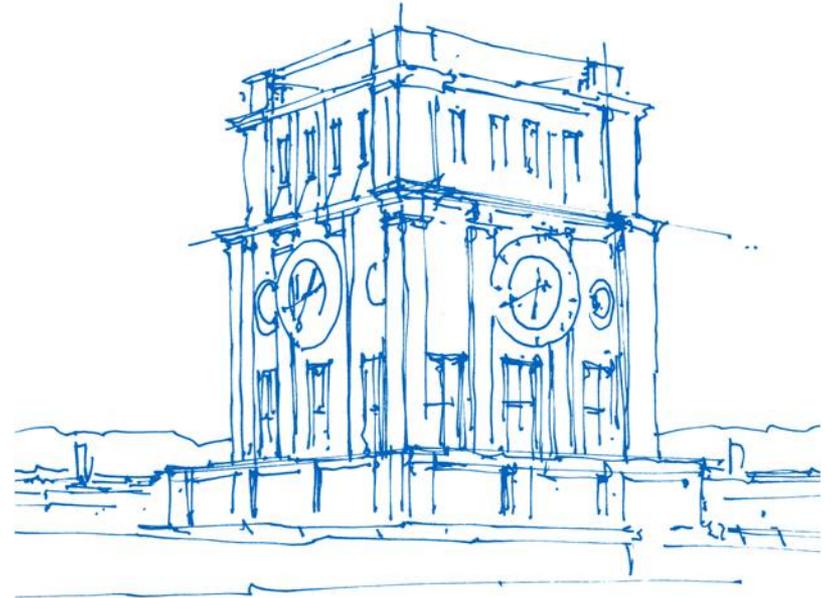


Database Systems on Modern CPU Architectures

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Chair for Database Systems

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kohna@in.tum.de



Uhrenturm der TUM

Organisation

- Lecture + Tutorial: Tuesdays from 14:00 – 17:00. (Next week: C++ crash course)
- Programming assignments every 2 weeks starting now. (probably 7)
- Announcements on the website & **Mattermost**.
- Assignments managed via **GitLab (CI)**. (Due Tuesdays at 14:00)
- No teams.
- Bonus system:
 - **0.3 / 0.4** grade bonus on final exam. ($\geq 75\%$ of all points)
 - **+4** points for correct implementation of assignments.
 - **+1** points for code quality per assignment. (≥ 1 point for implementation)



GitLab



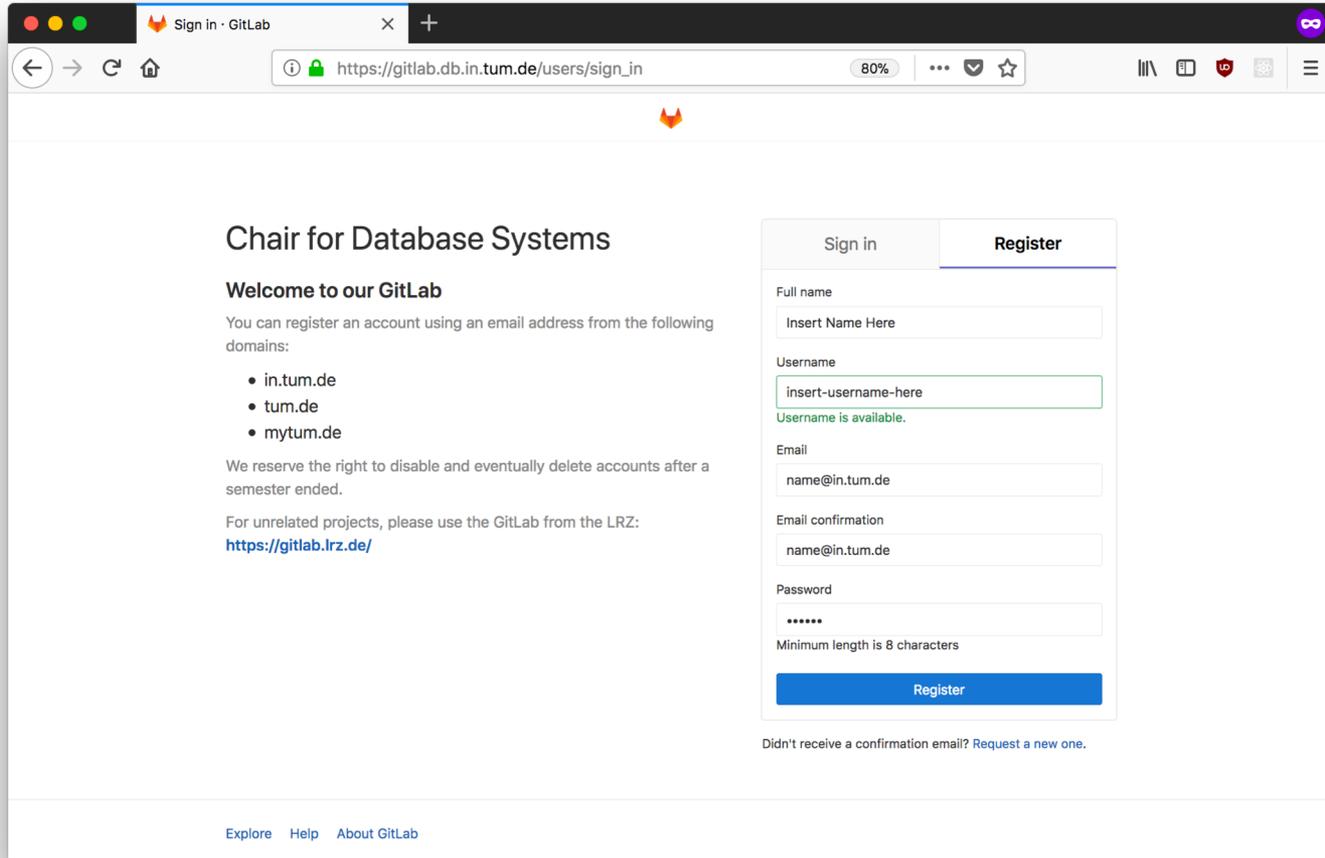
Mattermost®



GitLab



Mattermost®



Sign in · GitLab

https://gitlab.db.in.tum.de/users/sign_in

Chair for Database Systems

Welcome to our GitLab

You can register an account using an email address from the following domains:

- in.tum.de
- tum.de
- mytum.de

We reserve the right to disable and eventually delete accounts after a semester ended.

For unrelated projects, please use the GitLab from the LRZ:
<https://gitlab.lrz.de/>

Sign in

Register

Full name

Username

Username is available.

