gvtree

a git version tree browser

Version 1.9-0

Abstract

gvtree is a graphical git version tree browser written C++ for Linux platform using Qt libraries. The main focus is the review of repositories, rather than changing code and developing. The main functionality is to select a node in the version graph and compare it to the current HEAD version, the direct predecessors or a selected version. Additionally a comparison between the current local changes and the local HEAD version is possible. A version history of a individual file can be viewed as well.

Table of Contents

History....4
Credits....5
References....6
OS and Build Environment....7
  Debian 12 Environment....7
  Debian 11 Environment....7
  Additional Dependencies....7
Build....8
  cmake....8
  qmake....8
Command Line Arguments....10
Tutorial....12
  Step 1 Sample git repository....12
  Step 2 Compare Versions....22
  Step 3 Preferences....30
    Rendering....30
    Basic Settings....30
    Tag Settings....32
    Mime Types....34
  Step 4 Some more features....35
  Step 5 Folder....36
  Step 6 Selecting a version....40
  Step 7 Context menu of edges....42
  Step 8 Lookup version information....43
  Step 9 The Branch List widget....47
Appendix A License....51
    GNU GENERAL PUBLIC LICENSE....51
      Preamble....51
      TERMS AND CONDITIONS....52
        0. Definitions....52
        1. Source Code....53
        2. Basic Permissions....53
        3. Protecting Users' Legal Rights From Anti-Circumvention Law....54
        4. Conveying Verbatim Copies....54
        5. Conveying Modified Source Versions....54
        6. Conveying Non-Source Forms....55
        7. Additional Terms....57

8. Termination....58
9. Acceptance Not Required for Having Copies....58
10. Automatic Licensing of Downstream Recipients....58
11. Patents....59
12. No Surrender of Others' Freedom....60
13. Use with the GNU Affero General Public License....60
14. Revised Versions of this License....60
15. Disclaimer of Warranty....61
16. Limitation of Liability....61
17. Interpretation of Sections 15 and 16....61

History

Date	Version	Changes
September to December 2021	gvtree-1.1-0-beta.2	Initial Document Version
30. January 2022	gvtree-1.1-0-beta.4	Added History Revision of all Chapters Update of Screenshots "Current git status" dock widget
5. February 2022	gvtree-1.1-0-beta.7	Preferences Chapter Update of Screenshots
6. February 2022	gvtree-1.1-0	Release
2. March 2022	gvtree-1.2-0-beta.1	Revision of all Chapters
12. April 2022	gvtree-1.2-0	Release
2. October 2022	gvtree-1.3-0-beta.2	Revision of all Chapters
11. October 2022	gvtree-1.3-0-beta.5	Revision of all Chapters
14. October 2022	gvtree-1.3-0	Added Chapter 9 to Chapter 8
29. October 2022	gvtree-1.4-0-beta.3	Revision of all Chapters
29. November 2022	gvtree-1.5-0	Revision of all Chapters
3. October 2023	gvtree-1.6-0	Revision of all Chapters
16. November 2024	gvtree-1.9-0	Revision of all Chapters

Credits

Thanks to Winfried Nöth, Carsten Raufuß and Kay Lauterbach for beta testing and hints for improvement. Thanks to Ulrich Eckard for bugfixes and adaption of the build system to cmake.

References

(1) https://doc.qt.io/archives/qt-4.8/classes.html

This is the class reference of the Qt Documentation Archives.

(2) /usr/lib/qt4/examples/graphicsview/elasticnodes

The elasticnodes was a good example to get started building up node and edge structures with QGraphicsItems.

(3) https://rachel53461.wordpress.com/2014/04/20/algorithm-for-drawing-trees

Rachel Lim's Blog, Algorithm for Drawing Trees
The description to draw a tree graph without collisions is very helpful.
For *gvtree* the step to distribute the middle nodes is not used.

