control System

Version Control System(VCS)

◆ **Software(Tool) that helps you**

- Manage changes to source code over time
- Keep track of modifications
- Roll back to earlier version if necessary
- Allow team members to work in parallel
- Automate the test and deployment process

◆ **Benefits**

- Traceability
- Branching and merging
 - Manual merging is difficult and messy
- Rollback to clean safe point

◆ Basic Concepts

- Check-out the code
- Work on the local copy
- Diff
- Commit your work to the server
- Update
- Conflict

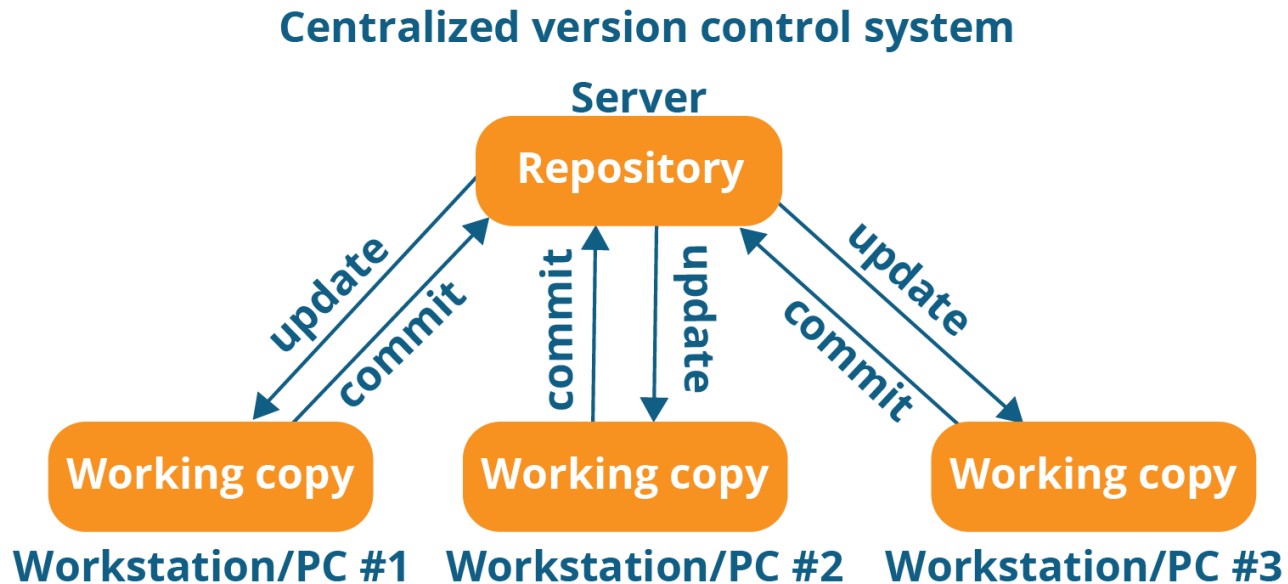
◆ Well-known VCS

- CVS, SVN (Subversion), Mercurial, Git
- Many proprietary software

VCS - CVS

◆ CVS (Concurrent Versions System)

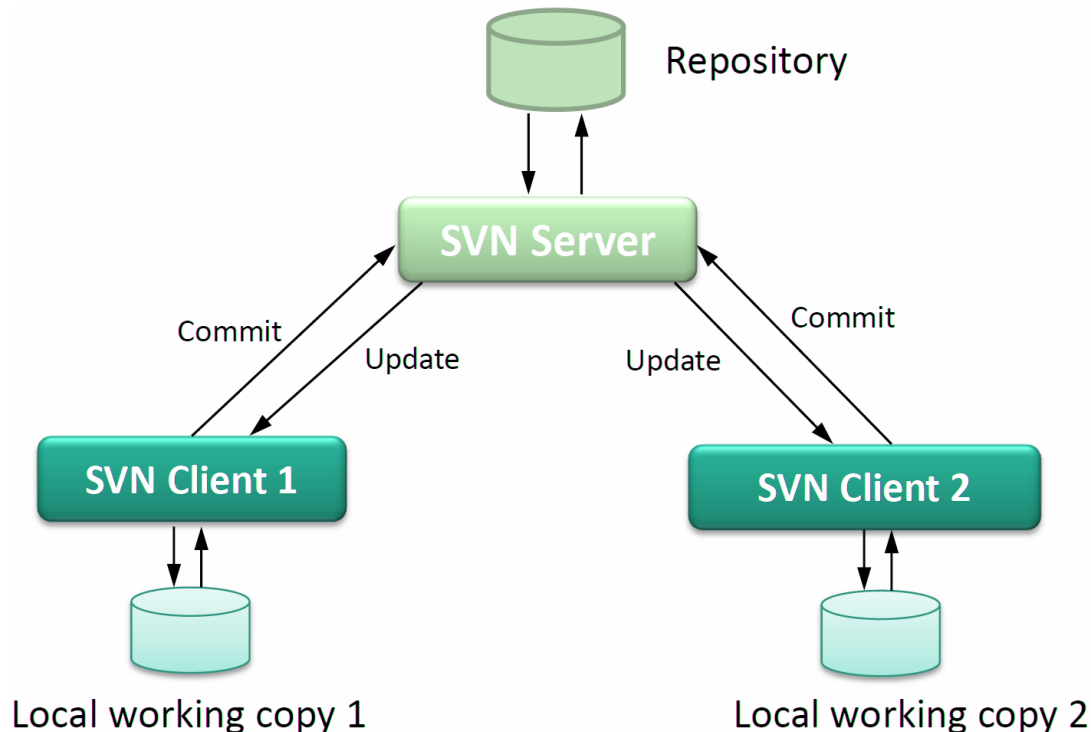
- Concurrent access by multiple developers
- Single repository
- Diff between versions
- Centralized architecture → Problem: “single point of failure”



VCS - Subversion (SVN)

◆ Subversion (SVN)

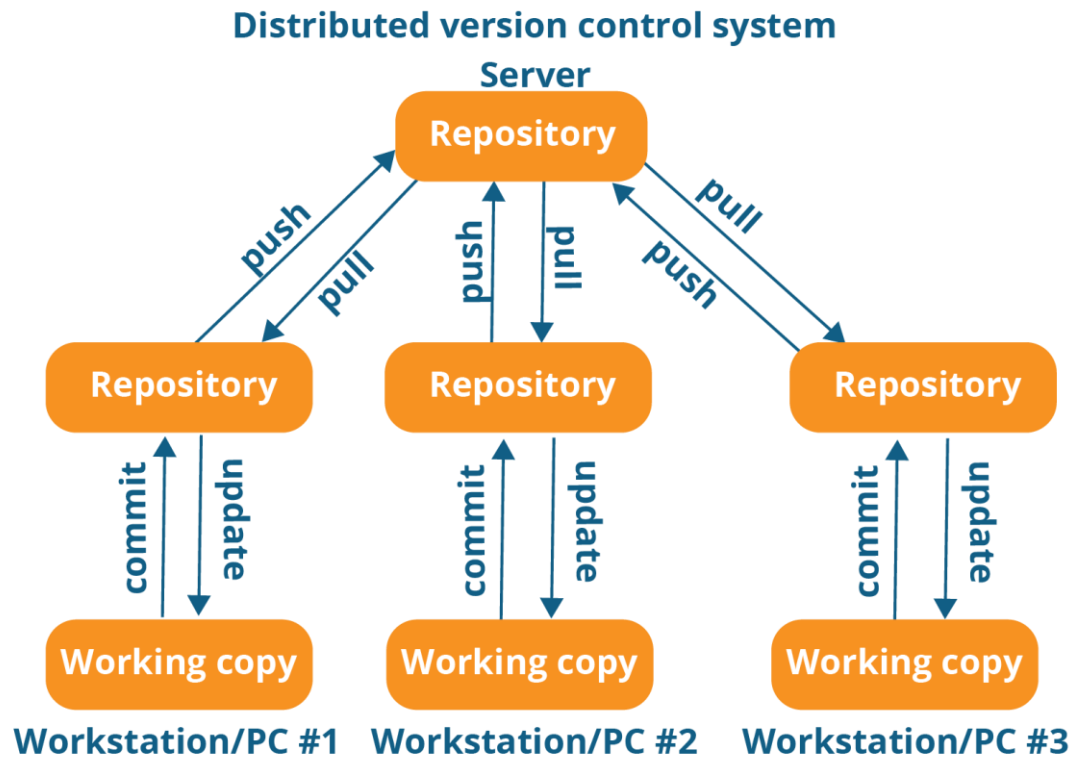
- Centralized: The same as CVS
- Advantage over CVS
 - CVS keeps track of file-by-file changes
 - SVN manages "revision" history
 - Atomic commit



VCS - Git

♦ Git

- Distributed architecture
 - Every contributor has a clone of repository with full history
 - Commit the changes to the local copy



◆ Git Advantages

- **Speed**
 - Very fast operations compared to other VCS (cvs or svn)
- **Space**
 - Compression can be done across repository not just per file
 - Minimizes local size as well as push/pull data transfers
- **Simplicity**
 - Object model is very simple
- **Large userbase with robust tools**

◆ Git interface based systems

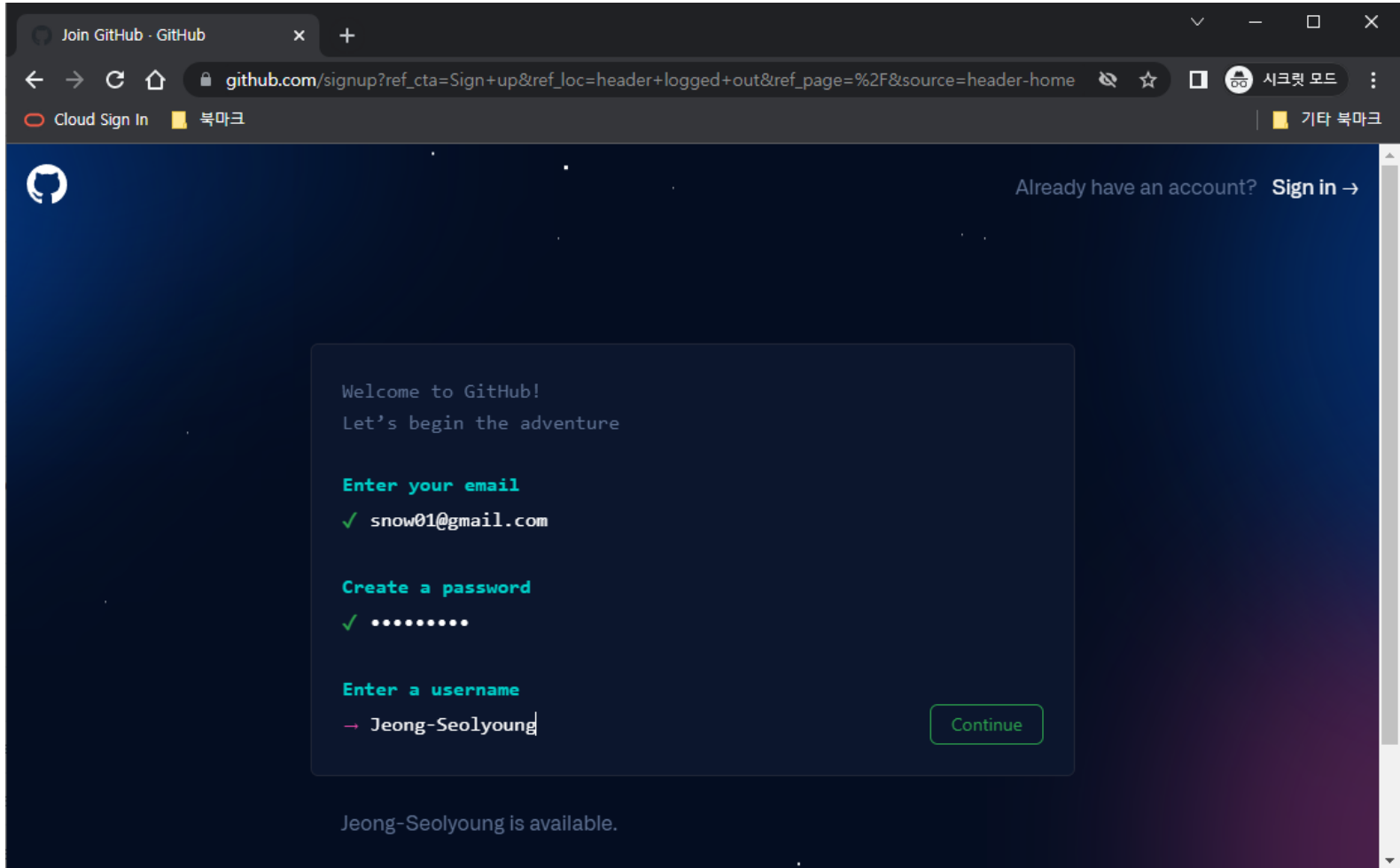
- Github, Gitlab, bitbucket, etc.