Email

Email confirmation

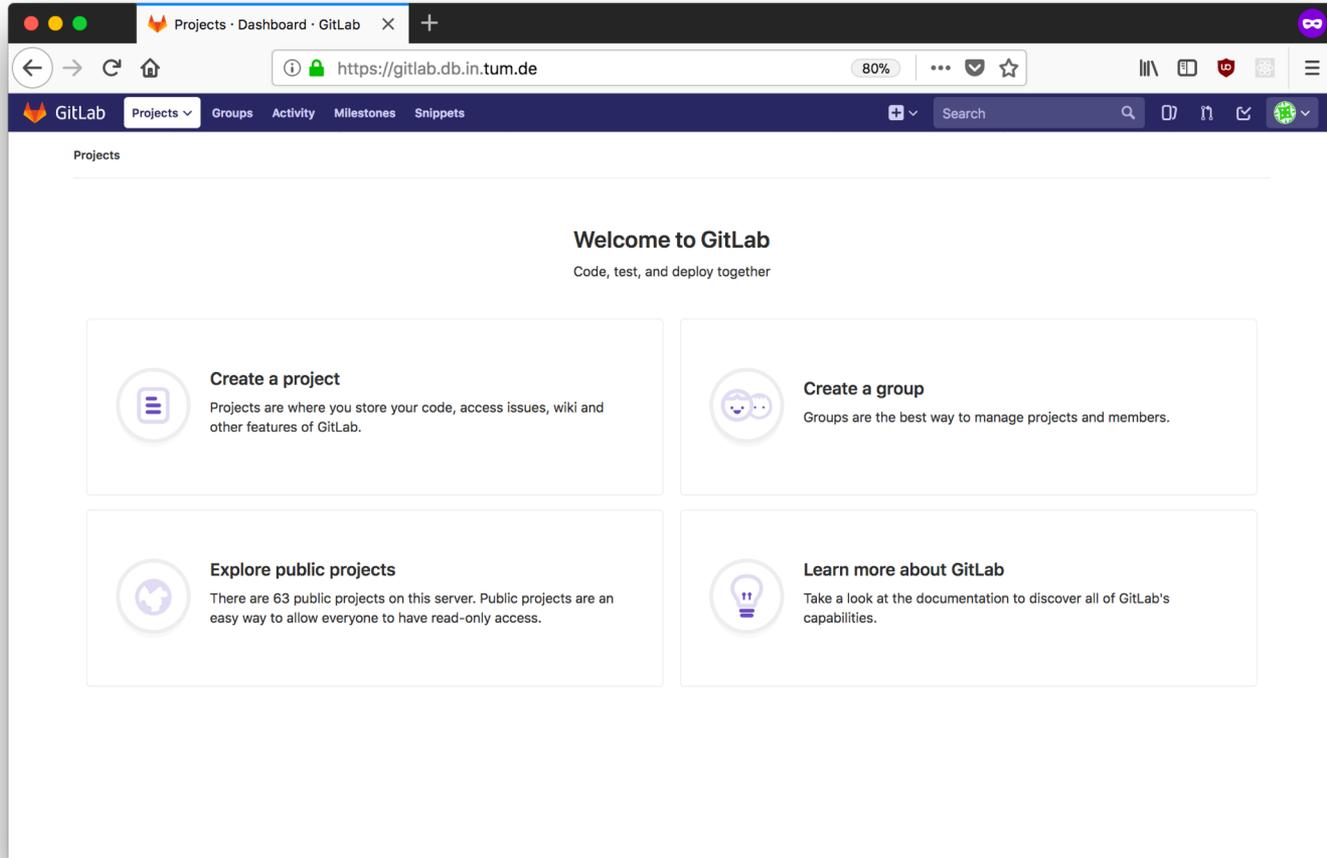
Password

Minimum length is 8 characters

Register

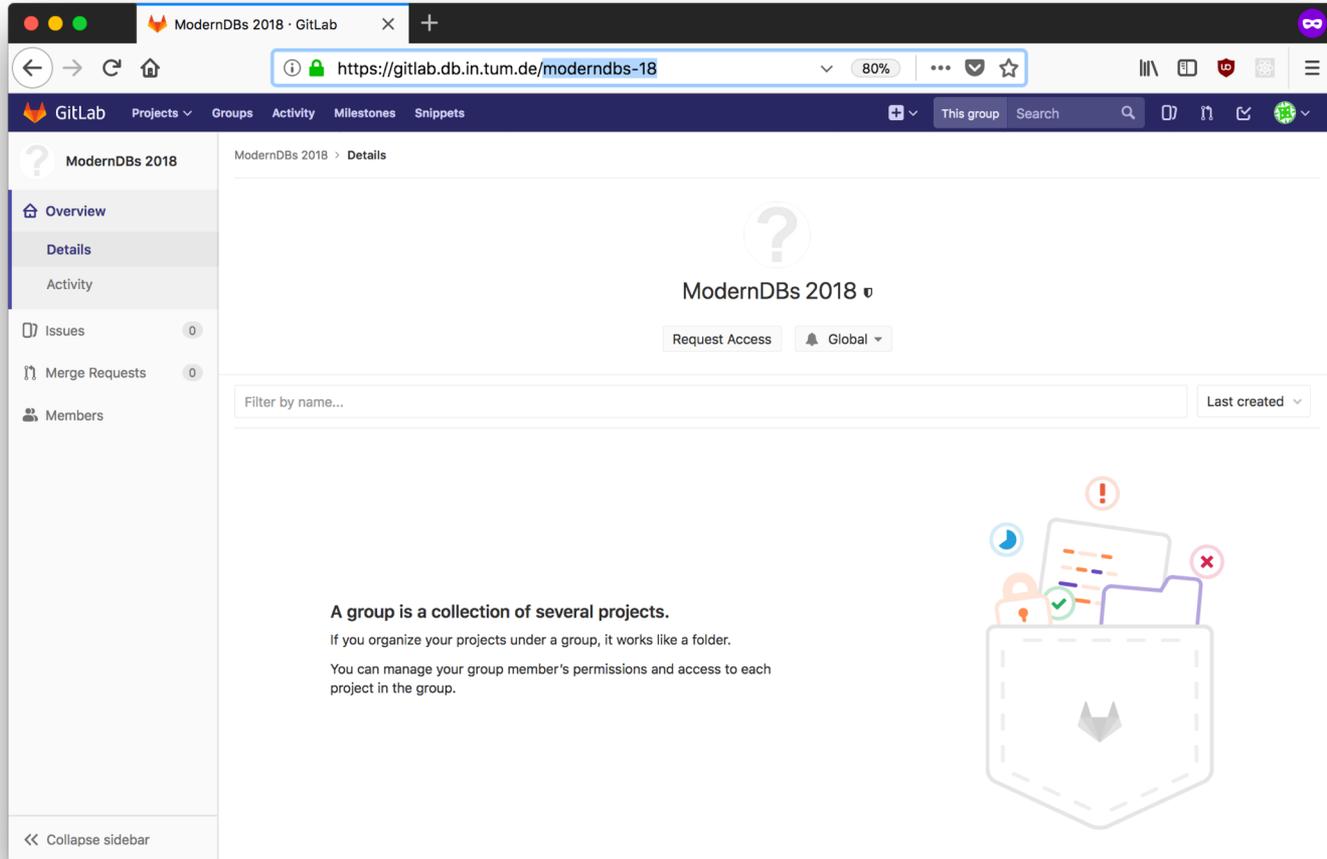
Didn't receive a confirmation email? [Request a new one.](#)

[Explore](#) [Help](#) [About GitLab](#)



The screenshot shows a web browser window with the URL `https://gitlab.db.in.tum.de`. The page title is "Projects - Dashboard - GitLab". The navigation bar includes "GitLab", "Projects", "Groups", "Activity", "Milestones", and "Snippets". The main content area is titled "Projects" and features a "Welcome to GitLab" message with the tagline "Code, test, and deploy together". Below the welcome message are four interactive cards:

- Create a project**: Projects are where you store your code, access issues, wiki and other features of GitLab.
- Create a group**: Groups are the best way to manage projects and members.
- Explore public projects**: There are 63 public projects on this server. Public projects are an easy way to allow everyone to have read-only access.
- Learn more about GitLab**: Take a look at the documentation to discover all of GitLab's capabilities.



ModernDBs 2018 · GitLab

https://gitlab.db.in.tum.de/moderndbs-18

GitLab Projects Groups Activity Milestones Snippets

ModernDBs 2018

ModernDBs 2018 > Details

Overview
Details
Activity

Issues 0
Merge Requests 0
Members

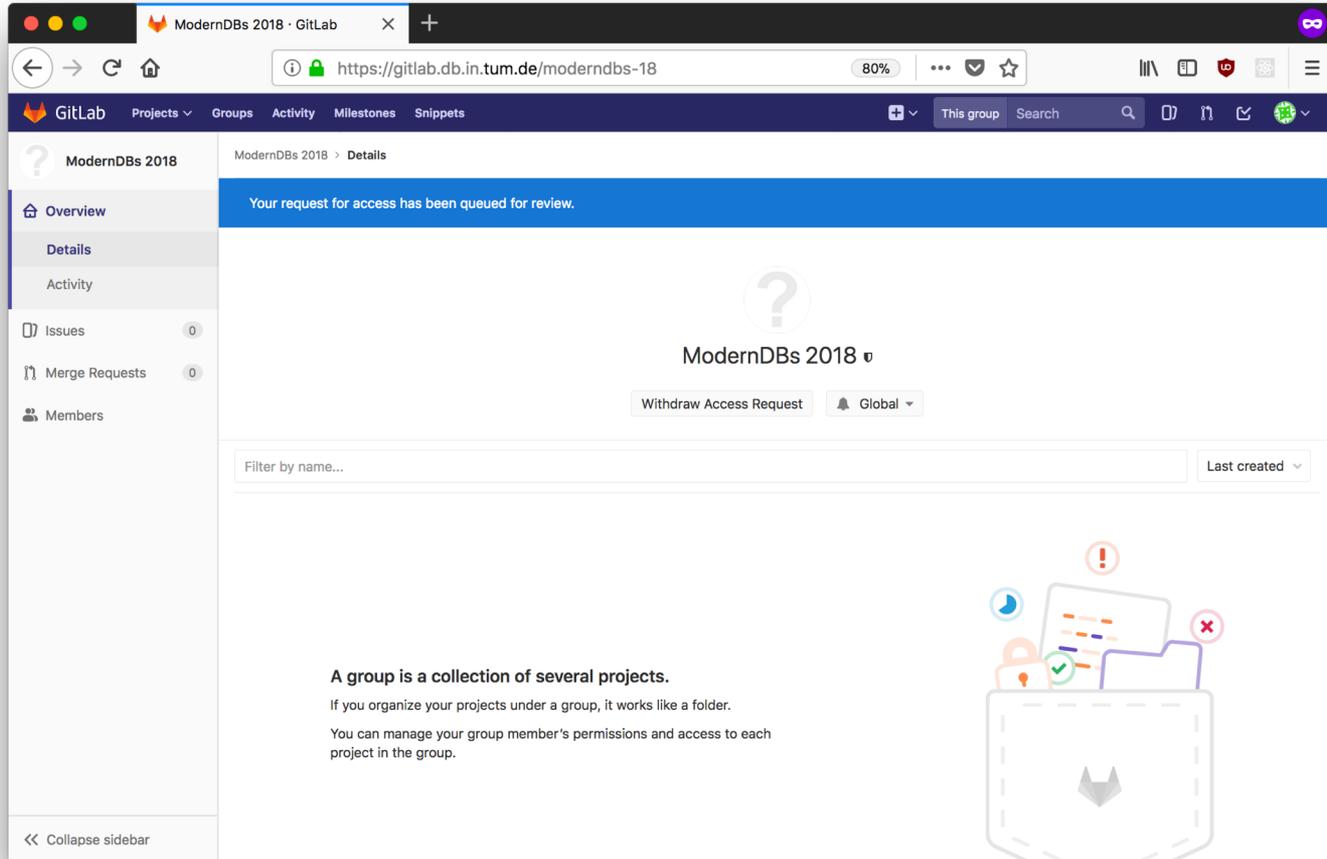
ModernDBs 2018

Request Access Global

Filter by name... Last created

A group is a collection of several projects.
If you organize your projects under a group, it works like a folder.
You can manage your group member's permissions and access to each project in the group.





The screenshot shows a web browser window with the address bar displaying `https://gitlab.db.in.tum.de/moderndbs-18`. The page title is "ModernDBs 2018 - GitLab". The navigation bar includes "Projects", "Groups", "Activity", "Milestones", and "Snippets". The left sidebar shows the "ModernDBs 2018" group with sub-items: Overview, Details (selected), Activity, Issues (0), Merge Requests (0), and Members. The main content area shows a blue banner with the message "Your request for access has been queued for review." Below this is a large question mark icon and the text "ModernDBs 2018". There are two buttons: "Withdraw Access Request" and "Global". A search bar with the placeholder "Filter by name..." and a dropdown menu set to "Last created" are also visible. At the bottom, there is a section titled "A group is a collection of several projects." with explanatory text and an illustration of a folder containing various icons representing different project states.

ModernDBs 2018

ModernDBs 2018 > Details

Your request for access has been queued for review.

ModernDBs 2018

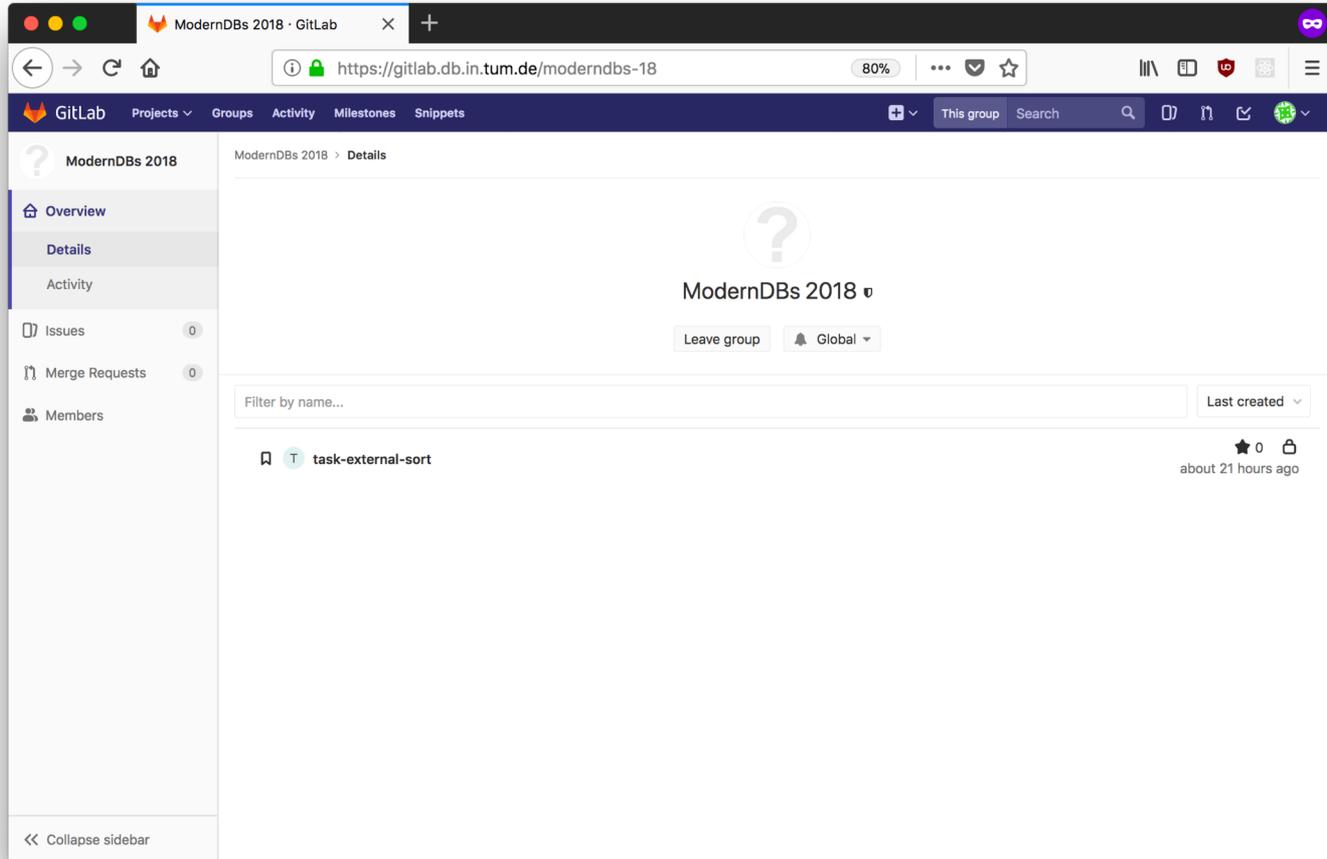
Withdraw Access Request Global

Filter by name... Last created

A group is a collection of several projects.