OS and Build Environment

The development started with Debian 9.4.0 and Qt 4.8 version. With v1.9-0 Qt 4.8 is no longer supported. The source code can now be compiled with Qt 5 or Qt6 libraries. The program has been compiled and checked with the following environments:

Debian 12 Environment

- gcc (Debian 12.2.0-9) 12.2.0
- cmake 3.25.1-1
- qt5base5-dev (...) 5.15.8+dfsg-11
- xserver-xorg 1:7.7+23
- vim 2:9.0.1378-2
- git 2.39.2-1-1

Debian 11 Environment

- g++ (Debian 10.2.1-6) 10.2.1 20210110
- qt5base5-dev (...) 5.15.2+dfsg-9
- xserver-xorg 1:7.7+22
- vim-common 2:8.2.2434-3
- git 2.30.2

Additional Dependencies

To work with the application git should be installed and an editor capable to compare files. The default is `gvim -d [file 1] [file 2] ... [file n]` to compare files and `gvim [file]` to show/edit the current local file.

To compare other objects like images or sound or perhaps pdf documents, the mime type of a file can be mapped to an appropriate tool.

Build

After extracting the source package:

tar -vxzf gvtree-1.9-0.tar.gz

Change to the folder `gvtree-1.9-0`

cd gvtree-1.9-0

cmake

Now, just run the following command

cmake -D CMAKE_BUILD_TYPE=RELEASE
make

To execute the program enter:

./bin/gvtree

If you like to install it to a $PATH directory, e.g. `/usr/local/bin`, use the following commands instead:

**cmake -D CMAKE_BUILD_TYPE=RELEASE **
-D CMAKE_INSTALL_PREFIX=/usr/local
make
sudo make install

Now you can just type if /usr/local/bin is contained in $PATH

gvtree

To use Qt >= 6.0 use -D USE_QT6=true switch, default is false.

cmake -D USE_QT6=true CMakeLists.txt

qmake

Now, just run the following command

qmake
make

To execute the program enter:

./gvtree

If you like to install it to a $PATH directory, e.g. `/usr/local/bin`, use the following commands instead:

qmake PREFIX=/usr/local
make
sudo make install

Now you can just type:

gvtree

Command Line Arguments

With command line argument **-h** the following information is printed:

```
gvtree-1.9-0

Tool to display git log graph

gvtree Copyright (C) 2021 Wolfgang Trummer

  This program comes with ABSOLUTELY NO WARRANTY
  This is free software, and you are welcome to redistribute it
  under certain conditions

  This program is licensed under
  GNU GENERAL PUBLIC LICENSE
  Version 3, 29 June 2007

--------------------------------------------------------------------------------

Parameters:

[path]

   Set a file constraint. The version tree of the file will
   be displayed.

-r [local git repository directory]

   If not specified the current path is checked for a valid repository
   or the repository used in the previous session is displayed.
   Which one is used can be controlled by the preferences setting.

--version Version string is printed to stdout

--silent true|false Silent mode.

   If true, commands are not printed to stdout. The preferences
   'print commandline to stdout' is set to this value.

--css [style sheet file]

   Load a css style sheet file.
   If not specified the last file used will be taken.
   Perhaps it is a good idea to copy gvtree.css to ~/.config/gvtree
   and run ./gvtree --css ~/.config/gvtree/gvtree.css once.

-t Testing:

   Display the test tree graph from (3).

-f [gitlog]

   Testing:
   Load a file created with
     git log --graph --decorate --pretty="#%h#%at#%an#%d#%s#"
   This has been helpful during development to import constraint and
   complex repository data.

-h This information.
```

```
--------------------------------------------------------------------------------
```

The arguments **-t** and **-f** are just for testing the rendering of the graph and the parsing the **git log** output.

With the first start `~/.config/gvtree/gvtree.ini` is created. The window state and the preferences are saved there.

It is a good idea to copy the file `css/gvtree.css` to `~/.config/gvtree/gvtree.css` as well and run

gvtree --css ~/.config/gvtree/gvtree.css

once. The css file path is then written to `gvtree.ini` and always used.

The gvtree.css file can be customized before.

The path to the css file can be changed in Windows - Preferences - Basic Settings menu as well.

The default directory for temporary files is `/tmp` it can be changed in the preferences to a different directory, too.

Tutorial

The following sections describe a walk trough of the functionality of *gvtree*.

Step 1 Sample git repository

To show the functionality of *gvtree* a sandbox repository is created with the following steps.

The directory to start with is `/home/gvtree`.