<https://github.com/>

Github

Join Github

◆ Sign up → Create account



The screenshot shows the GitHub sign-up page in a web browser. The browser's address bar displays the URL `github.com/signup?ref_cta=Sign+up&ref_loc=header+logged+out&ref_page=%2F&source=header-home`. The page features the GitHub logo in the top left and a link to "Sign in" for existing users in the top right. The main content area is a dark blue box with the text "Welcome to GitHub! Let's begin the adventure". Below this, there are three input fields, each with a green checkmark indicating successful input: "Enter your email" with the value `snow01@gmail.com`, "Create a password" with masked characters `.....`, and "Enter a username" with the value `Jeong-Seolyoung`. A green "Continue" button is positioned to the right of the username field. At the bottom of the box, a message states "Jeong-Seolyoung is available."

Join GitHub · GitHub

github.com/signup?ref_cta=Sign+up&ref_loc=header+logged+out&ref_page=%2F&source=header-home

Cloud Sign In 북마크

Already have an account? Sign in →

Welcome to GitHub!
Let's begin the adventure

Enter your email
✓ snow01@gmail.com

Create a password
✓

Enter a username
→ Jeong-Seolyoung

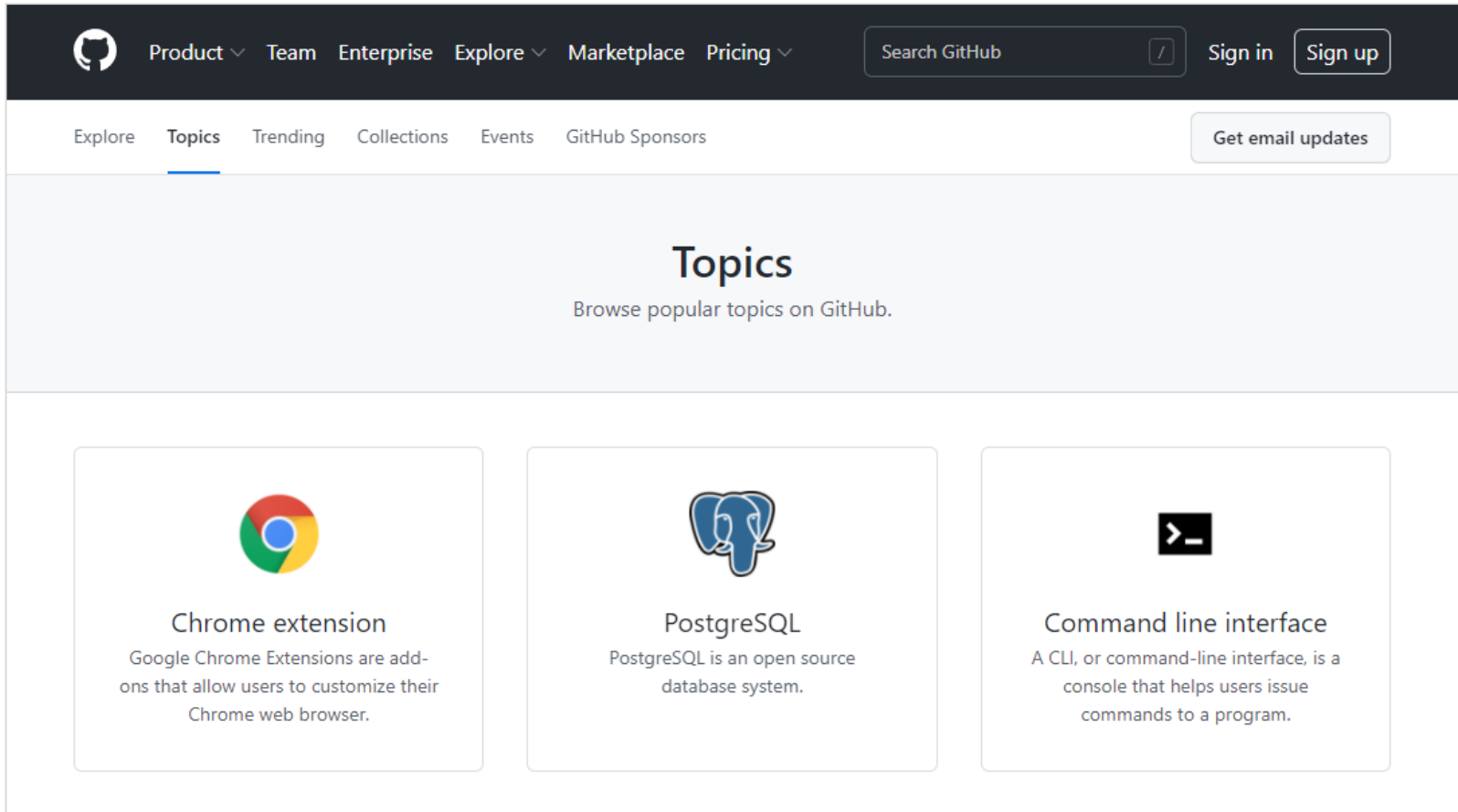
Continue

Jeong-Seolyoung is available.

Explore Github

◆ Explore → Topics

- recommended topics / alphabetical order list / ...



Explore Github

◆ Search topic by language, keyword

- C++, C, Java, Python, etc.
- Blockchain, Andoird, Chrome, Deep Learning, Algorithm, etc.

2022

The screenshot shows the GitHub search interface with the search term 'blockchain'. The left sidebar displays navigation links and statistics for various categories. The main content area shows 122,944 repository results, sorted by 'Best match'. The top three results are:

- dvf/blockchain**: A simple Blockchain in Python. Tags: blockchain, python, flask, bitcoin, cryptocurrency. 6.8k stars, C# language, MIT license, updated 2 days ago, 1 issue needs help.
- LiuBoyuu/blockchain**: 区块链 - 中文资源. Tag: blockchain. 5.7k stars, MIT license, updated on 9 Feb.
- itheima1/BlockChain**: 黑马程序员 120天全栈区块链开发 开源教程. Tags: blockchain, cryptocurrency, hyperledger, itheima, bitcion. 3.6k stars, JavaScript language, CC-BY-SA-4.0 license, updated on 12 Feb.

Below these results, a link to [chaozh/awesome-blockchain-cn](#) is partially visible.

Category	Count
Repositories	122K
Code	?
Commits	729K
Issues	184K
Discussions	2K
Packages	169
Marketplace	7
Topics	521
Wikis	14K
Users	23K

Language	Count
JavaScript	38,176
Python	12,919

Explore Github

♦ Repository Bookmarking : Repository → “Star”

The screenshot shows the GitHub interface for the repository `firstcontributions / first-contributions`. The repository is public and has 22.5k stars, 43.5k forks, and 67 issues. The 'Star' button is highlighted with a red box. The repository has a README, a MIT License, and a Code of conduct. The repository is described as 'Help beginners to contribute to open source projects'.

firstcontributions / first-contributions Public

Notifications Fork 43.5k Star 22.5k

Code Issues 67 Pull requests 1.7k Actions Projects Wiki Security Insights

master 2 branches 0 tags Go to file Code

firstcontributions-bot Merge pull request #48275 f... c6204c0 27 minutes ago 38,886 commits

.github	Add Gabriel Santana to the reviewers list	16 months ago
additional-material	Add Vaishnav Chandurkar to Contributors list & moved ...	6 months ago
gui-tool-tutorials	A small change in the text.	6 months ago
translations	Merge branch 'master' into habray	6 months ago
.gitignore	Remove a bunch of names	6 months ago
CODE_OF_CONDUCT.md	Reset commits to reduce size of the repo	2 years ago
Contributors.md	Merge pull request #48275 from Himuu14/new-Delhi	27 minutes ago
LICENSE	Reset commits to reduce size of the repo	2 years ago