If you organize your projects under a group, it works like a folder.

You can manage your group member's permissions and access to each project in the group.



The screenshot shows a web browser window with the address bar displaying `https://gitlab.db.in.tum.de/moderndbs-18`. The browser's address bar includes navigation icons (back, forward, refresh, home), a security lock icon, and a zoom level of 80%. The GitLab navigation bar at the top features the GitLab logo, a dropdown menu for 'Projects', and links for 'Groups', 'Activity', 'Milestones', and 'Snippets'. On the right side of the navigation bar, there are icons for 'This group', 'Search', and other utility icons.

The main content area is titled 'ModernDBs 2018 > Details'. It features a large question mark icon representing the group's profile picture. Below the icon, the group name 'ModernDBs 2018' is displayed with a dropdown arrow. There are two buttons: 'Leave group' and 'Global' with a dropdown arrow. A search bar with the placeholder text 'Filter by name...' is present, along with a 'Last created' dropdown menu. A single issue is listed: 'task-external-sort' by user 'T', with 0 stars and a lock icon, and a timestamp of 'about 21 hours ago'. The left sidebar contains a navigation menu with 'Overview', 'Details' (selected), 'Activity', 'Issues' (0), 'Merge Requests' (0), and 'Members'. A 'Collapse sidebar' button is located at the bottom left of the sidebar.

ModernDBs 2018 / task-external-sort

https://gitlab.db.in.tum.de/moderndbs-18/task-external-sort

GitLab Projects Groups Activity Milestones Snippets

task-external-sort

You won't be able to pull or push project code via SSH until you add an SSH key to your profile [Don't show again](#) | [Remind later](#)

ModernDBs 2018 > task-external-sort > Details

T

task-external-sort

Star 0 Fork 1 HTTPS https://gitlab.db.in.tum.de/ + Global

Files (420 KB) Commit (1) Branch (1) Tags (0) Readme MIT License CI/CD configuration

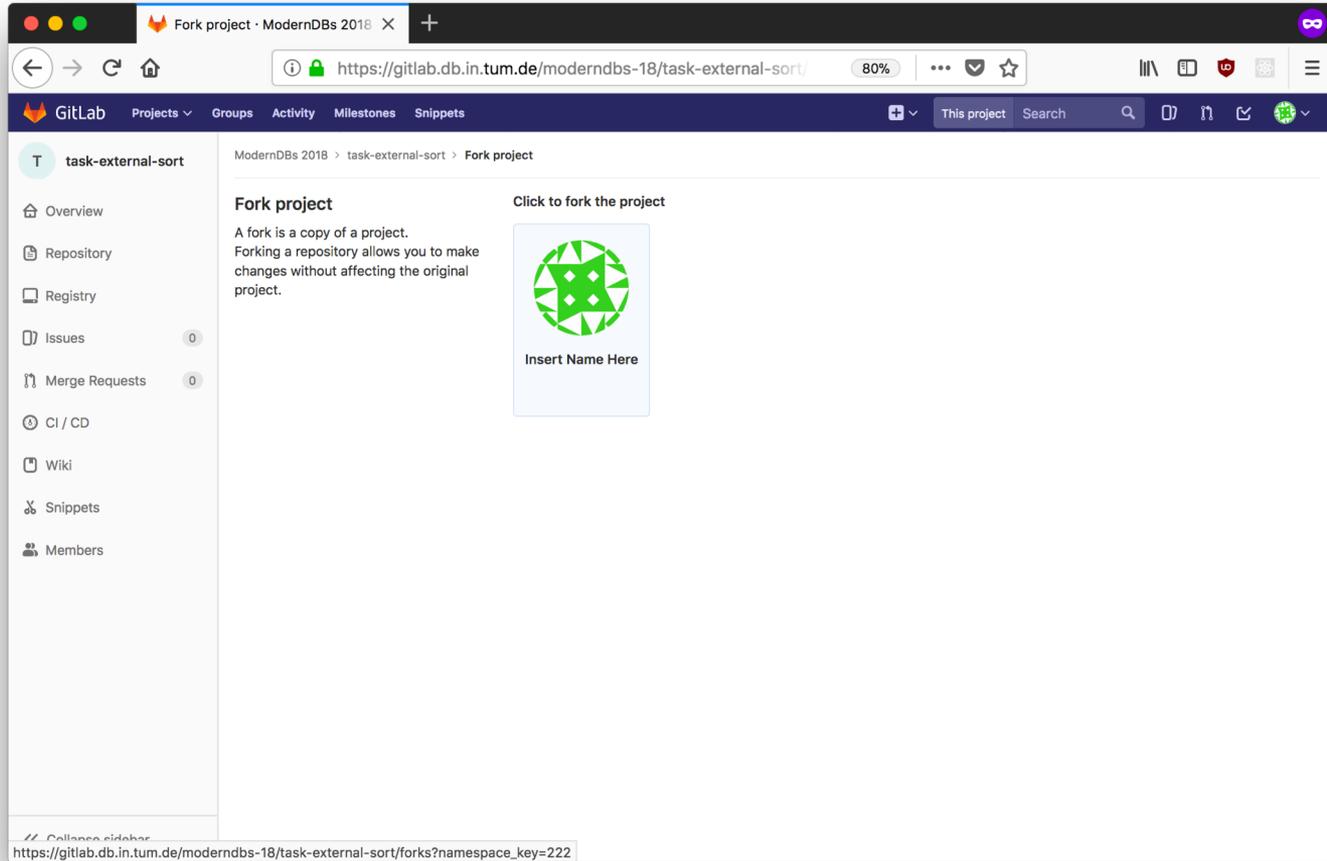
Add Changelog Add Contribution guide

master task-external-sort / + History Find file

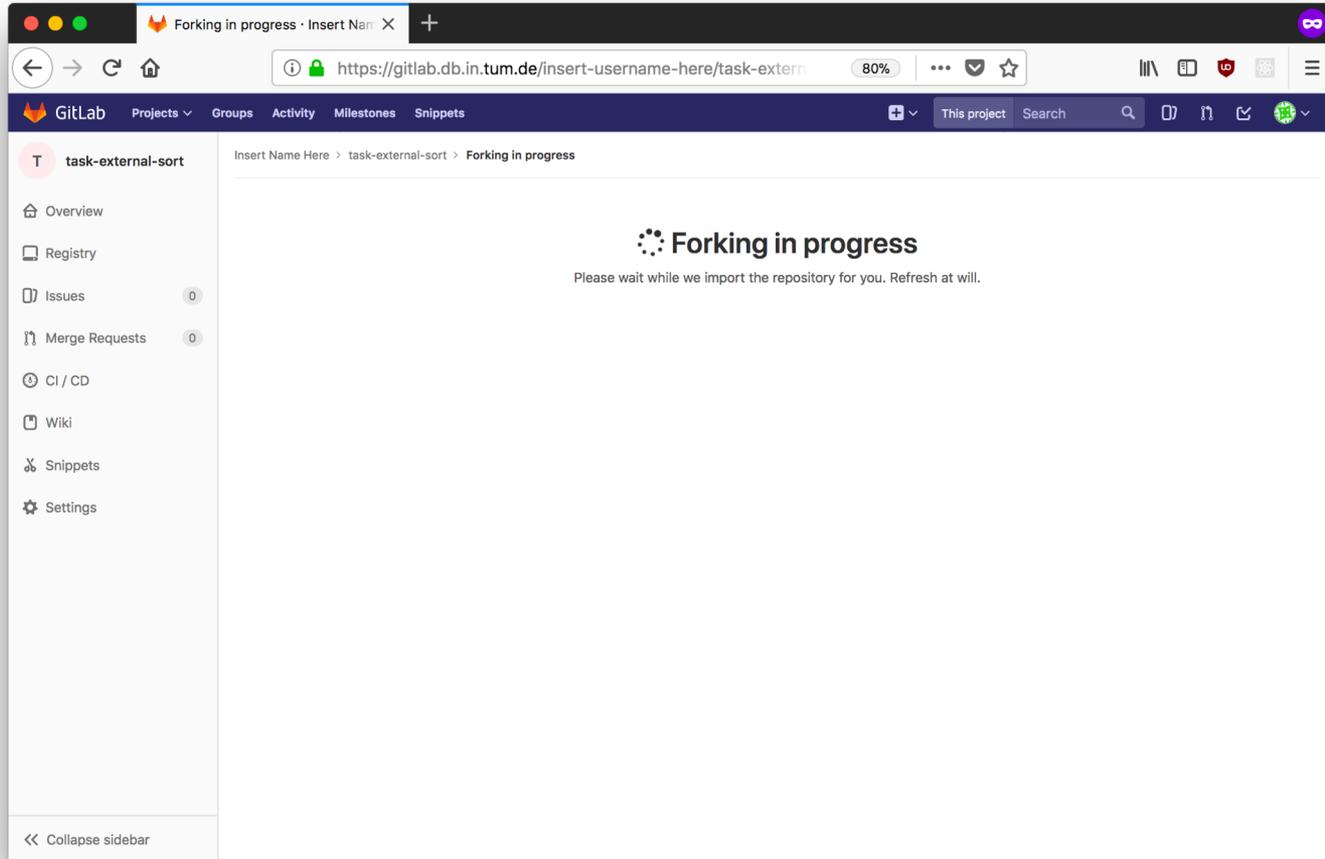
Initial commit
Moritz Sichert authored about 17 hours ago dc47dd59

Name	Last commit	Last update
bench	Initial commit	about 17 hours ago
cmake	Initial commit	about 17 hours ago
include	Initial commit	about 17 hours ago
src	Initial commit	about 17 hours ago

<< Collapse sidebar



The screenshot shows a web browser window with the address bar displaying `https://gitlab.db.in.tum.de/moderndbs-18/task-external-sort/`. The page is the GitLab interface for a project named 'task-external-sort'. The left sidebar contains navigation links: Overview, Repository, Registry, Issues (0), Merge Requests (0), CI / CD, Wiki, Snippets, and Members. The main content area is titled 'Fork project' and includes the following text: 'Click to fork the project', 'A fork is a copy of a project. Forking a repository allows you to make changes without affecting the original project.', and a large green GitLab logo with the text 'Insert Name Here' below it. The browser's address bar at the bottom shows the URL `https://gitlab.db.in.tum.de/moderndbs-18/task-external-sort/forks?namespace_key=222`.



The screenshot shows a web browser window with the following elements:

- Browser Tab:** "Forking in progress · Insert Nam" with a close button.
- Address Bar:** "https://gitlab.db.in.tum.de/insert-username-here/task-extern" with a 80% zoom level and navigation icons.
- GitLab Header:** "GitLab" logo, navigation tabs for "Projects", "Groups", "Activity", "Milestones", and "Snippets", and a search bar.
- Left Sidebar:** A navigation menu for the project "task-external-sort" with options: Overview, Registry, Issues (0), Merge Requests (0), CI / CD, Wiki, Snippets, and Settings. A "Collapse sidebar" button is at the bottom.
- Main Content Area:** Breadcrumbs "Insert Name Here > task-external-sort > Forking in progress" and a central message: "Forking in progress" with a GitLab logo icon and the text "Please wait while we import the repository for you. Refresh at will."