Create a subdirectory `test_repository`

mkdir test_repository

Change into the new directory and initialize a new git repository

cd test_repository

git init

Create a file `main.c`, perhaps with the following content:

```
#include <stdlib.h>
#include <stdio.h>

int main(int argc, char* argv[])
{
  printf("Hello world!\n");
  return 0;
}
```

Add the file to the repository

git add main.c

and commit it.

git commit

Now just run *gvtree* for the first time.

gvtree -r /home/gvtree/test_repository

or, if you are already in the directory `/home/gvtree/test_repository` just start

gvtree

The result should look like this:

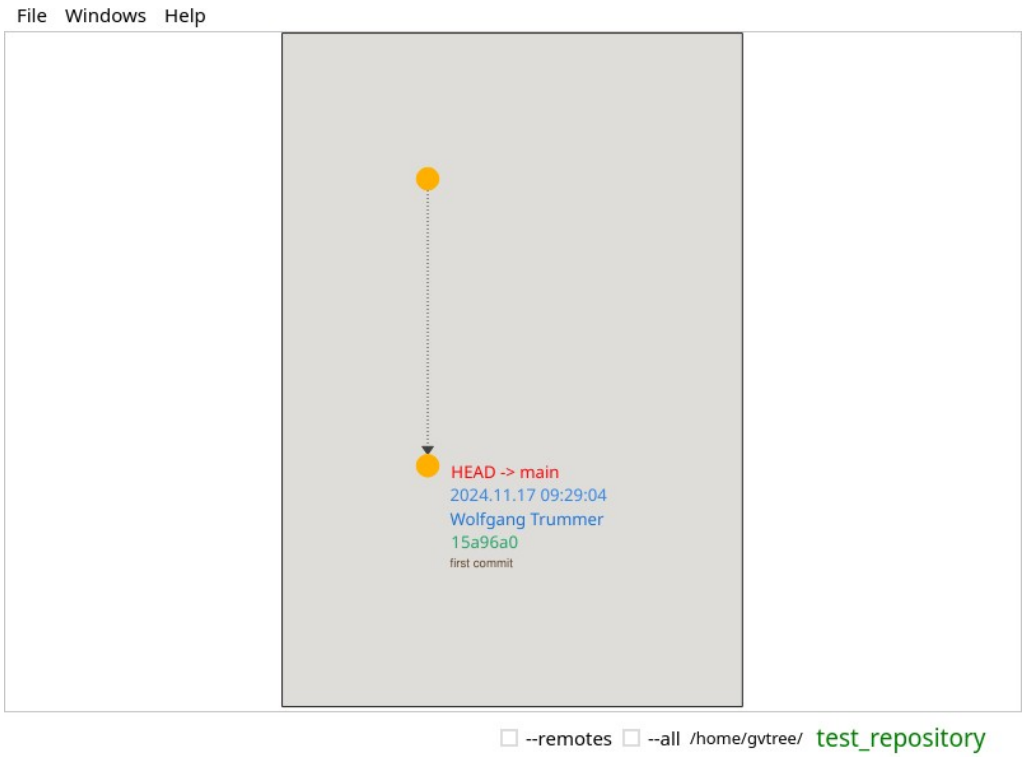

Figure 1: Initial window layout

The
window's minimal size is 400x400 pixels. The default size is 800x600.

At the moment the version tree for the current local repository contains only one version. The first displayed node is the empty root node. The information attached in this example is the commit date and time, tag and branch information, the git version hash and the user name.

Now open the top menu Windows and tag all dock widgets Version Information, Current git status, Compare Versions, Search Version and Branch List.

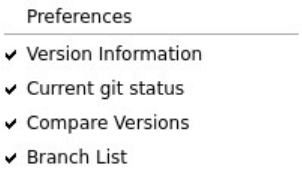

Figure 2: Windows menu

The main window should look like this, then:

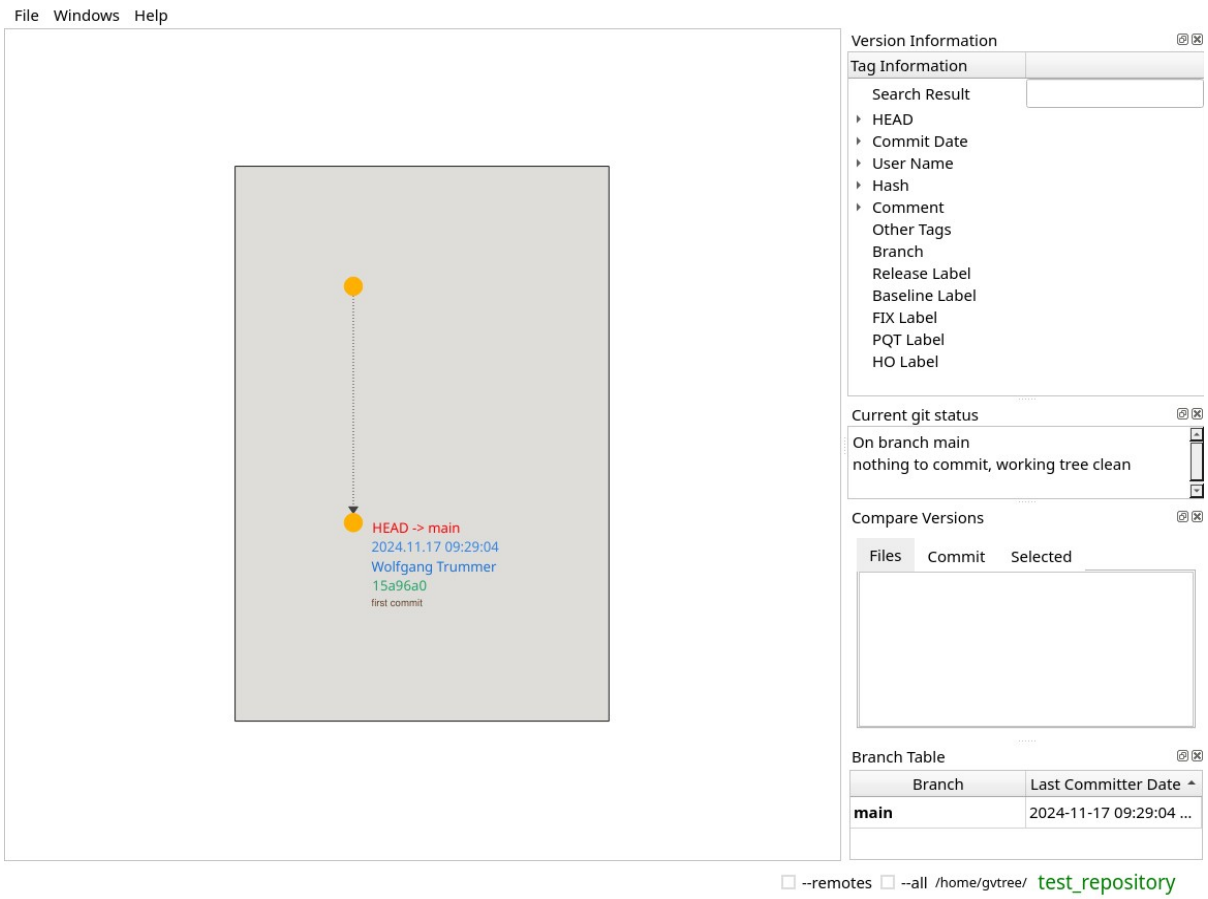

Figure 3: All dock widgets open.

- On the left side there is the graphical representation of the version graph.
- On the right side there are four dock widgets.
  - Version Information contains a tree widget with selection options for commit date, commit user, certain git tags, the git hash value and the commit commentThe search dialog is integrated into this widget, too.
  - The Current git status section just shows the output of **git status**.
  - The Compare Versions section is filled as soon as versions are compared.
  - The Branch List shows the current selected branch. If the selection is changed, the main view is adapted to the corresponding branch and the latest version of this branch is focused.

For the moment close all right dock widgets again.