About

Help beginners to contribute to open source projects

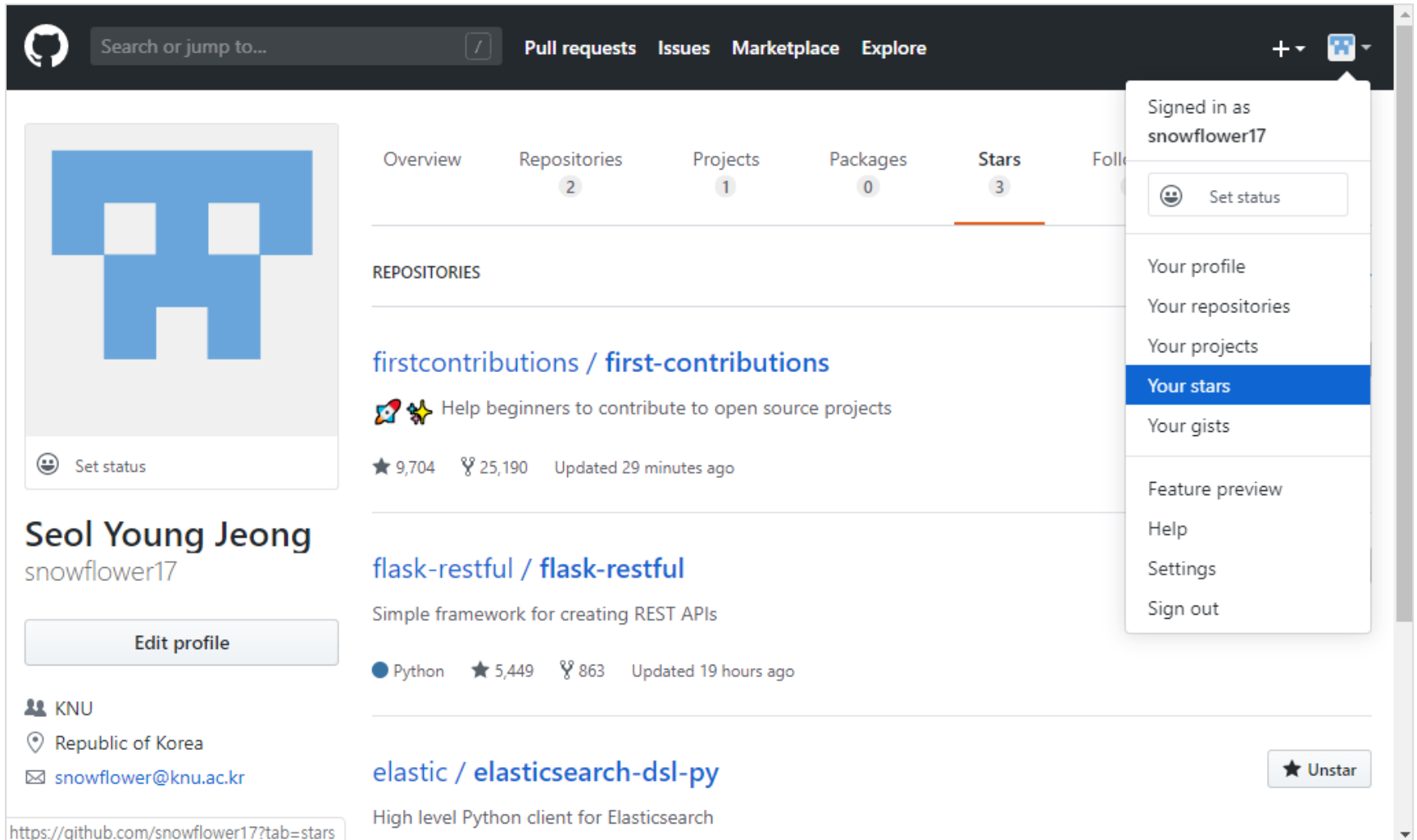
firstcontributions.github.io

open-source community tutorial tutorials contribution

Readme MIT License Code of conduct 22.5k stars 467 watching 43.5k forks

Explore Github

◆ Bookmark list : Your stars



The screenshot shows the GitHub profile of user **snowflower17**. The profile includes a blue square avatar, the name **Seol Young Jeong**, and the username **snowflower17**. The user's bio is "Help beginners to contribute to open source projects". The profile shows 9,704 stars and 25,190 forks. The user is affiliated with KNU, Republic of Korea, and has the email **snowflower@knu.ac.kr**. The profile is public and has a bio link to <https://github.com/snowflower17?tab=stars>.

The **Stars** tab is selected, showing a list of starred repositories:

- firstcontributions / first-contributions**
Help beginners to contribute to open source projects
★ 9,704 🍴 25,190 Updated 29 minutes ago
- flask-restful / flask-restful**
Simple framework for creating REST APIs
● Python ★ 5,449 🍴 863 Updated 19 hours ago
- elastic / elasticsearch-dsl-py**
High level Python client for Elasticsearch

A dropdown menu is open in the top right corner, showing the user is signed in as **snowflower17**. The menu options are: Set status, Your profile, Your repositories, Your projects, **Your stars** (highlighted), Your gists, Feature preview, Help, Settings, and Sign out.

Explore Github

♦ Repository → fork

The screenshot shows the GitHub interface for the repository `firstcontributions / first-contributions`. The repository is public and has 22.5k stars and 43.5k forks. The 'Fork' button is highlighted with a red box. The repository has 67 issues, 1.7k pull requests, and 38,886 commits. The file list shows several files and folders, including `.github`, `additional-material`, `gui-tool-tutorials`, `translations`, `.gitignore`, `CODE_OF_CONDUCT.md`, `Contributors.md`, and `LICENSE`. The right sidebar contains the 'About' section with a description, a link to `firstcontributions.github.io`, and various tags like `open-source`, `community`, `tutorial`, `tutorials`, and `contribution`. It also lists the repository's metadata: Readme, MIT License, Code of conduct, 22.5k stars, 467 watching, and 43.5k forks.

Product ▾ Team Enterprise Explore ▾ Marketplace Pricing ▾

Search / Sign in Sign up

firstcontributions / first-contributions Public

Notifications Fork 43.5k Star 22.5k ▾

<> Code Issues 67 Pull requests 1.7k Actions Projects Wiki Security Insights

master ▾ 2 branches 0 tags

Go to file Code ▾

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About

🚀🌟 Help beginners to contribute to open source projects

🔗 firstcontributions.github.io

open-source community tutorial

tutorials contribution

📖 Readme

📄 MIT License

📄 Code of conduct

☆ 22.5k stars

👁 467 watching

🍴 43.5k forks

Explore Github

◆ Copy project to my repository

The screenshot shows the GitHub interface for the repository `snow-prof / first-contributions`. The repository is public and has 43.5k forks and 0 stars. The main branch is `master`, with 2 branches and 0 tags. The repository is forked from `firstcontributions/first-contributions`. The repository description is "Help beginners to contribute to open source projects" and the website is `firstcontributions.github.io`. The repository has a README, MIT License, and Code of conduct. The repository has 0 stars, 0 watching, and 43.5k forks. The repository has a list of files and folders, including `.github`, `additional-material`, `assets`, `translations`, and `.gitignore`. The repository has a merge pull request `firstcontributions...` by `Roshanjossey` on 18 Mar 2020, with 49,458 commits.

Search or jump to... / Pull requests Issues Marketplace Explore

snow-prof / first-contributions Public

forked from firstcontributions/first-contributions

<> Code Pull requests Actions Projects Wiki Security Insights Settings

master 2 branches 0 tags Go to file Add file Code

This branch is 49458 commits ahead, 38886 commits behind firstcontributions:master. Contribute Fetch upstream

Roshanjossey Merge pull request firstcontributions... c3a16ab on 18 Mar 2020 49,458 commits

.github	Update contributing guide to be tutorial specific	3 years ago
additional-material	Merge pull request firstcontributions#23666 from DXTk...	2 years ago
assets	Merge pull request firstcontributions#23099 from Hars...	2 years ago
translations	Fixing and adding missing parts of Bangla Translation	2 years ago
.gitignore	added sometemp files, eslint, & spec files for Vim & su...	4 years ago

About

Help beginners to contribute to open source projects

firstcontributions.github.io

Readme

MIT License

Code of conduct

0 stars

0 watching

43.5k forks

Releases

Creating a Repository


◆ Profile → Repositories → New

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository.](#)

Owner *

Repository name *

 snow-prof ▾

 /

osp_repo ✓

Great repository names are short and memorable. Need inspiration? How about [cuddly-robot?](#)

Description (optional)

☒  **Public**

Anyone on the internet can see this repository. You choose who can commit.

☐  **Private**

You choose who can see and commit to this repository.

Initialize this repository with:

Skip this step if you're importing an existing repository.

☒ **Add a README file**

This is where you can write a long description for your project. [Learn more.](#)

☐ **Add .gitignore**

Choose which files not to track from a list of templates. [Learn more.](#)

☐ **Choose a license**

A license tells others what they can and can't do with your code. [Learn more.](#)

This will set  **main** as the default branch. Change the default name in your [settings](#).

Create repository

Repository Created

The screenshot shows the GitHub interface for a newly created repository named 'osp_repo' under the user 'snow-prof'. The repository is public and has no stars, 1 watch, and 0 forks. The main content area displays the 'README.md' file, which contains the text 'osp_repo'. The right sidebar shows the 'About' section with no description, website, or topics provided, and the 'Releases' and 'Packages' sections, both indicating no published items.

Repository: snow-prof / osp_repo (Public)

Actions: Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, Settings

main 1 branch 0 tags

Go to file Add file Code

snow-prof Initial commit 47a8362 now 1 commit

README.md Initial commit now

README.md

osp_repo

About

No description, website, or topics provided.

Readme

0 stars

1 watching

0 forks

Releases

No releases published
[Create a new release](#)

Packages

No packages published
[Publish your first package](#)

Install & Setting up Git Client

◆ Upgrade to the latest Ubuntu package

```
$ sudo apt update
```

```
$ sudo apt upgrade -y (same as "--yes")
```

◆ Install git

```
$ sudo apt install git
```

```
$ git --version
```

◆ Setting up

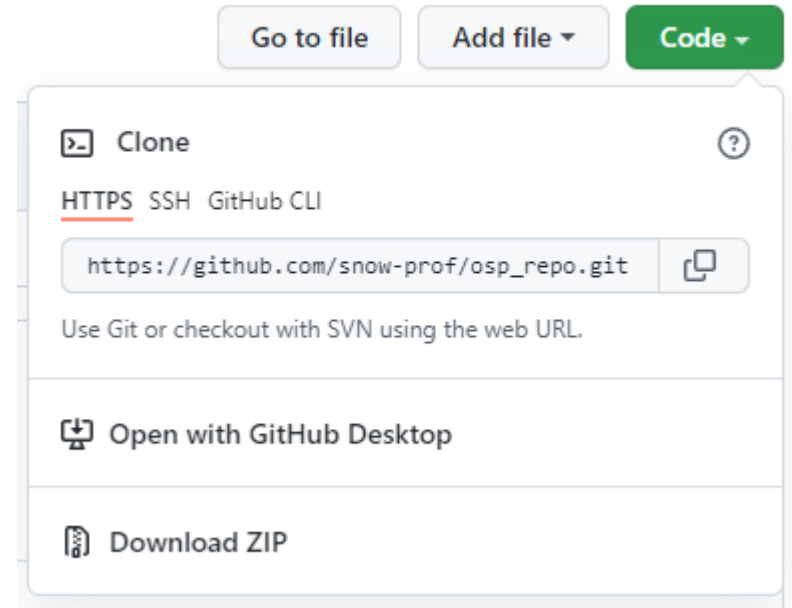
```
$ git config --global user.name "git username"
```

```
$ git config --global user.email "email address"
```

```
$ git config --list
```

Clone My Project

- ◆ Click "Code"
- ◆ Clone / Select
 - Use HTTPS
- ◆ Copy the URL string



- ◆ Come to your local terminal

```
$ git clone https://github.com/.../...git
$ ls
$ cd directory(repo_name)
$ ls -la
```


Adding New File

- ◆ Create a new file `$ echo "git test" > new_file.txt`
- ◆ Check current file status `$ git status`

```
On branch main
Your branch is up to date with 'origin/main'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
    new_file.txt

nothing added to commit but untracked files present (use "git add" to track)
```

- ◆ Add your new file to the stage area

```
$ git add new_file.txt
```

- ◆ Check your status again `$ git status`

```
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
    new file:   new_file.txt
```