Insert Name Here / task-extern... X +

https://gitlab.db.in.tum.de/insert-username-here/task-e...

GitLab Projects Groups Activity Milestones Snippets

task-external-sort You won't be able to pull or push project code via SSH until you add an SSH key to your profile Don't show again | Remind later

Insert Name Here > task-external-sort > Details

The project was successfully forked.

T

task-external-sort

Forked from ModernDBs 2018 / task-external-sort

Star 0 Fork 0 HTTPS https://gitlab.db.in.tum.de/ Global

Files (123 KB) Commit (1) Branch (1) Tags (0) Readme MIT License CI/CD configuration

Add Changelog Add Contribution guide Add Kubernetes cluster

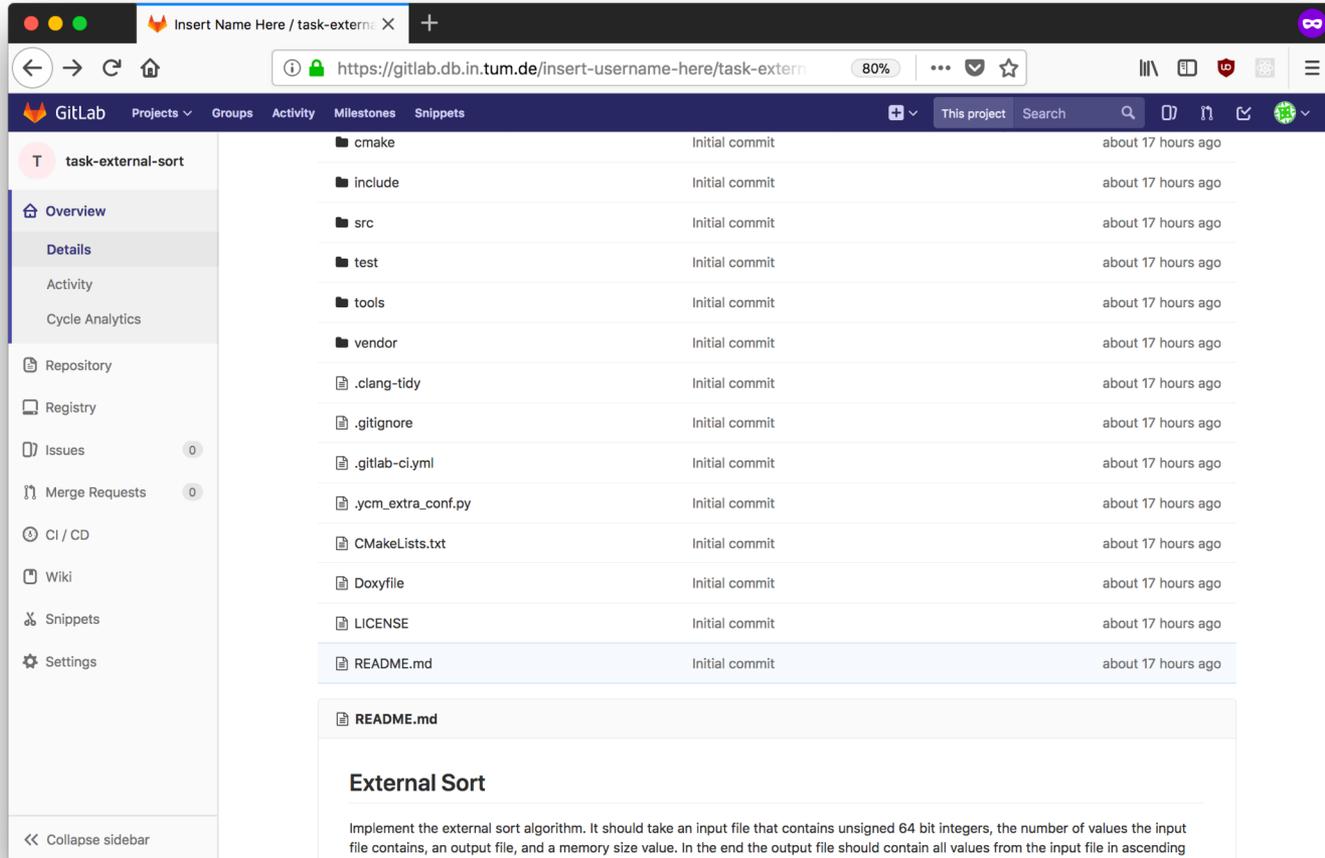
master task-external-sort / +

History Find file

Initial commit
Moritz Sichert authored about 17 hours ago dc47dd59

Name	Last commit	Last update
bench	Initial commit	about 17 hours ago
cmake	Initial commit	about 17 hours ago

<< Collapse sidebar



The screenshot shows a web browser displaying a GitLab repository page. The browser's address bar shows the URL: `https://gitlab.db.in.tum.de/insert-username-here/task-extern...`. The GitLab interface includes a top navigation bar with tabs for Projects, Groups, Activity, Milestones, and Snippets. A left sidebar contains navigation options: Overview (selected), Details, Activity, Cycle Analytics, Repository, Registry, Issues (0), Merge Requests (0), CI / CD, Wiki, Snippets, and Settings. The main content area displays a file tree for the repository 'task-external-sort'. The files listed are:

File Name	Commit Type	Time
cmake	Initial commit	about 17 hours ago
include	Initial commit	about 17 hours ago
src	Initial commit	about 17 hours ago
test	Initial commit	about 17 hours ago
tools	Initial commit	about 17 hours ago
vendor	Initial commit	about 17 hours ago
.clang-tidy	Initial commit	about 17 hours ago
.gitignore	Initial commit	about 17 hours ago
.gitlab-ci.yml	Initial commit	about 17 hours ago
.ycm_extra_conf.py	Initial commit	about 17 hours ago
CMakeLists.txt	Initial commit	about 17 hours ago
Doxyfile	Initial commit	about 17 hours ago
LICENSE	Initial commit	about 17 hours ago
README.md	Initial commit	about 17 hours ago

The 'README.md' file is selected and its content is displayed below the file list:

External Sort

Implement the external sort algorithm. It should take an input file that contains unsigned 64 bit integers, the number of values the input file contains, an output file, and a memory size value. In the end the output file should contain all values from the input file in ascending

task-external-sort

Insert Name Here > task-external-sort > Repository

master task-external-sort / .gitlab-ci.yml

Find file Blame History Permalink

Initial commit dc47dd59
 Moritz Sichert authored about 17 hours ago

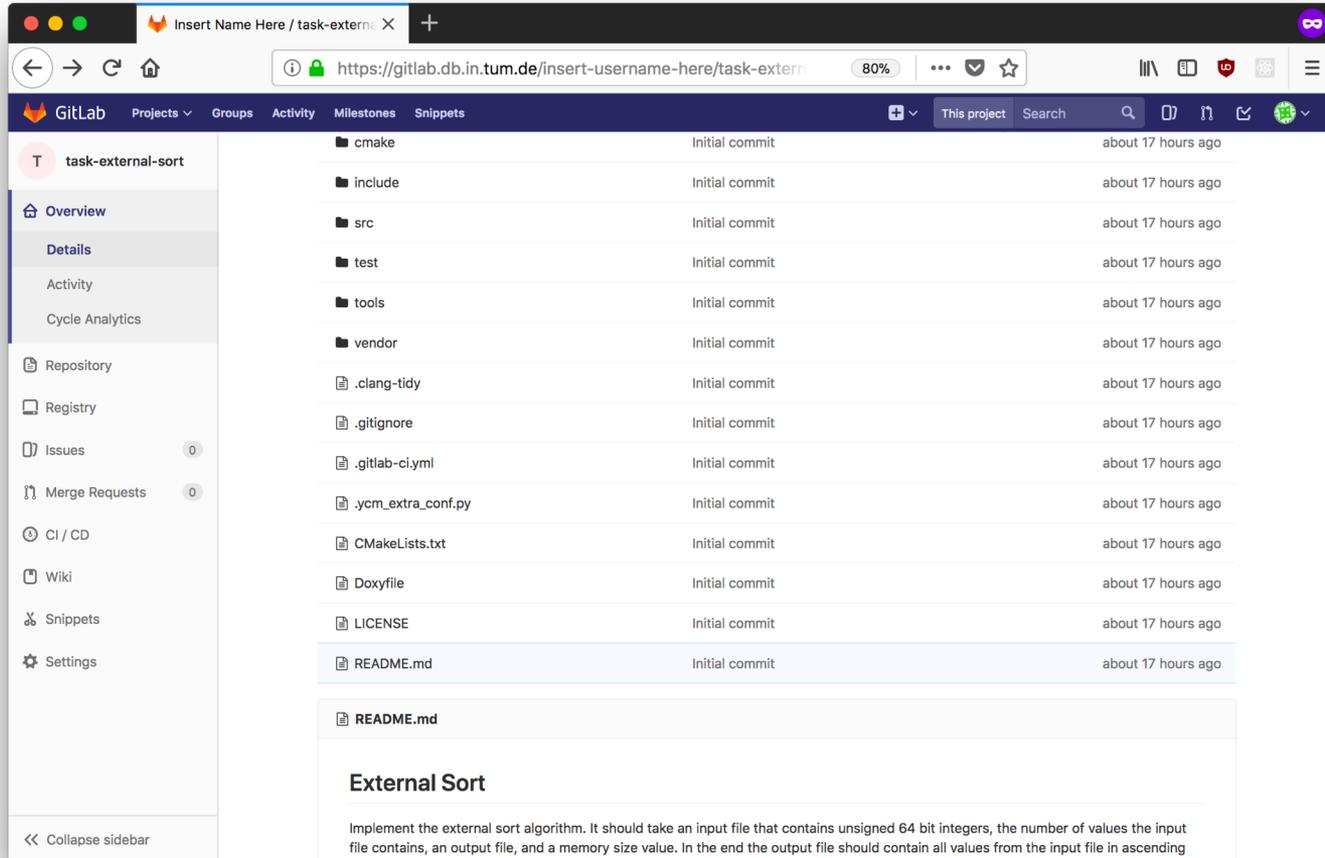
✓ This GitLab CI configuration is valid. [Learn more](#)

.gitlab-ci.yml 1.6 KB

Edit Replace Delete

```

1 # -----
2 # MODERNDBS
3 # -----
4
5 stages:
6   - build
7   - test
8   - cleanup
9
10 make:
11   stage: build
12   script:
13     - mkdir -p build
14     - cd build
15     - cmake -DCMAKE_BUILD_TYPE=Debug ..
16     - make
17   cache:
18     key: "$CI_PIPELINE_ID"
19     paths:
20       - build/
21     policy: pull-push
22   tags:
23     - "clang-5.0"
24     - "cmake"
25     - "authen3"
  
```



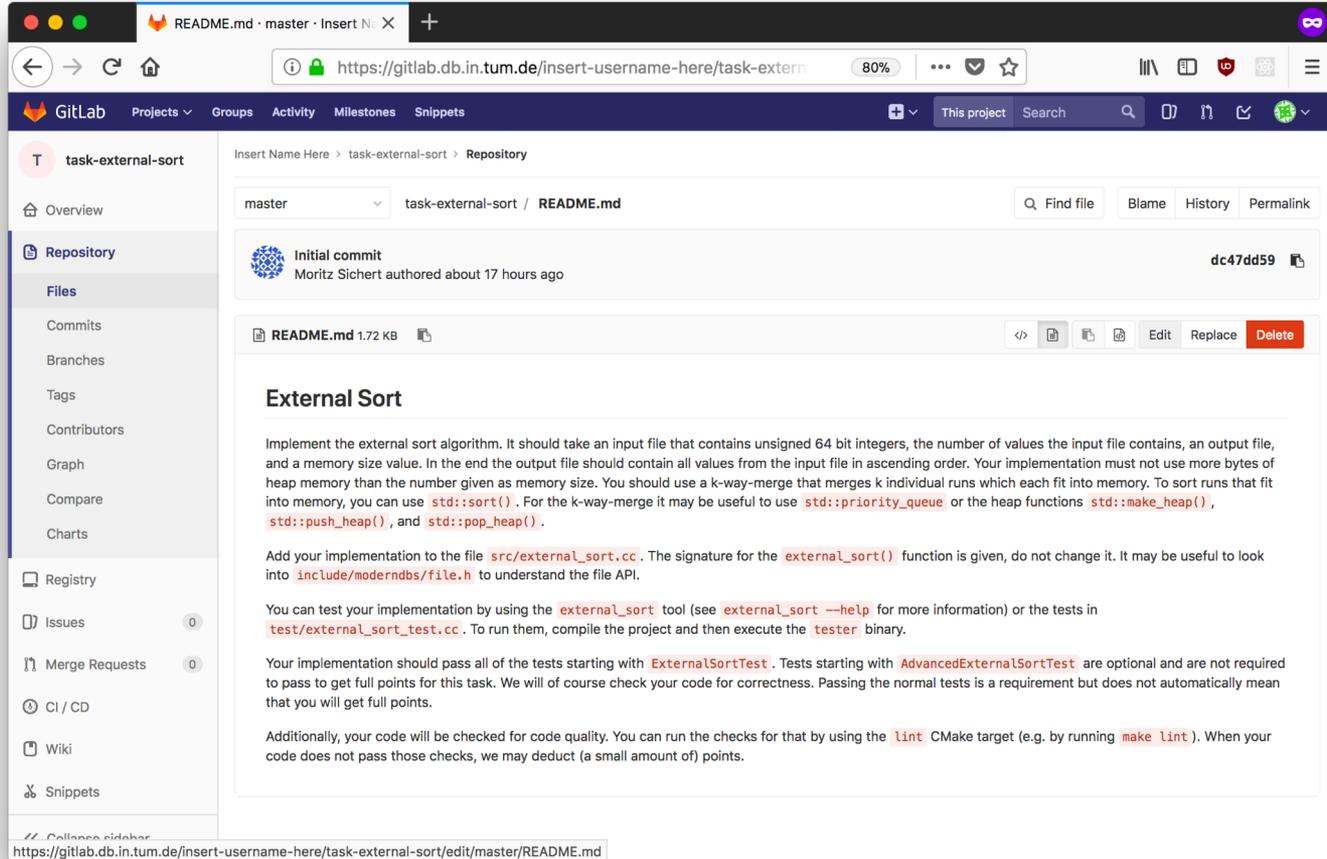
The screenshot shows a web browser window displaying the GitLab interface for a project named 'task-external-sort'. The browser's address bar shows the URL 'https://gitlab.db.in.tum.de/insert-username-here/task-extern...'. The GitLab navigation bar includes 'Projects', 'Groups', 'Activity', 'Milestones', and 'Snippets'. The left sidebar contains navigation options: Overview (selected), Details, Activity, Cycle Analytics, Repository, Registry, Issues (0), Merge Requests (0), CI / CD, Wiki, Snippets, and Settings. The main content area displays a file tree with the following items:

File Name	Commit Type	Time Ago
cmake	Initial commit	about 17 hours ago
include	Initial commit	about 17 hours ago
src	Initial commit	about 17 hours ago
test	Initial commit	about 17 hours ago
tools	Initial commit	about 17 hours ago
vendor	Initial commit	about 17 hours ago
.clang-tidy	Initial commit	about 17 hours ago
.gitignore	Initial commit	about 17 hours ago
.gitlab-ci.yml	Initial commit	about 17 hours ago
.ycm_extra_conf.py	Initial commit	about 17 hours ago
CMakeLists.txt	Initial commit	about 17 hours ago
Doxyfile	Initial commit	about 17 hours ago
LICENSE	Initial commit	about 17 hours ago
README.md	Initial commit	about 17 hours ago

The 'README.md' file is selected, and its content is displayed below:

External Sort

Implement the external sort algorithm. It should take an input file that contains unsigned 64 bit integers, the number of values the input file contains, an output file, and a memory size value. In the end the output file should contain all values from the input file in ascending



[task-external-sort](#) Insert Name Here > [task-external-sort](#) > [Repository](#)

master task-external-sort / README.md Find file Blame History Permalink

 **Initial commit** dc47dd59
 Moritz Sichert authored about 17 hours ago

 **README.md** 1.72 KB Code Download Copy Edit Replace Delete

External Sort

Implement the external sort algorithm. It should take an input file that contains unsigned 64 bit integers, the number of values the input file contains, an output file, and a memory size value. In the end the output file should contain all values from the input file in ascending order. Your implementation must not use more bytes of heap memory than the number given as memory size. You should use a k-way-merge that merges k individual runs which each fit into memory. To sort runs that fit into memory, you can use `std::sort()`. For the k-way-merge it may be useful to use `std::priority_queue` or the heap functions `std::make_heap()`, `std::push_heap()`, and `std::pop_heap()`.

Add your implementation to the file `src/external_sort.cc`. The signature for the `external_sort()` function is given, do not change it. It may be useful to look into `include/modernndbs/file.h` to understand the file API.

You can test your implementation by using the `external_sort` tool (see `external_sort --help` for more information) or the tests in `test/external_sort_test.cc`. To run them, compile the project and then execute the `tester` binary.

Your implementation should pass all of the tests starting with `ExternalSortTest`. Tests starting with `AdvancedExternalSortTest` are optional and are not required to pass to get full points for this task. We will of course check your code for correctness. Passing the normal tests is a requirement but does not automatically mean that you will get full points.

Additionally, your code will be checked for code quality. You can run the checks for that by using the `lint` CMake target (e.g. by running `make lint`). When your code does not pass those checks, we may deduct (a small amount of) points.

<https://gitlab.db.in.tum.de/insert-username-here/task-external-sort/edit/master/README.md>

Edit · README.md · master · Ins X +
 https://gitlab.db.in.tum.de/insert-username-here/task-e... 80%

GitLab Projects Groups Activity Milestones Snippets This project Search

task-external-sort
 Overview
 Repository
 Files
 Commits
 Branches
 Tags
 Contributors
 Graph
 Compare
 Charts
 Registry
 Issues 0
 Merge Requests 0
 CI / CD
 Wiki
 Snippets
 Collapse sidebar

Insert Name Here > task-external-sort > Repository

Edit file Template

Write Preview

Y master README.md Soft wrap text

```

1 > Insert Your Name Here
2
3 # External Sort
4
5 Implement the external sort algorithm. It should take an input file that
6 contains unsigned 64 bit integers, the number of values the input file
7 contains, an output file, and a memory size value. In the end the output file
8 should contain all values from the input file in ascending order. Your
9 implementation must not use more bytes of heap memory than the number given as
10 memory size. You should use a k-way-merge that merges k individual runs which
11 each fit into memory. To sort runs that fit into memory, you can use
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14 `std::push_heap()`, and `std::pop_heap()`.
15
16 Add your implementation to the file `src/external_sort.cc`. The signature for
17 the `external_sort()` function is given, do not change it. It may be useful to
18 look into `include/moderndbs/file.h` to understand the file API.
19
20 You can test your implementation by using the `external_sort` tool (see
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22 `test/external_sort_test.cc`. To run them, compile the project and then execute
23 the `tester` binary.
24
25 Your implementation should pass all of the tests starting with
26 `ExternalSortTest`. Tests starting with `AdvancedExternalSortTest` are optional
27 and are not required to pass to get full points for this task. We will of
28 course check your code for correctness. Passing the normal tests is a
29 requirement but does not automatically mean that you will get full points.
30
31 Additionally, your code will be checked for code quality. You can run the
  
```

Commit message Update README.md

Edit · README.md · master · Ins X +

<https://gitlab.db.in.tum.de/insert-username-here/task-e> 80%

GitLab Projects Groups Activity Milestones Snippets

This project Search

T task-external-sort

Overview

Repository

Files

Commits

Branches

Tags

Contributors

Graph

Compare

Charts

Registry

Issues 0

Merge Requests 0

CI / CD

Wiki

Snippets

<< Collapse sidebar

```

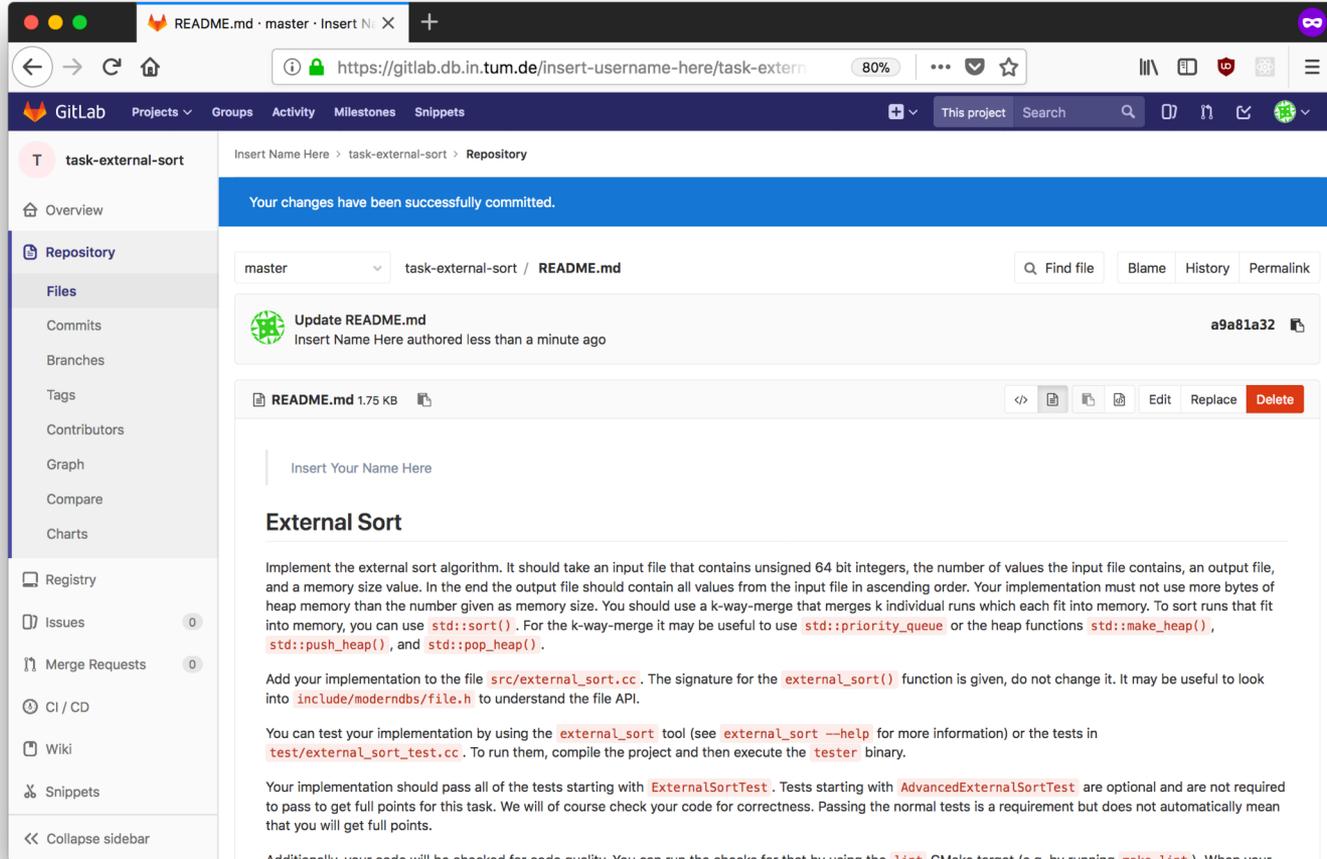
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29 requirement but does not automatically mean that you will get full points.
30
31 Additionally, your code will be checked for code quality. You can run the
32 checks for that by using the `lint` CMake target (e.g. by running `make lint`).
33 When your code does not pass those checks, we may deduct (a small amount of)
34 points.
35