Commit Changes and Push

◆ Commit change to the local repository

```
$ git commit -a -m "new file added"
```

```
[main cc83637] new file added  
1 file changed, 1 insertion(+)  
create mode 100644 new_file.txt
```

◆ Check your status

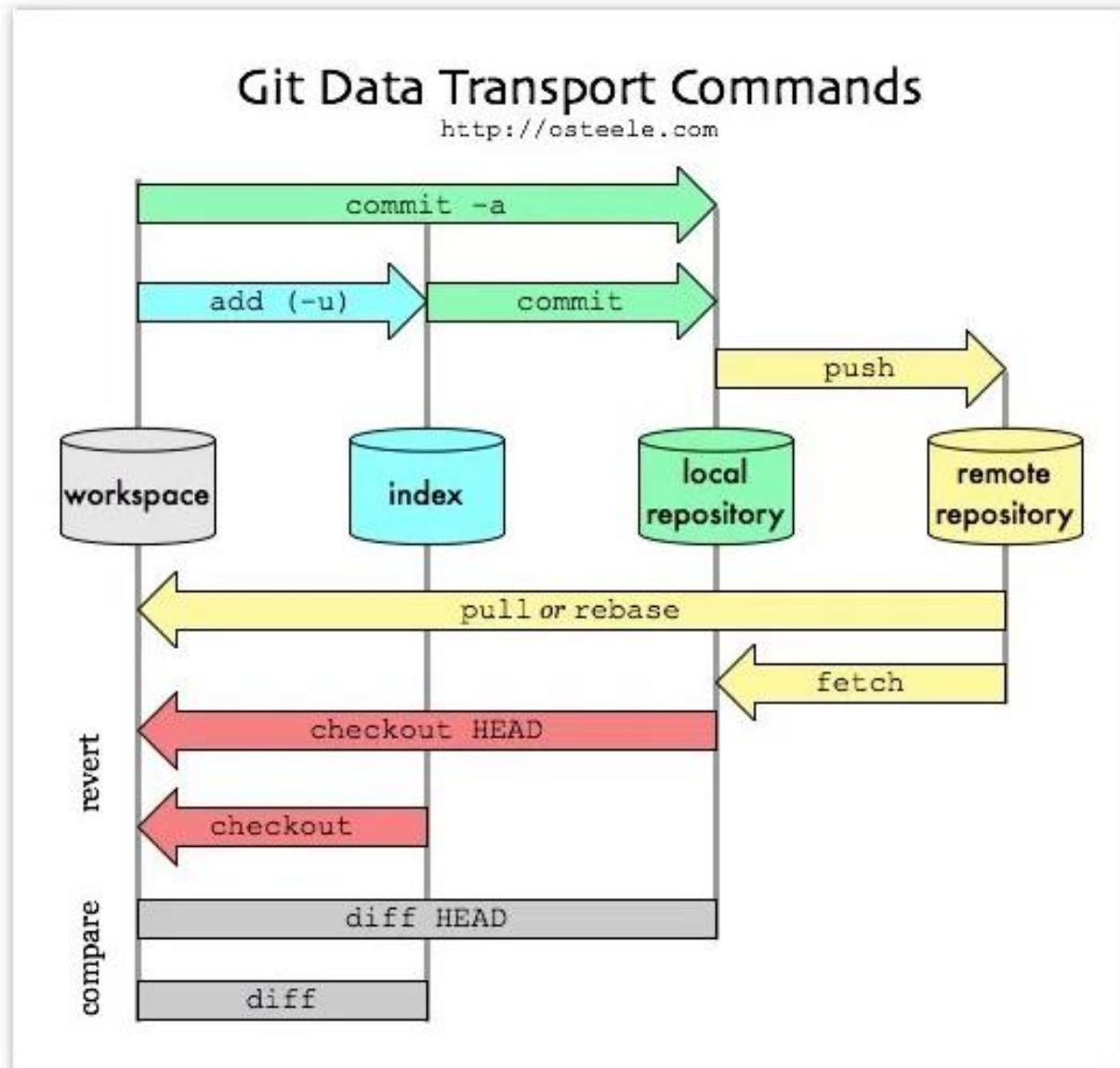
```
$ git status
```

```
On branch main  
Your branch is ahead of 'origin/main' by 1 commit.  
  (use "git push" to publish your local commits)  
  
nothing to commit, working tree clean
```

```
$ git log
```

```
commit cc83637060ec8e10a2d229fd5bb7cfa8a7c79e21 (HEAD -> main)  
Author: snow-prof <snowflower@knu.ac.kr>  
Date:   Thu Mar 17 15:52:42 2022 +0900  
  
    new file added  
  
commit 47a8362ff370f1062b498a7d99ac9453400ada8b (origin/main, origin/HEAD)  
Author: Seol Young Jeong <snowflower@knu.ac.kr>  
Date:   Thu Mar 17 15:23:05 2022 +0900  
  
    Initial commit
```

Git Data Transport Commands



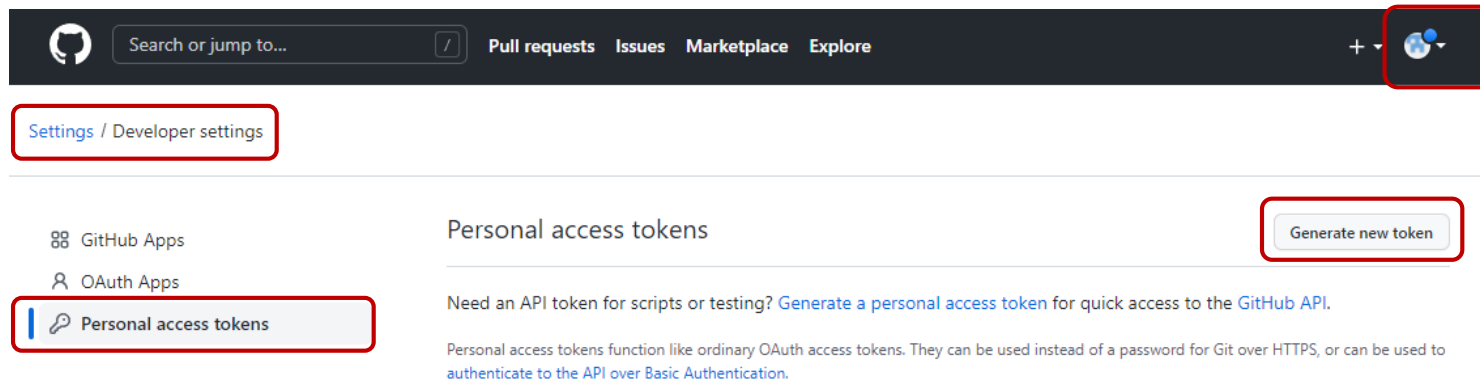
Push to the github

- ◆ Push new commits to the github remote repository

\$ git push

```
snow@snow-ubuntu:~/osp_repo$ git push
Username for 'https://github.com': snow-prof
Password for 'https://snow-prof@github.com':
remote: Support for password authentication was removed on August 13, 2021. Please use a personal access token instead.
remote: Please see https://github.blog/2020-12-15-token-authentication-requirements-for-git-operations/ for more information.
fatal: Authentication failed for 'https://github.com/snow-prof/osp_repo.git/'
```

- ◆ (Web) Profile → Settings → Developer settings → Personal access tokens



Push to the github

◆ Generate token value

Select scopes

Scopes define the access for personal tokens. [Read more about OAuth scopes.](#)

<input checked="" type="checkbox"/> repo	Full control of private repositories
<input checked="" type="checkbox"/> repo:status	Access commit status
<input checked="" type="checkbox"/> repo_deployment	Access deployment status
<input checked="" type="checkbox"/> public_repo	Access public repositories
<input checked="" type="checkbox"/> repo:invite	Access repository invitations
<input checked="" type="checkbox"/> security_events	Read and write security events

◆ Save the personal access token value! → Copy


Personal access tokens

Generate new token

Revoke all

Tokens you have generated that can be used to access the [GitHub API](#).

Make sure to copy your personal access token now. You won't be able to see it again!

✓ ghp_akPoZVPDIIs7qvsUVSdZvpXuJOet6Xw12AbUP 

Delete

Personal access tokens function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to [authenticate to the API over Basic Authentication](#).

Push to the github

◆ Push new commits to the github remote repository

\$ git push

```
snow@snow-ubuntu:~/osp_repo$ git push
Username for 'https://github.com': snow-prof
Password for 'https://snow-prof@github.com': hidden... ★
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 8 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 287 bytes | 287.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To https://github.com/snow-prof/osp_repo.git
 47a8362..cc83637  main -> main
```

- (Web) Copy → (Local) Mouse Right → Paste

◆ Caching Token

\$ vi .git/config → [remote "origin"] url=https://<user-id>:<token>@github.com/...

```
1 [core]
2     repositoryformatversion = 0
3     filemode = true
4     bare = false
5     logallrefupdates = true
6 [remote "origin"]
7     url = https://snow-prof: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@github.com/
      snow-prof/osp_repo.git
8     fetch = +refs/heads/*:refs/remotes/origin/*
9 [branch "main"]
10     remote = origin
11     merge = refs/heads/main
```

Check Github

◆ New file appears!

The screenshot shows the GitHub interface for the repository 'snow-prof / osp_repo'. The repository is public and has 0 stars, 0 forks, and 1 watcher. The 'Code' tab is selected, showing a list of files. A new file, 'new_file.txt', has been added 35 minutes ago, as indicated by the commit message 'snow-prof new file added' and the commit hash 'cc83637'. The file 'README.md' is also listed, with an initial commit 1 hour ago. The repository name 'osp_repo' is displayed in the main content area.

Search or jump to... Pull requests Issues Marketplace Explore

snow-prof / osp_repo Public

Pin Unwatch 1 Fork 0 Star 0

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

main 1 branch 0 tags Go to file Add file Code

snow-prof new file added cc83637 35 minutes ago 2 commits

README.md Initial commit 1 hour ago

new_file.txt new file added 35 minutes ago

README.md

osp_repo

About No description, website, or topics provided.


Readme 0 stars 1 watching 0 forks


Releases No releases published Create a new release

Check Github


◆ Detailed Commit Histories

- commits


 main ▾

 Commits on Mar 17, 2022


new file added


 snow-prof committed 38 minutes ago


Initial commit


 snow-prof committed 1 hour ago

Verified

 47a8362



 cc83637



Modifying a File

- ◆ Come back to your terminal
- ◆ Edit new_file.txt

```
$ vi new_file.txt  
$ cat new_file.txt
```

- ◆ Verify the changes you made

```
$ git diff  
diff --git a/new_file.txt b/new_file.txt  
index f6edd6e..d6babab 100644  
--- a/new_file.txt  
+++ b/new_file.txt  
@@ -1,2 @@  
git test  
+KNU_OSP
```

Modifying a File

◆ Check status

```
$ git status
```

```
On branch main
```

```
Your branch is up to date with 'origin/main'.
```

```
Changes not staged for commit:
```

```
  (use "git add <file>..." to update what will be committed)
```

```
  (use "git restore <file>..." to discard changes in working directory)
```

```
    modified:   new_file.txt
```

```
no changes added to commit (use "git add" and/or "git commit -a")
```

◆ Put it to the stage area

```
$ git add new_file.txt
```

◆ Commit

```
$ git commit -a -m "my first update"
```

◆ Push commits

```
$ git push
```

Modifying a File

- ◆ Apply new commit to the remote repository using push
- ◆ Verify from github website

The screenshot shows the GitHub interface for a repository named 'osp_repo' by user 'snow-prof'. The repository is public and has 1 branch (main) and 0 tags. The commit history shows two commits: 'Initial commit' for README.md (2 hours ago) and 'my first update' for new_file.txt (12 minutes ago). The README.md file is currently open, showing the text 'osp_repo'. The right sidebar contains the 'About' section (no description), 'Readme', '0 stars', '1 watching', and '0 forks'. The 'Releases' section shows 'No releases published' with a link to 'Create a new release'.