```

Commit message

Target Branch

Commit changes Cancel



[task-external-sort](#) Insert Name Here > [task-external-sort](#) > [Repository](#)

Your changes have been successfully committed.

master task-external-sort / README.md
 Find file Blame History Permalink

 **Update README.md**
 Insert Name Here authored less than a minute ago a9a81a32

 **README.md** 1.75 KB
 </> 📄 📄 📄 Edit Replace Delete

Insert Your Name Here

External Sort

Implement the external sort algorithm. It should take an input file that contains unsigned 64 bit integers, the number of values the input file contains, an output file, and a memory size value. In the end the output file should contain all values from the input file in ascending order. Your implementation must not use more bytes of heap memory than the number given as memory size. You should use a k-way-merge that merges k individual runs which each fit into memory. To sort runs that fit into memory, you can use `std::sort()`. For the k-way-merge it may be useful to use `std::priority_queue` or the heap functions `std::make_heap()`, `std::push_heap()`, and `std::pop_heap()`.

Add your implementation to the file `src/external_sort.cc`. The signature for the `external_sort()` function is given, do not change it. It may be useful to look into `include/moderndbs/file.h` to understand the file API.

You can test your implementation by using the `external_sort` tool (see `external_sort --help` for more information) or the tests in `test/external_sort_test.cc`. To run them, compile the project and then execute the `tester` binary.

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Additionally, your code will be checked for code quality. You can run the checks for that by using the `lint` CMake target (e.g. by running `make lint`). When your

Pipelines · Insert Name Here / t: X

https://gitlab.db.in.tum.de/insert-username-here/task-extern 80%

GitLab Projects Groups Activity Milestones Snippets This project Search

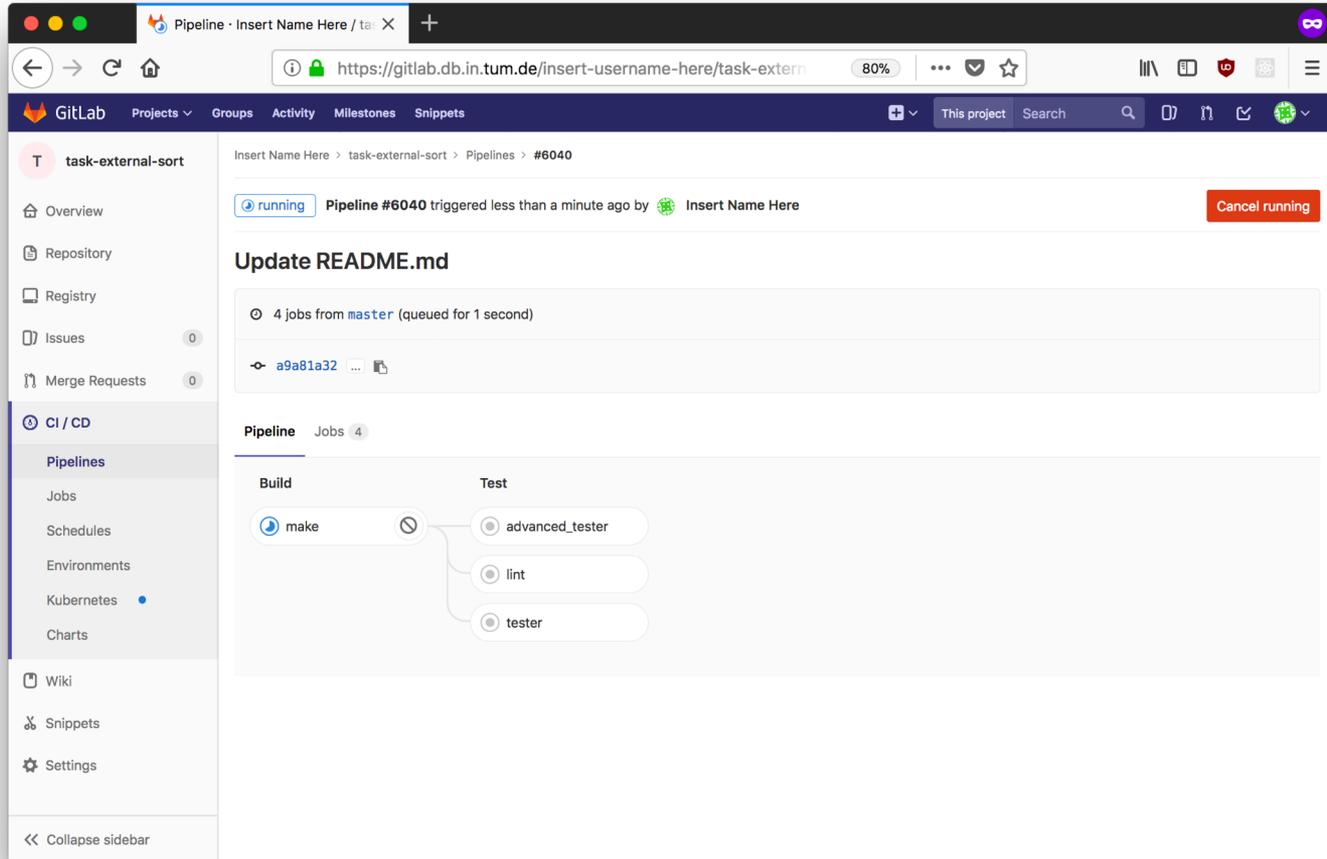
task-external-sort

Insert Name Here > task-external-sort > Pipelines

All 1 Pending 0 Running 1 Finished 0 Branches Tags Run Pipeline Clear Runner Caches CI Lint

Status	Pipeline	Commit	Stages
running	#6040 by latest	master -> a9a81a32 Update README.md	

Overview
Repository
Registry
Issues 0
Merge Requests 0
CI / CD
Pipelines
Jobs
Schedules
Environments
Kubernetes
Charts
Wiki
Snippets
Settings
Collapse sidebar



The screenshot shows the GitLab web interface for a pipeline. The browser address bar shows the URL `https://gitlab.db.in.tum.de/insert-username-here/task-extern`. The page title is "Pipeline · Insert Name Here / ta · X". The left sidebar contains navigation options: Overview, Repository, Registry, Issues (0), Merge Requests (0), CI / CD (selected), Pipelines (selected), Jobs, Schedules, Environments, Kubernetes (1), Charts, Wiki, Snippets, and Settings. The main content area shows the pipeline details for "task-external-sort". The pipeline is currently "running" and was triggered by "Insert Name Here" less than a minute ago. A "Cancel running" button is visible. The pipeline title is "Update README.md". Below the title, it shows "4 jobs from master (queued for 1 second)" and a commit hash "a9a81a32". The pipeline graph shows a "Build" stage with a job named "make" and a "Test" stage with three jobs: "advanced_tester", "lint", and "tester".

make (#23094) · Jobs · Insert Name Here

https://gitlab.db.in.tum.de/insert-username-here/task-external 80%

GitLab Projects Groups Activity Milestones Snippets This project Search

task-external-sort Insert Name Here > task-external-sort > Jobs > #23094

running Job #23094 triggered less than a minute ago by Insert Name Here

```

Running with gitlab-runner 10.4.0 (857480b6)
on 8cfe4c9079e6 (e44d29d3)
Using Docker executor with image gitlab.db.in.tum.de:5005/infra/gpdi/image ...
Using docker image sha256:109d1538442e5cd1345edde2ff7f158164d1975fac9c71fd54fd513a68a77d79 for predefined container
...
Pulling docker image gitlab.db.in.tum.de:5005/infra/gpdi/image ...
Using docker image gitlab.db.in.tum.de:5005/infra/gpdi/image ID=sha256:7e117f9c0327c72e0ea1a3548c5d75e2404e548b642
9d958f1493b9b6d58ef48 for build container...
Running on runner-e44d29d3-project-427-concurrent-0 via 3411bb7d4fc9...
Cloning repository...
Cloning into '/builds/insert-username-here/task-external-sort'...
Checking out a9a81a32 as master...
Skipping Git submodule setup
Checking cache for 6040...
Successfully extracted cache
$ mkdir -p build
$ cd build
$ cmake -DCMAKE_BUILD_TYPE=Debug ..
-- The C compiler identification is GNU 7.2.0
-- The CXX compiler identification is GNU 7.2.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Looking for pthread.h
-- Looking for pthread.h - found
-- Looking for pthread_create

```

make

Duration: 26 seconds
Runner: #4
Tags: python3 cmake clang-5.0
Cancel

Commit a9a81a32
Update README.md

Pipeline #6040 from master
build

→ make

[Pipeline · Insert Name Here / ta](#) X +

[https://gitlab.db.in.tum.de/insert-username-here/task-extern](#) 80%

GitLab Projects Groups Activity Milestones Snippets

task-external-sort

- Overview
- Repository
- Registry
- Issues 0
- Merge Requests 0
- CI / CD**
 - Pipelines**
 - Jobs
 - Schedules
 - Environments
 - Kubernetes
 - Charts
- Wiki
- Snippets
- Settings

Insert Name Here > task-external-sort > Pipelines > #6040

failed Pipeline #6040 triggered 13 minutes ago by [Insert Name Here](#) Retry

Update README.md

4 jobs from `master` in 3 minutes 8 seconds (queued for 1 second)

[a9a81a32](#) ...