Search or jump to... Pull requests Issues Marketplace Explore

snow-prof / osp_repo Public

Pin Unwatch 1 Fork 0 Star 0

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

main 1 branch 0 tags

Go to file Add file Code

snow-prof my first update d653da6 12 minutes ago 3 commits

File	Commit	Time
README.md	Initial commit	2 hours ago
new_file.txt	my first update	12 minutes ago

README.md

osp_repo

About

No description, website, or topics provided.

Readme

0 stars

1 watching

0 forks

Releases

No releases published

Create a new release

Modifying a File

◆ You can directly edit a file from UI

The screenshot displays the GitHub web interface for editing a file. At the top, the repository path is `snow-prof / osp_repo` (Public). Navigation links include Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. The file `new_file.txt` is selected in the `main` branch. The editor shows the following content:

```
1 git test
2 KNU_OSP
3 new new new
```

Below the editor, the **Commit changes** dialog is open. It includes a text input for the commit message (containing "Update new_file.txt"), a description field, and two commit options:

- ☒ Commit directly to the `main` branch.
- ☐ Create a new branch for this commit and start a pull request. [Learn more about pull requests.](#)

At the bottom of the dialog are **Commit changes** and **Cancel** buttons.

Modifying a File

- ◆ To apply new commits to your local repository

```
$ git pull
```

```
remote: Enumerating objects: 5, done.
remote: Counting objects: 100% (5/5), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), 686 bytes | 686.00 KiB/s, done.
From https://github.com/snow-prof/osp_repo
   d653da6..e95fcef  main      -> origin/main
Updating d653da6..e95fcef
Fast-forward
   new_file.txt | 1 +
   1 file changed, 1 insertion(+)
```

```
$ cat new_file.txt
```

Collaboration Practice

◆ Settings → Access → Collaborators

- Add people : github id (user name / email)

The screenshot shows the GitHub repository settings page for 'snow-prof / osp_repo'. The repository is public. The 'Settings' tab is selected, and the 'Access' section is expanded, showing 'Collaborators' as the active sub-tab. The 'Who has access' section shows 'PUBLIC REPOSITORY' and 'DIRECT ACCESS'. The 'Manage access' section displays a message: 'You haven't invited any collaborators yet' with an 'Add people' button highlighted by a red box.

snow-prof / osp_repo Public

Pin Unwatch 1 Fork 0 Star 0

< Code Issues Pull requests Actions Projects Wiki Security Insights Settings

General

Access

Collaborators

Moderation options

Code and automation

Branches

Tags

Actions

Webhooks

Environments

Pages

Security

Code security and analysis

Deploy keys

Who has access

PUBLIC REPOSITORY

This repository is public and visible to anyone.

Manage

DIRECT ACCESS

0 collaborators have access to this repository. Only you can contribute to this repository.

Manage access

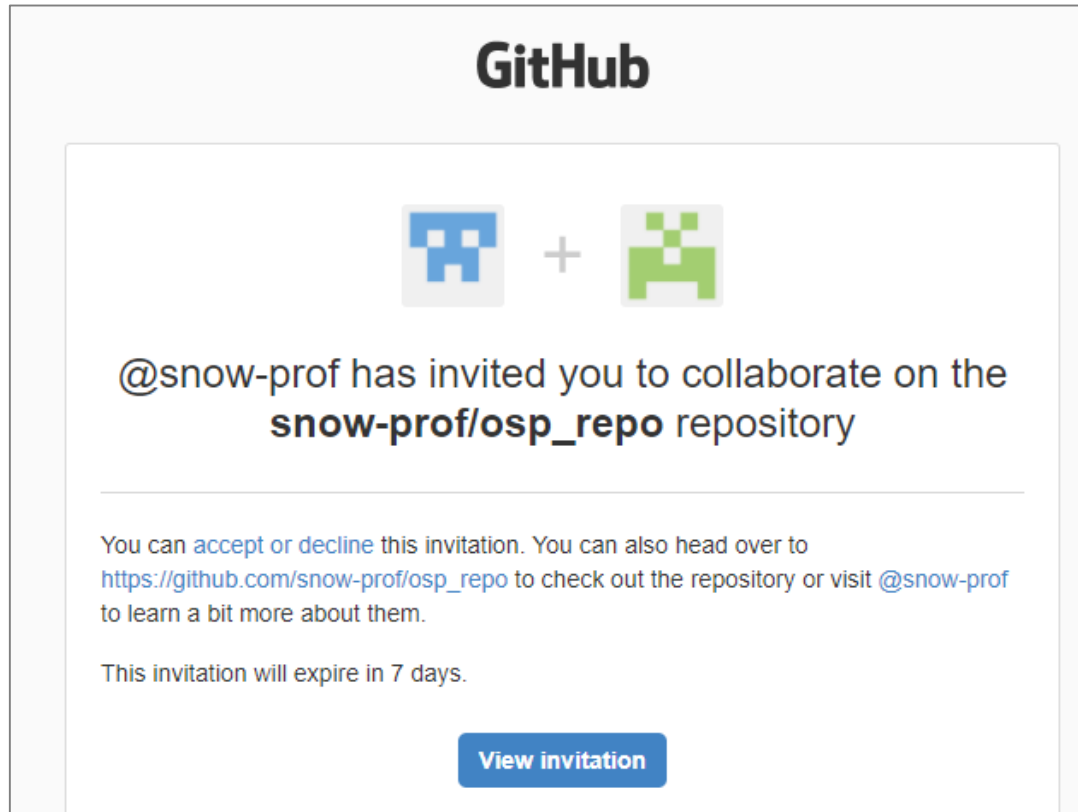
You haven't invited any collaborators yet

Add people

Collaboration Practice

◆ Collaborator:

- Inviting email



- Accept invitation → Repository Star or Fork!!!

Collaboration Practice

◆ Collaborator:

- Change file
- Preview Changes / Commit changes

The screenshot shows a GitHub repository page for 'snow-prof / osp_repo' (Public). The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, and Insights. On the right, there are buttons for Watch (1), Fork (0), and Starred (1). Below the navigation bar, the file path 'osp_repo / new_file.txt' is shown, along with a 'main' branch selector and a 'Cancel changes' button. The main content area displays a diff view for 'new_file.txt'. The diff shows changes between two versions of the file, with line numbers 4 through 8. The changes are highlighted in blue (deletions) and green (additions). The diff content is as follows:

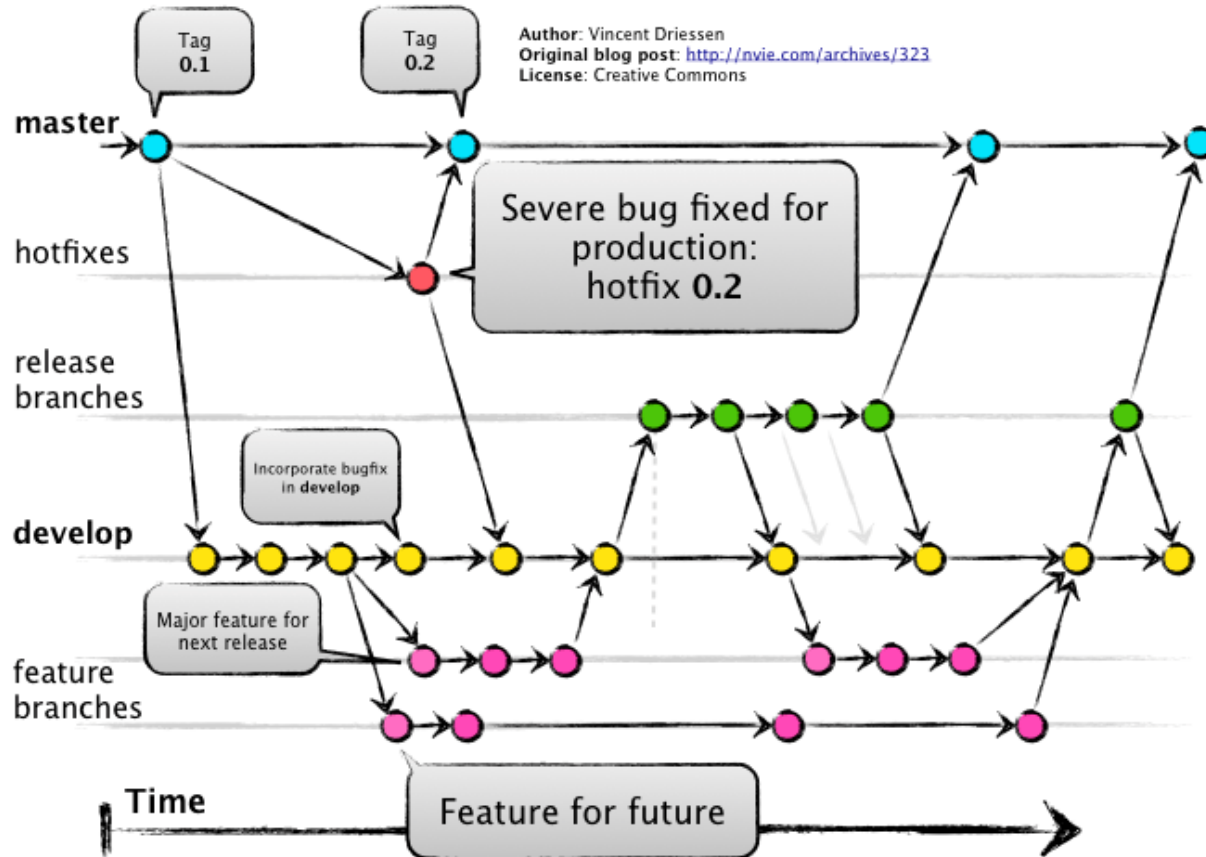
Line	Old File	New File
...	...	@@ -4,3 +4,5 @@ new new new
4	4	
5	5	I'm your collaborator~
6	6	test test test
7		+ test test
8		+ test

Below the diff view, there is a 'Commit changes' dialog box. It features a commit icon, a text input field for the commit message (containing 'Update new_file.txt'), and a larger text area for an optional extended description (containing 'Add an optional extended description...'). At the bottom of the dialog, there are two radio button options: 'Commit directly to the main branch.' (selected) and 'Create a new branch for this commit and start a pull request. Learn more about pull requests.' Below the options are two buttons: 'Commit changes' (green) and 'Cancel' (white).

Branch

◆ Separate commit sequences

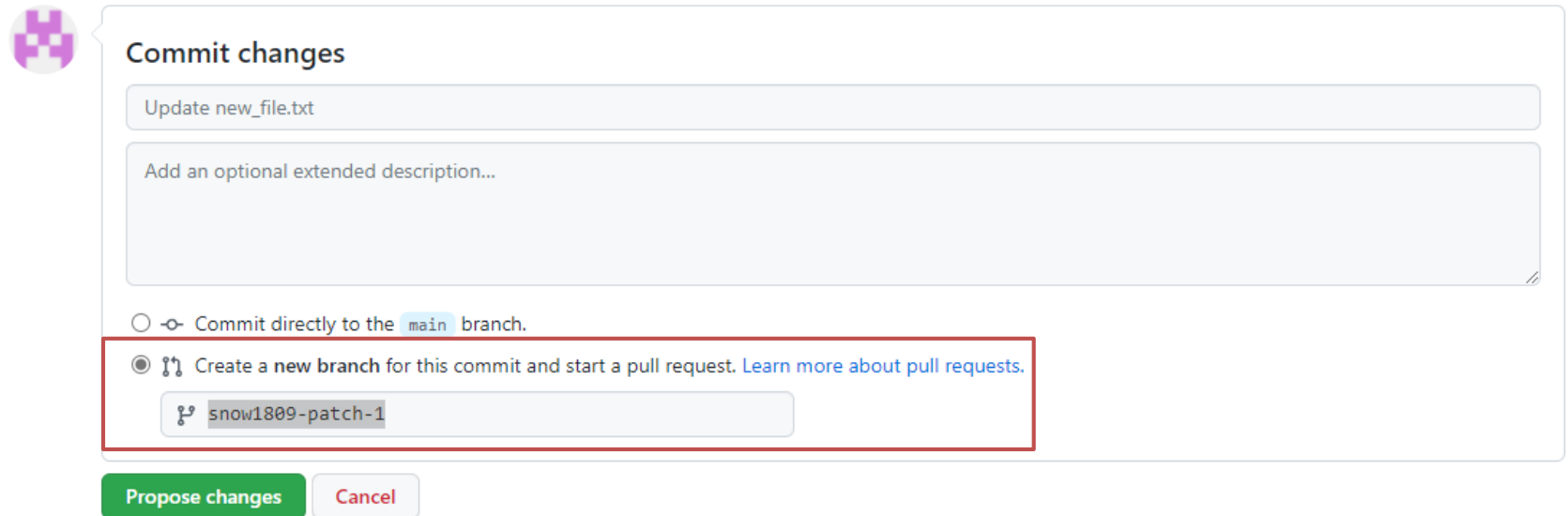
- To test out new features in parallel
- To avoid conflicting with other changes



Collaboration Practice

◆ Collaborator:

- Change file → **Create a new branch** for this commit and start a pull request → Propose changes



The image shows a GitHub 'Commit changes' dialog box. It has a purple and white checkered icon in the top left corner. The title is 'Commit changes'. Below the title is a text input field containing 'Update new_file.txt'. Underneath that is a larger text area with the placeholder 'Add an optional extended description...'. At the bottom, there are two radio button options. The first option is 'Commit directly to the main branch.' with a radio button that is not selected. The second option is 'Create a new branch for this commit and start a pull request. [Learn more about pull requests.](#)' with a radio button that is selected. Below the second option is a text input field containing 'snow1809-patch-1'. At the bottom of the dialog are two buttons: 'Propose changes' (green) and 'Cancel' (grey).

Commit changes

Update new_file.txt

Add an optional extended description...

☐ Commit directly to the `main` branch.

☒ Create a new branch for this commit and start a pull request. [Learn more about pull requests.](#)

Propose changes Cancel

Collaboration Practice

◆ Collaborator:

- Open a pull request → Create pull request

The screenshot shows the GitHub 'Open a pull request' page for the repository `snow-prof / osp_repo` (Public). The page has tabs for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, and Insights. The 'Pull requests' tab is active.

The main heading is 'Open a pull request'. Below it, a message states: 'The change you just made was written to a new branch named `snow1809-patch-1`. Create a pull request below to propose these changes.'

A comparison bar shows 'base: main' and 'compare: snow1809-patch-1' with a green checkmark and the text 'Able to merge. These branches can be automatically merged.'

The pull request title is 'Update new_file.txt'. Below the title are 'Write' and 'Preview' tabs. The 'Write' tab is active, showing a text area with the placeholder 'Leave a comment'. Below the text area is a note: 'Attach files by dragging & dropping, selecting or pasting them.' and a 'Create pull request' button.

On the right side, there are sections for 'Reviewers' (No reviews), 'Assignees' (No one—assign yourself), 'Labels' (None yet), 'Projects' (None yet), 'Milestone' (No milestone), and 'Development' (Use Closing keywords in the description to automatically close issues).

At the bottom, there is a note: 'Remember, contributions to this repository should follow our [GitHub Community Guidelines](#)'. Below this note is a dropdown menu with two options: 'Create pull request' (checked) and 'Create draft pull request'.

Collaboration Practice

◆ Master:

- Pull request → Merge pull request → Confirm merge

The screenshot shows a GitHub pull request titled "Update new_file.txt #1" in the repository "snow-prof/osp_repo". The pull request is from the "snow1809-patch-1" branch to the "main" branch. It shows a single commit "Update new_file.txt" with a verified status. The interface includes a comment section with a "Merge pull request" button and a "Close pull request" button. The right sidebar shows various settings like Reviewers, Assignees, Labels, Projects, Milestone, Development, and Notifications.

snow-prof/osp_repo Public

Watch 1 Fork 0 Starred 1

<> Code Issues Pull requests 1 Actions Projects Wiki Security Insights

Update new_file.txt #1

Edit <> Code

Open snow1809 wants to merge 1 commit into main from snow1809-patch-1

Conversation 0 Commits 1 Checks 0 Files changed 1 +2 -0

snow1809 commented 1 minute ago Collaborator

No description provided.

Update new_file.txt Verified 5b7bb8b

Add more commits by pushing to the snow1809-patch-1 branch on snow-prof/osp_repo.

✓ This branch has no conflicts with the base branch
Merging can be performed automatically.

Merge pull request You can also open this in GitHub Desktop or view command line instructions.

Write Preview H B I ≡ <> @ ↩

Leave a comment

Attach files by dragging & dropping, selecting or pasting them.

Close pull request Comment

Reviewers
No reviews
Still in progress? Convert to draft

Assignees
No one—assign yourself

Labels
None yet

Projects
None yet

Milestone
No milestone

Development
Successfully merging this pull request may close these issues.
None yet

Notifications
Customize
Unsubscribe

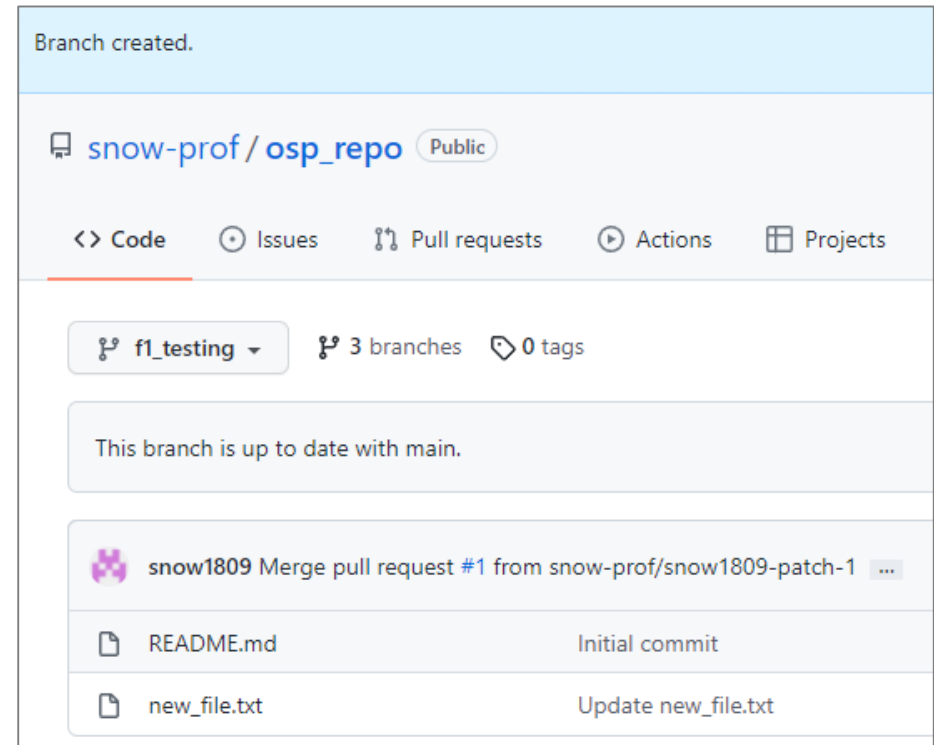
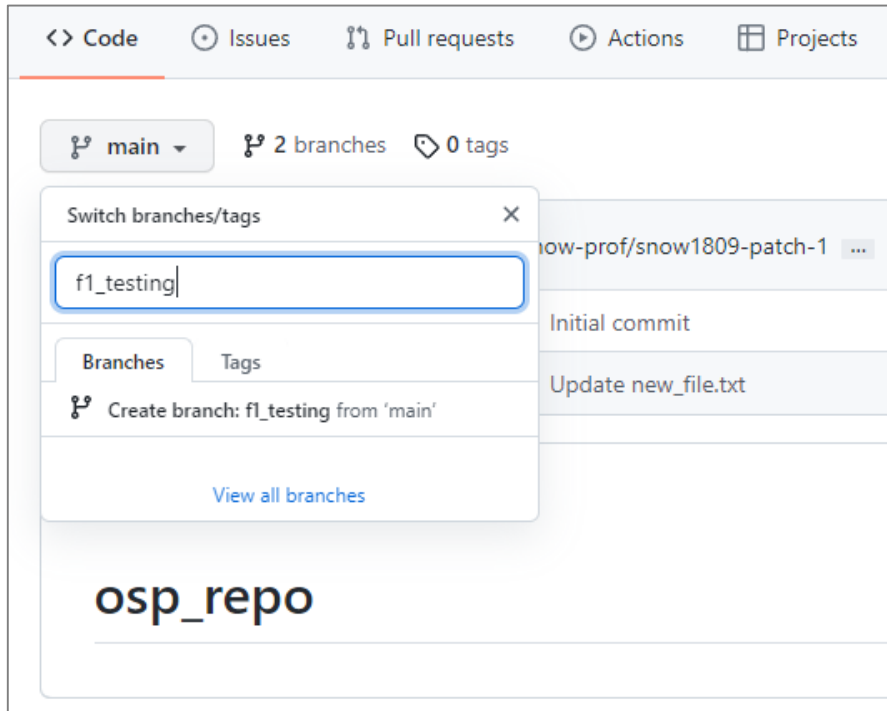
Collaboration Practice

◆ Collaborator / Master: view new branch

The screenshot shows the GitHub interface for the repository 'snow-prof / osp_repo'. The repository is public and has 1 watch, 0 forks, and 1 star. The main branch is 'main'. A dropdown menu for 'Switch branches/tags' is open, showing a search bar 'Find or create a branch...' and a list of branches: 'main' (checked) and 'snow1809-patch-1'. The 'snow1809-patch-1' branch is highlighted. The repository name 'osp_repo' is visible at the bottom left. The right sidebar shows the 'About' section with no description, website, or topics provided, and the 'Releases' section with no releases published.