Pipeline Jobs 4 Failed Jobs 3

Build

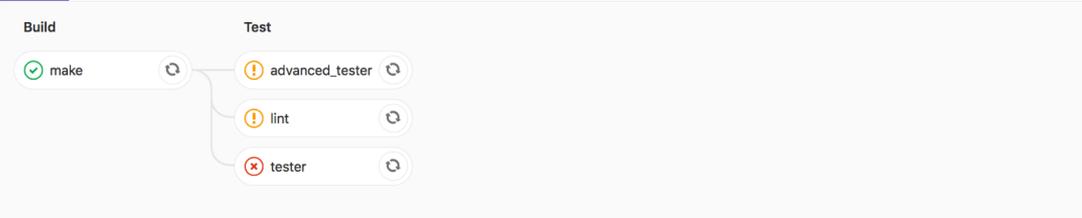
make refresh

Test

advanced_tester refresh

lint refresh

tester refresh

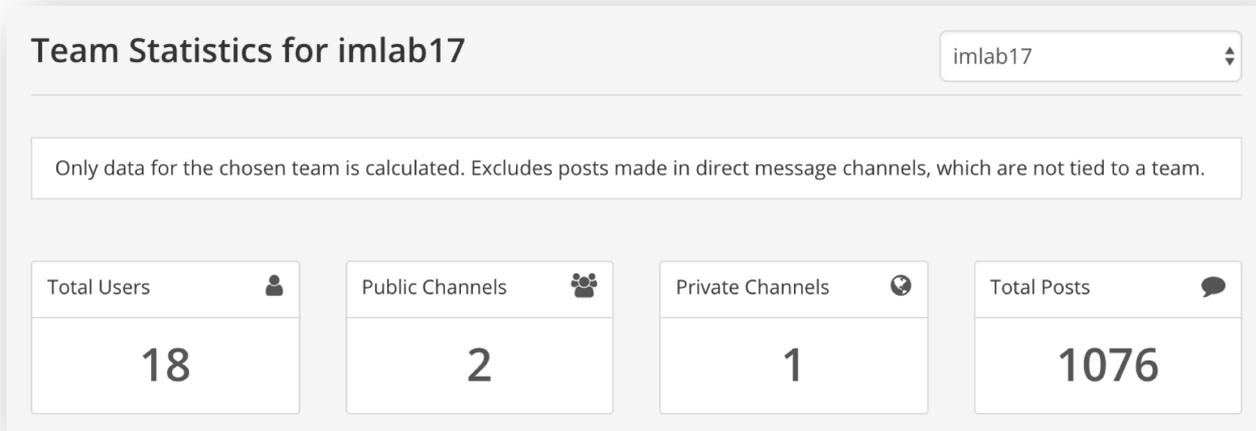


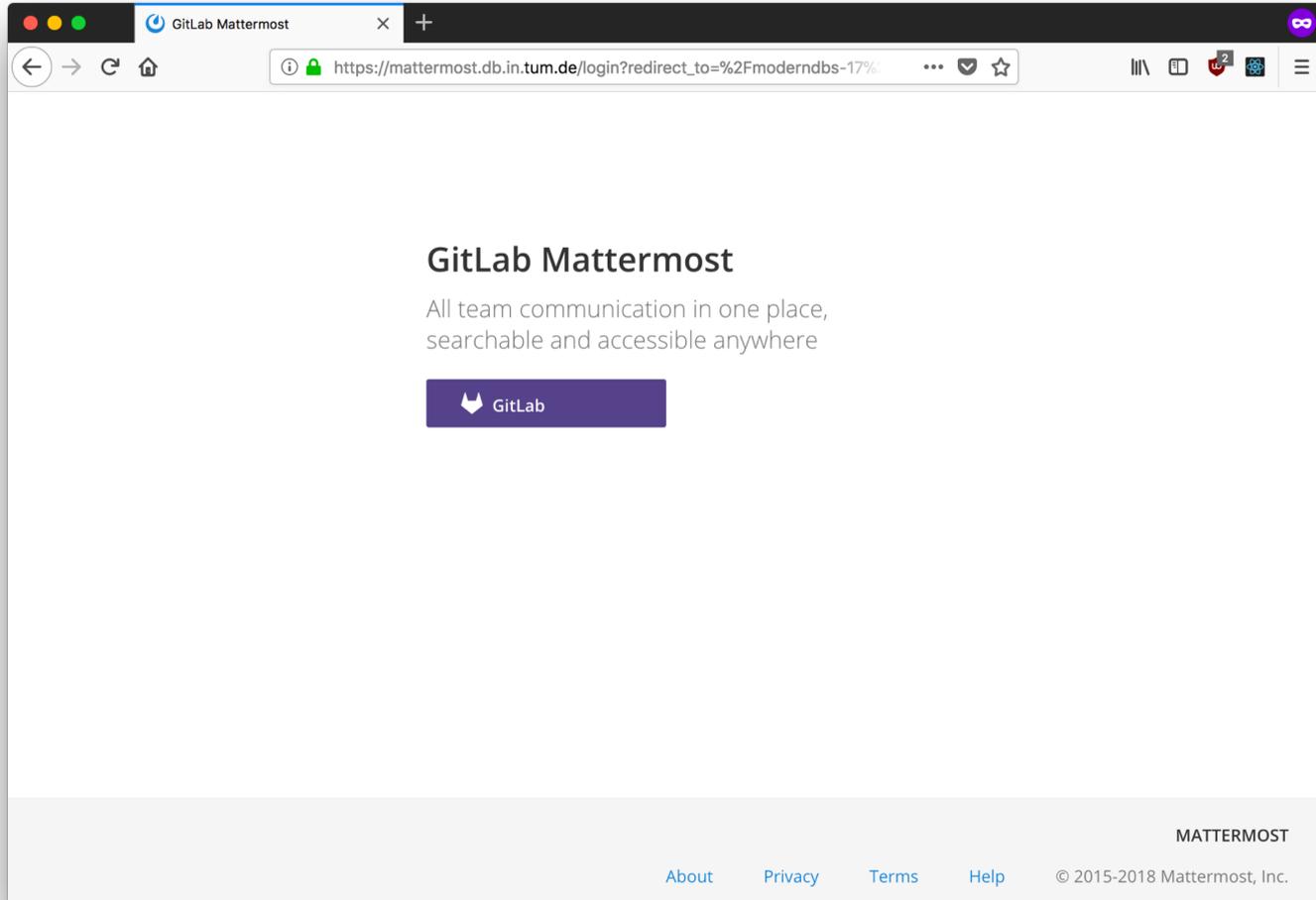


GitLab



Mattermost®





GitLab Mattermost

https://mattermost.db.in.tum.de/login?redirect_to=%2Fmoderndbs-17%

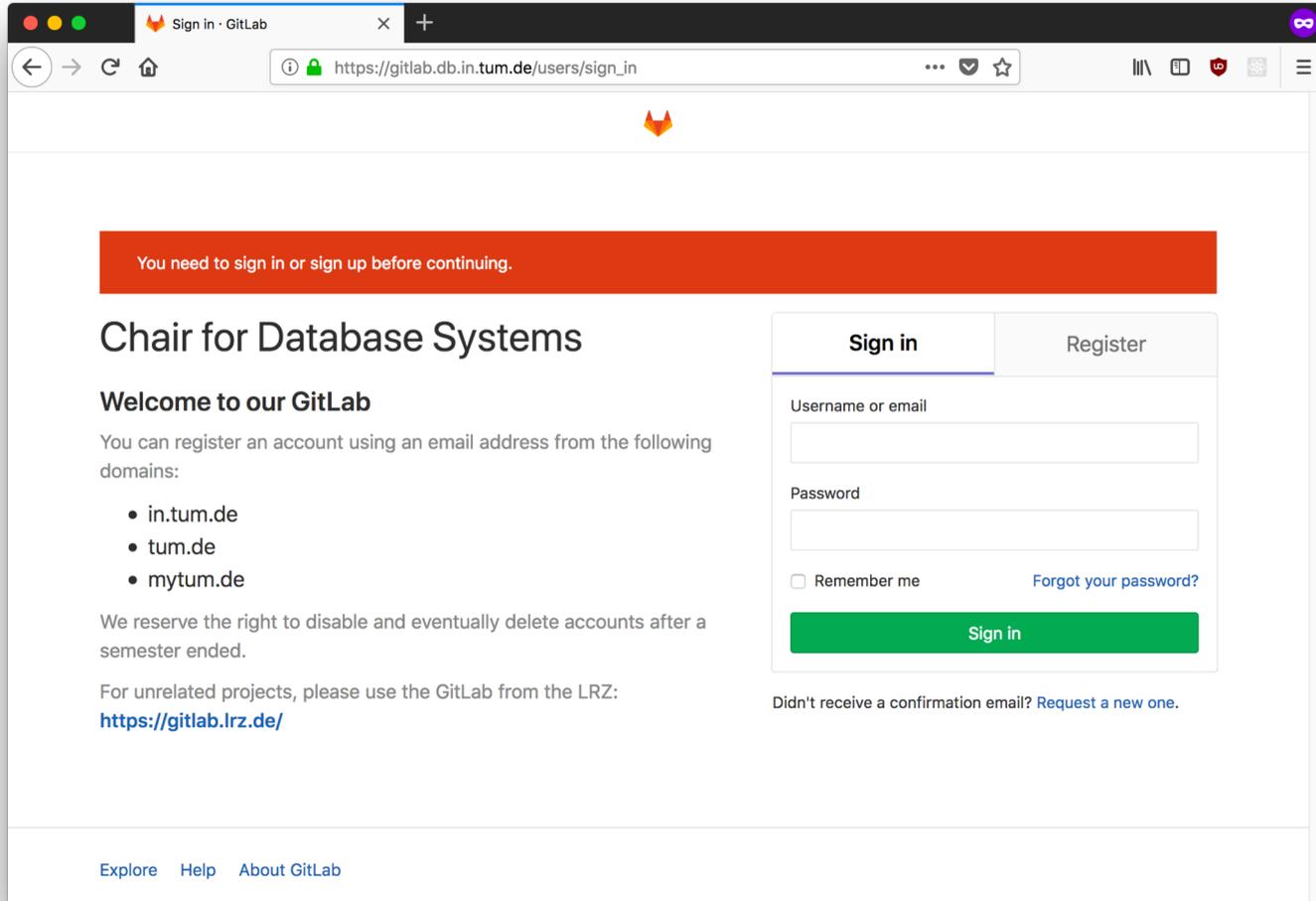
GitLab Mattermost

All team communication in one place,
searchable and accessible anywhere

 GitLab

MATTERMOST

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Sign in · GitLab

https://gitlab.db.in.tum.de/users/sign_in

You need to sign in or sign up before continuing.

Chair for Database Systems

Welcome to our GitLab

You can register an account using an email address from the following domains:

- in.tum.de
- tum.de
- mytum.de

We reserve the right to disable and eventually delete accounts after a semester ended.

For unrelated projects, please use the GitLab from the LRZ:
<https://gitlab.lrz.de/>