Creating a Branch

◆ From Github UI



Creating a Branch

◆ From Terminal

```
$ git branch f2_testing
```

◆ Verify

```
$ git branch
```

```
snow@snow-ubuntu:~/osp_repo$ git branch f2_testing
snow@snow-ubuntu:~/osp_repo$ git branch
  f2_testing
* main
snow@snow-ubuntu:~/osp_repo$
```

◆ List all branches (Local & Remote)

```
$ git branch --all
```

```
snow@snow-ubuntu:~/osp_repo$ git branch --all
  f2_testing
* main
remotes/origin/HEAD -> origin/main
remotes/origin/main
```

List Branches

◆ Pull

```
$ git pull
```

```
snow@snow-ubuntu:~/osp_repo$ git pull
remote: Enumerating objects: 6, done.
remote: Counting objects: 100% (6/6), done.
remote: Compressing objects: 100% (4/4), done.
remote: Total 4 (delta 1), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (4/4), 1.29 KiB | 662.00 KiB/s, done.
From https://github.com/snow-prof/osp_repo
   98ed231..2dea4b3  main                -> origin/main
* [new branch]      f1_testing          -> origin/f1_testing
* [new branch]      snow1809-patch-1    -> origin/snow1809-patch-1
Updating 98ed231..2dea4b3
Fast-forward
 new_file.txt | 2 ++
 1 file changed, 2 insertions(+)
```

◆ List all branches (Local & Remote)

```
$ git branch --all
```

```
f2_testing
* main
remotes/origin/HEAD -> origin/main
remotes/origin/f1_testing
remotes/origin/main
remotes/origin/snow1809-patch-1
```


Switching Branches

- ◆ Switch to new branch

```
$ git checkout f2_testing  
Switched to branch 'f2_testing'
```

- ◆ List all branches

```
$ git branch --all
```

```
snow@snow-ubuntu:~/osp_repo$ git branch --all  
* f2_testing  
main  
remotes/origin/HEAD -> origin/main  
remotes/origin/fl_testing  
remotes/origin/main  
remotes/origin/snow1809-patch-1
```

Switching Branches

♦ Create & Add new file in new branch

```
$ echo "hello world" > hello.txt  
$ ls  
$ git add hello.txt
```

♦ Commit & Push new branch

```
$ git commit -a -m "f2-new file"  
$ git push origin f2_testing
```

```
snow@snow-ubuntu:~/osp_repo$ git commit -a -m "f2-new file"
```

```
[f2_testing 601a67a] f2-new file
```

```
1 file changed, 1 insertion(+)
```

```
create mode 100644 hello.txt
```

```
snow@snow-ubuntu:~/osp_repo$ git push origin f2_testing
```

```
Enumerating objects: 4, done.
```

```
Counting objects: 100% (4/4), done.
```

```
Delta compression using up to 8 threads
```

```
Compressing objects: 100% (2/2), done.
```

```
Writing objects: 100% (3/3), 320 bytes | 320.00 KiB/s, done.
```

```
Total 3 (delta 0), reused 0 (delta 0)
```

```
remote:
```

```
remote: Create a pull request for 'f2_testing' on GitHub by visiting:
```

```
remote:      https://github.com/snow-prof/osp_repo/pull/new/f2_testing
```

```
remote:
```

```
To https://github.com/snow-prof/osp_repo.git
```

```
* [new branch]      f2_testing -> f2_testing
```

Switching Branches

◆ Github UI

The screenshot shows the GitHub interface for the repository `snow-prof / osp_repo`, which is public. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. A yellow banner indicates that the `f2_testing` branch had recent pushes 5 minutes ago, with a `Compare & pull request` button. Below this, the current branch is `f1_testing`, and there are 4 branches and 0 tags. Buttons for `Go to file`, `Add file`, and `Code` are visible. A dropdown menu for switching branches/tags is open, showing a search bar and a list of branches: `main` (default), `f1_testing` (checked), `f2_testing`, and `snow1809-patch-1`. A `View all branches` link is at the bottom of the list. The commit history on the right shows the `snow-prof/snow1809-patch-1` branch with commit `2dea4b3` from 20 minutes ago, which has 11 commits. The history includes an initial commit 5 days ago and an update to `new_file.txt` 37 minutes ago.

snow-prof / osp_repo Public

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

f2_testing had recent pushes 5 minutes ago [Compare & pull request](#)

f1_testing 4 branches 0 tags [Go to file](#) [Add file](#) [Code](#)

Switch branches/tags

Find or create a branch...

Branches Tags

main default

✓ f1_testing

f2_testing

snow1809-patch-1

[View all branches](#)

snow-prof/snow1809-patch-1 2dea4b3 20 minutes ago 11 commits

Initial commit 5 days ago

Update new_file.txt 37 minutes ago

Switching Branches

◆ Branch @f2_testing

```
$ git checkout f2_testing
$ ls -l
...
```

◆ Branch @main

```
$ git checkout main
$ ls -l
...
$ git merge f2_testing
... (Editing message / Exit)
```

```
Merge made by the 'recursive' strategy.
hello.txt | 1 +
1 file changed, 1 insertion(+)
create mode 100644 hello.txt
```

```
$ git push
```

Collaboration Practice

◆ Collaborator:

- Create new file

The screenshot shows the GitHub interface for the repository 'snow-prof / osp_repo', which is public. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, and Insights. Below this, the repository name is followed by a 'Public' badge and a 'Watch' button. A branch selector shows 'snow1809-patch...' with 4 branches and 0 tags. Action buttons include 'Go to file', 'Add file', and 'Code'. A status bar indicates 'This branch is 2 commits ahead, 3 commits behind main.' with a 'Contribute' button. The commit history shows a list of commits by user 'snow1809', including 'Create test2.txt' (626cb22, now), 'Create test.txt' (12 minutes ago), 'Update new_file.txt' (1 hour ago), and 'Initial commit' (5 days ago).

snow-prof / osp_repo Public Watch

<> Code Issues Pull requests Actions Projects Wiki Security Insights

snow1809-patch... 4 branches 0 tags Go to file Add file Code

This branch is 2 commits ahead, 3 commits behind main. Contribute

snow1809 Create test2.txt 626cb22 now 12 commits

README.md	Initial commit	5 days ago
new_file.txt	Update new_file.txt	1 hour ago
test.txt	Create test.txt	12 minutes ago
test2.txt	Create test2.txt	now

Collaboration Practice

◆ Collaborator:

- Pull requests → New pull request → Create pull request

The screenshot shows the GitHub 'Compare changes' page. At the top is a navigation bar with links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, and Insights. Below the navigation bar, the title 'Compare changes' is followed by a subtitle: 'Compare changes across branches, commits, tags, and more below. If you need to, you can also [compare across forks](#).' Below this is a comparison selector with 'base: main' and 'compare: main' dropdowns. A yellow banner below the selector contains the text 'Choose different branches or forks above to discuss and review changes. [Learn about pull requests](#)' and a green 'Create pull request' button. The main content area features a large pull request icon, the heading 'Compare and review just about anything', and a subtitle 'Branches, tags, commit ranges, and time ranges. In the same repository and across forks.' Below this is a table titled 'Example comparisons'.

Example comparisons	
snow1809-patch-1	43 seconds ago
f2_testing	25 minutes ago
f1_testing	40 minutes ago
main@{1day}...main	24 hours ago

Collaboration Practice


◆ Collaborator:

- Choose change → Create pull request




[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#)


Comparing changes


Choose two branches to see what's changed or to start a new pull request. If you need to, you can also [compare across forks](#).



 base: main ← compare: snow1809-patch-1 ✓ **Able to merge.** These branches can be automatically merged.


Discuss and review the changes in this comparison with others. [Learn about pull requests](#) [Create pull request](#)



 2 commits  2 files changed  1 contributor

 Commits on Mar 22, 2022

Create test.txt
 snow1809 committed 13 minutes ago

Verified  37f4f23 

Create test2.txt
 snow1809 committed 1 minute ago

Verified  626cb22 

Collaboration Practice




◆ Collaborator:

- Merge pull request
- Create a merge commit
- **Squash and merge**
- Rebase and merge


Snow1809 patch 1 #2





 Open snow1809 wants to merge 2 commits into `main` from `snow1809-patch-1` 

Conversation 0 Commits 2 Checks 0 Files changed 2


 snow1809 commented now Collaborator  


No description provided.



 snow1809 added 2 commits 15 minutes ago

-   Create test.txt Verified 37f4f23
-   Create test2.txt Verified 626cb22

Add more commits by pushing to the `snow1809-patch-1` branch on `snow-prof/osp_repo`.










 **This branch has no conflicts with the base branch**
Merging can be performed automatically.


Merge pull request  You can also [open this in GitHub Desktop](#) or view [command line instructions](#).

  **Create a merge commit**
All commits from this branch will be added to the base branch via a merge commit.

Squash and merge
The 2 commits from this branch will be combined into one commit in the base branch.

Rebase and merge
The 2 commits from this branch will be rebased and added to the base branch.

H B I         

ing them. 

Collaboration Practice

◆ Master:

- One merge two files

The screenshot shows the GitHub interface for the repository `snow-prof / osp_repo`, which is public. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. On the right, there are buttons for Pin, Unwatch (1), Fork (0), and Star (1). Below the navigation bar, a dropdown menu shows the current branch is `main`. The commit history section shows a commit titled "Snow1809 patch 1 (#2)" with a list of changes: "* Create test.txt" and "* Create test2.txt". The commit was made by `snow1809` 5 minutes ago. The commit is marked as "Verified" and the commit hash `8e10559` is displayed.

snow-prof / osp_repo Public

Pin Unwatch 1 Fork 0 Star 1

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

main

Commits on Mar 22, 2022

Snow1809 patch 1 (#2) ... Verified 8e10559 <>

- * Create test.txt
- * Create test2.txt

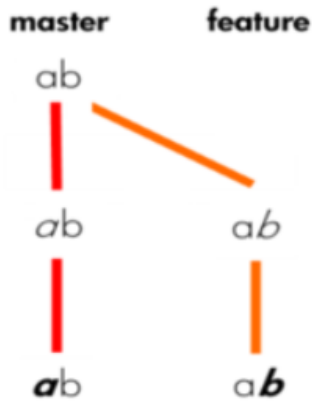
snow1809 committed 5 minutes ago

Merge Branches

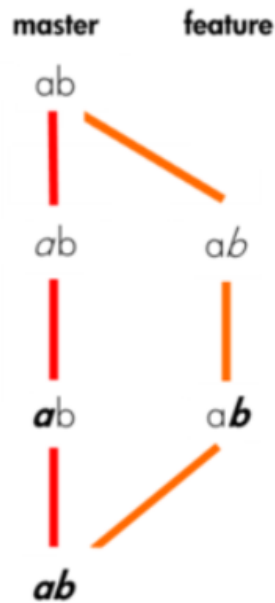
◆ Merge vs. Rebase

<https://hackernoon.com/git-merge-vs-rebase-whats-the-diff-76413c117333>

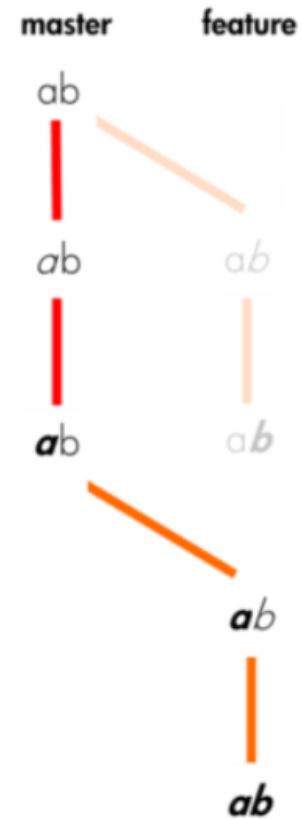
Commits



Merge



Rebase



Rebase Branches

♦ new file & commits & push @f2_testing


```
$ git checkout f2_testing
$ echo "test1" > new_test.txt
$ ls
$ git add new_test.txt
$ git commit -a -m "new test"
... (many commits)
... (many commits)
... (many commits)
... (many commits)
... (many commits)
```





```
$ git push origin f2_testing
```










```
snow@snow-ubuntu:~/osp_repo$ git push origin f2_testing
Enumerating objects: 16, done.
Counting objects: 100% (16/16), done.
Delta compression using up to 8 threads
Compressing objects: 100% (10/10), done.
Writing objects: 100% (15/15), 1.10 KiB | 1.10 MiB/s, done.
Total 15 (delta 5), reused 0 (delta 0)
remote: Resolving deltas: 100% (5/5), completed with 1 local object.
To https://github.com/snow-prof/osp_repo.git
  601a67a..8f3ab5e  f2_testing -> f2_testing
```


Rebase Branches


◆ f2_testing branch



















 snow-prof / osp_repo Public

 Pin  Unwatch 1  Fork 0  Star 1

 Code  Issues  Pull requests  Actions  Projects  Wiki  Security  Insights  Settings


 f2_testing





 Commits on Mar 22, 2022










test5  snow-prof committed 5 minutes ago	 8f3ab5e 
test4  snow-prof committed 6 minutes ago	 13ce605 
test3  snow-prof committed 6 minutes ago	 a4dd4f2 
test2  snow-prof committed 7 minutes ago	 b031ed2 
new test  snow-prof committed 7 minutes ago	 872251d 
f2-new file  snow-prof committed 39 minutes ago	 601a67a 


Rebase Branches


◆ main branch






















 snow-prof / osp_repo Public

 Pin  Unwatch 1  Fork 0  Star 1

 Code  Issues  Pull requests  Actions  Projects  Wiki  Security  Insights  Settings

 main ▾

 Commits on Mar 22, 2022

Snow1809 patch 1 (#2) ...  snow1809 committed 12 minutes ago	Verified	 8e10559	
Merge branch 'f2_testing' into main  snow-prof committed 33 minutes ago		 2d157f1	
f2-new file  snow-prof committed 42 minutes ago		 601a67a	
Merge pull request #1 from snow-prof/snow1809-patch-1 ...  snow1809 committed 1 hour ago	Verified	 2dea4b3	
Update new_file.txt  snow1809 committed 1 hour ago	Verified	 5b7bb8b	
Update new_file.txt  snow1809 committed 2 hours ago	Verified	 98ed231	
Update new_file.txt  snow1809 committed 2 hours ago	Verified	 d166614	

Rebase Branches

◆ rebase from master & merge

- Change base point to current master version

```
$ git rebase main
```

```
First, rewinding head to replay your work on top of it...
Applying: new test
Applying: test2
Applying: test3
Applying: test4
Applying: test5
```

```
$ git checkout main
```

```
$ git merge f2_testing
```

```
snow@snow-ubuntu:~/osp_repo$ git checkout main
Switched to branch 'main'
Your branch is up to date with 'origin/main'.
snow@snow-ubuntu:~/osp_repo$ git merge f2_testing
Updating 2d157f1..5bf36c5
Fast-forward
 new_test.txt | 5 +++++
 1 file changed, 5 insertions(+)
 create mode 100644 new_test.txt
```

```
$ git push
```

Rebase Branches

◆ main branch

snow-prof / osp_repo Public

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

main

Commits on Mar 22, 2022


Merge branch 'main' of https://github.com/snow-prof/osp_repo into main snow-prof committed 1 minute ago	c51fa7d <>
test5 snow-prof committed 3 minutes ago	5bf36c5 <>
test4 snow-prof committed 3 minutes ago	f0eece <>
test3 snow-prof committed 3 minutes ago	dc59ab0 <>
test2 snow-prof committed 3 minutes ago	e3e171a <>
new test snow-prof committed 3 minutes ago	ac999de <>
Snow1809 patch 1 (#2) ... snow1809 committed 17 minutes ago	Verified 8e10559 <>

Conflict

- ◆ If a conflict occurs during collaboration?
- ◆ Collaborator A: Editing hello.txt file in main branch
- ◆ Collaborator B: Editing hello.txt file in f2_testing branch
→ Pull requests

Comparing changes

Choose two branches to see what's changed or to start a new pull request. If you need to, you can also [compare across forks](#).

 base: main ▾ ← compare: f2_testing ▾ ✗ Can't automatically merge. Don't worry, you can still create the pull request.

Discuss and review the changes in this comparison with others. [Learn about pull requests](#)

Create pull request

- ◆ Compare & Manually resolving conflicts...

Remote Repository

◆ Co-operation with many collaborators (team-members)

- In Remote Repository: Push/Pull changes, merge, tracking...
- “fork” is creating a personal repository

```
$ git remote  
origin
```

```
$ git remote -v  
origin https://github.com/myname/myrepo.git (fetch)  
origin https://github.com/myname/myrepo.git (push)
```

Remote Repository

◆ Add Remote Repository

- `git remote add <remote-name> <url>`

```
$ git remote add test https://github.com/username/collaborepo.git
```

```
$ git remote  
origin  
test
```

```
$ git remote -v  
origin https://github.com/myname/myrepo.git (fetch)  
origin https://github.com/myname/myrepo.git (push)  
test https://github.com/username/collaborepo.git (fetch)  
test https://github.com/username/collaborepo.git (push)
```

Remote Repository

◆ View Remote Repository

```
$ git remote show test
```

```
* remote test
```

```
Fetch URL: https://github.com/username/collaborepo.git
```

```
Push URL: https://github.com/username/collaborepo.git
```

```
Remote branch:
```

```
    main new (next fetch will store in remotes/test)
```

```
Local ref configured for 'git push':
```

```
    main pushes to main (local out of date)
```

Remote Repository

◆ Get data from remote repository

- `git fetch <remote-name>`
- none data in local repository, but get all data from remote repository → You can work in remote repository.

```
$ git fetch test
```

```
warning: no common commits
```

```
remote: Enumerating objects: 3, done.
```

```
remote: Counting objects: 100% (3/3), done.
```

```
remote: Total 3 (delta 0), reused 0 (delta 0), pack-  
reused 0
```

```
Unpacking objects: 100% (3/3), 586 bytes | 586.00  
KiB/s, done.
```

```
From https://github.com/snow1809/test
```

```
* [new branch]      main      -> test/main
```

Remote Repository

◆ Remote Branches

```
$ git branch --all
```

```
f2_testing  
* main  
remotes/origin/HEAD -> origin/main  
remotes/origin/fl_testing  
remotes/origin/f2_testing  
remotes/origin/main  
remotes/origin/snow1809-patch-1  
remotes/test/main
```

```
$ git checkout remotes/test/branch1
```

```
Note: switching to 'remotes/test/main'.
```

You are in 'detached HEAD' state. You can look around, make experimental changes and commit them, and you can discard any commits you make in this state without impacting any branches by switching back to a branch.

???

If you want to create a new branch to retain commits you create, you may do so (now or later) by using `-c` with the switch command. Example:

```
git switch -c <new-branch-name>
```

Or undo this operation with:

```
git switch -
```

Turn off this advice by setting config variable `advice.detachedHead` to false

```
HEAD is now at b9b6201 Initial commit
```

Remote Repository

◆ Create local branch from remote branch

```
$ git checkout -b test_branch1 remotes/test/main
Branch 'test_branch1' set up to track remote branch
'main' from 'test'.
Switched to a new branch 'test_branch1'
```

```
$ git branch --all
```

```
snow@snow-ubuntu:~/osp_repo$ git checkout -b test_branch1 remotes/test/main
Branch 'test_branch1' set up to track remote branch 'main' from 'test'.
Switched to a new branch 'test_branch1'
snow@snow-ubuntu:~/osp_repo$
snow@snow-ubuntu:~/osp_repo$ git branch --all
  f2_testing
  main
* test_branch1
  remotes/origin/HEAD -> origin/main
  remotes/origin/fl_testing
  remotes/origin/f2_testing
  remotes/origin/main
  remotes/origin/snow1809-patch-1
  remotes/test/main
```

Remote Repository

◆ Get latest data

- FETCH_HEAD : head of branch from remote repository
- It is valid after fetch...

```
$ git pull test branch1
```

```
From https://github.com/username/collaborepo
* branch          main      -> FETCH_HEAD
```

◆ Modify file & push to remote branch

```
$ echo "new remote file" > newfile.txt
```

```
$ git add newfile.txt
```

```
$ git commit -a -m "create newfile"
```

```
$ git push test test_branch1
```

Remote Repository

◆ in Github Web Repository

The screenshot shows the GitHub web interface for a repository named 'snow1809 / test', which is marked as 'Private'. The top navigation bar includes links for 'Code', 'Issues', 'Pull requests', 'Actions', 'Projects', 'Security', and 'Insights'. A yellow banner at the top indicates that 'test_branch1' had recent pushes 1 minute ago, with a 'Compare & pull request' button. Below this, the repository's branch and tag status is shown as 'main' (with a dropdown), '2 branches', and '0 tags'. To the right are buttons for 'Go to file', 'Add file', and 'Code'. A 'Switch branches/tags' dropdown menu is open, displaying a search bar 'Find or create a branch...' and a list of branches: 'main' (checked and marked 'default') and 'test_branch1'. A link 'View all branches' is at the bottom of the list. The commit history shows an 'Initial commit' with hash 'b9b6201' made '25 minutes ago' with '1 commit'. An edit icon is visible next to the commit details.

Remote Repository

- ◆ It is natural, since you don't have permission to write other's repository.
- ◆ Push Error

```
! [remote rejected] main -> main (permission denied)
Error: failed to push some refs to
'https://github.com/.../...git'
```
- ◆ That's why "Pull request" is amazing!

Any Questions...
Just Ask!