Sign in | Register

Username or email

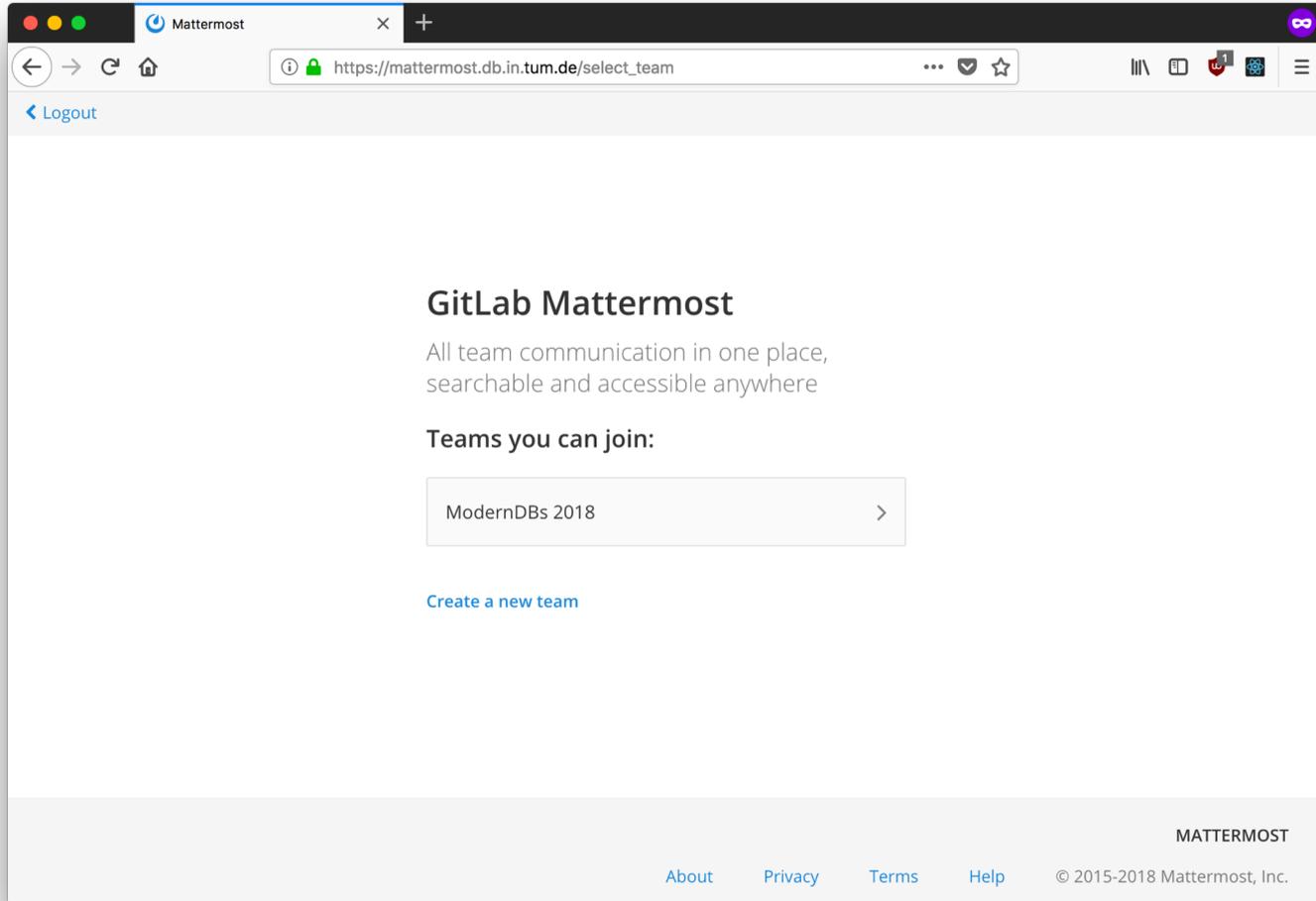
Password

Remember me [Forgot your password?](#)

Sign in

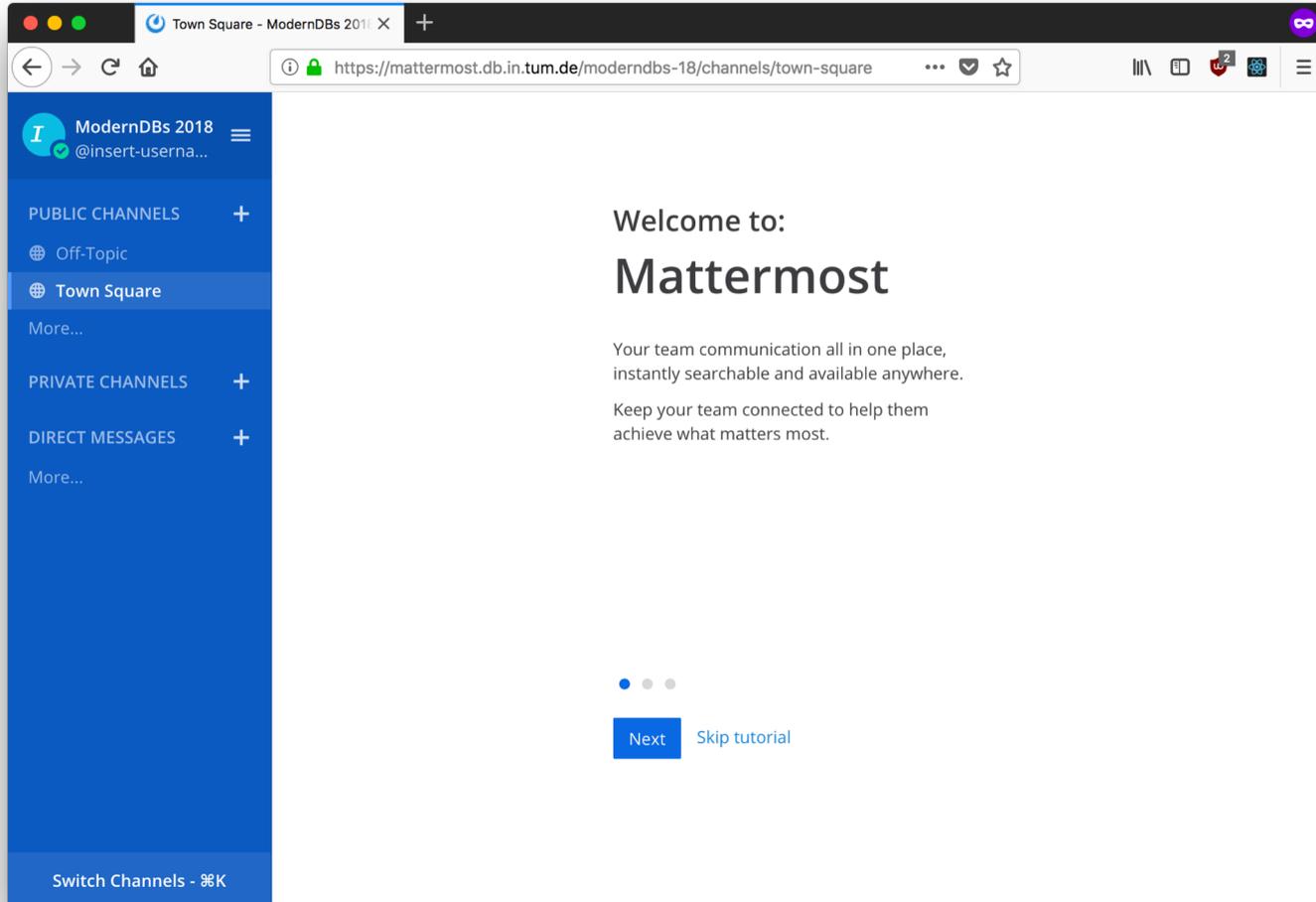
Didn't receive a confirmation email? [Request a new one.](#)

Explore Help About GitLab



The screenshot shows a web browser window with the URL `https://mattermost.db.in.tum.de/select_team`. The page content includes:

- A [Logout](#) link in the top left.
- A heading **GitLab Mattermost**.
- A descriptive text: "All team communication in one place, searchable and accessible anywhere".
- A section titled **Teams you can join:** containing a single team entry: "ModernDBs 2018" with a right-pointing chevron.
- A link [Create a new team](#).
- A footer with the text "MATTERMOST" and navigation links: [About](#), [Privacy](#), [Terms](#), [Help](#), and a copyright notice: "© 2015-2018 Mattermost, Inc."



Town Square - ModernDBs 2018 X +

https://mattermost.db.in.tum.de/moderndb-18/channels/town-square

ModernDBs 2018
@insert-userna...

PUBLIC CHANNELS +

Off-Topic

Town Square

More...

PRIVATE CHANNELS +

DIRECT MESSAGES +

More...

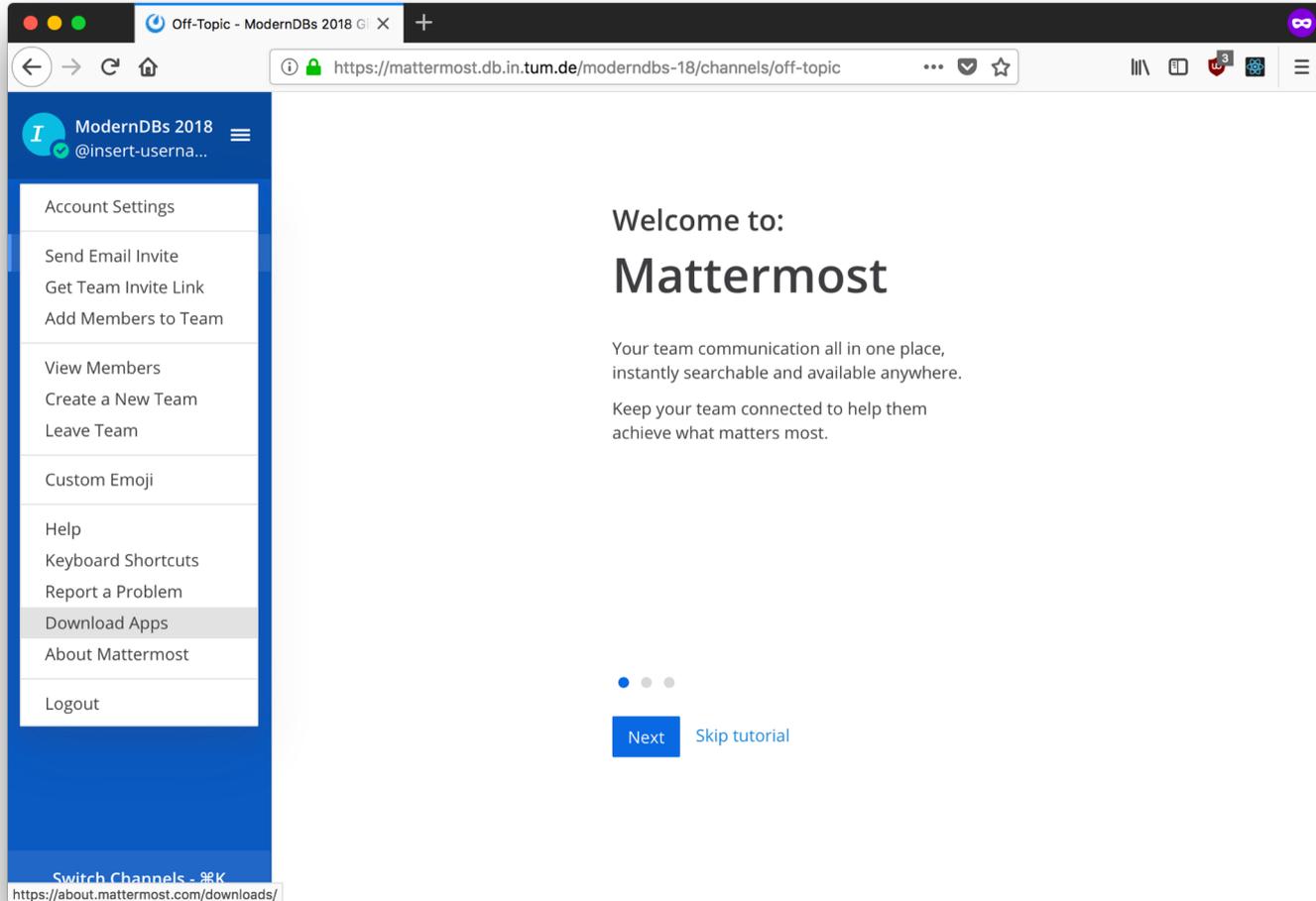
Switch Channels - ⌘K

Welcome to: Mattermost

Your team communication all in one place,
instantly searchable and available anywhere.

Keep your team connected to help them
achieve what matters most.

Next Skip tutorial



Off-Topic - ModernDBs 2018

https://mattermost.db.in.tum.de/moderndb-18/channels/off-topic

ModernDBs 2018
@insert-userna...

- Account Settings
- Send Email Invite
- Get Team Invite Link
- Add Members to Team
- View Members
- Create a New Team
- Leave Team
- Custom Emoji
- Help
- Keyboard Shortcuts
- Report a Problem
- Download Apps
- About Mattermost
- Logout

Switch Channels - ⌘K

https://about.mattermost.com/downloads/

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Next Skip tutorial

Questions?