Control	Keyboard	Mouse
Fit in view	1	
Focus latest version on the current visible branch. In most cases this is the local HEAD version.	h	
Focus HEAD version	o	
Zoom in	+	Wheel up
Zoom out	-	Wheel down
Pan	wasd	MMB + Move
Pan (faster)	Shift + wasd	
Pan	STRG	LMB + Move
Select version		LMB
Context menu		RMB
Search version	STRG + f	

Select the main view and press the key 1 to adjust the graph to fit into the view port.
Now create a branch

git branch branch1

and check out this branch.

git checkout branch1

Add a README file containing "YYY" in the first line.

git add README

git commit

Refresh the *gvtree* view by opening File menu and select Reload Repository

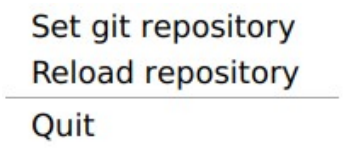

Figure 4: File menu

After the update the graph looks like this:

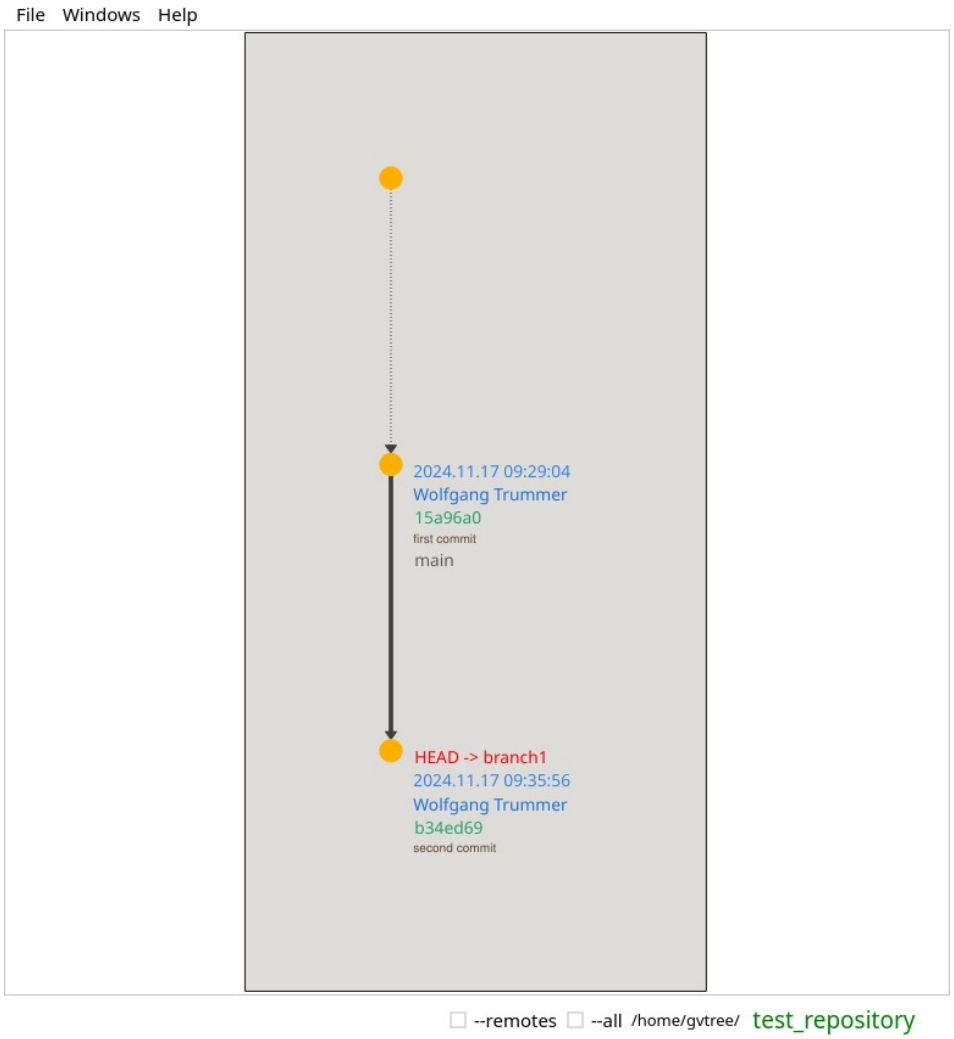

Figure 5: Update after repository change

All versions without incoming merges or outgoing branches are folded automatically. Versions with tags can be excluded from folding.

Now check out main again.

git checkout main

Again, create a README file with different content "XXX".

git add README

git commit

Update the *gvtree* graph view again.

Figure 6: View before expanding a folder

RMB click in the box containing the version node and a context menu will appear. Selecting Fold/Unfold will lead to this update:

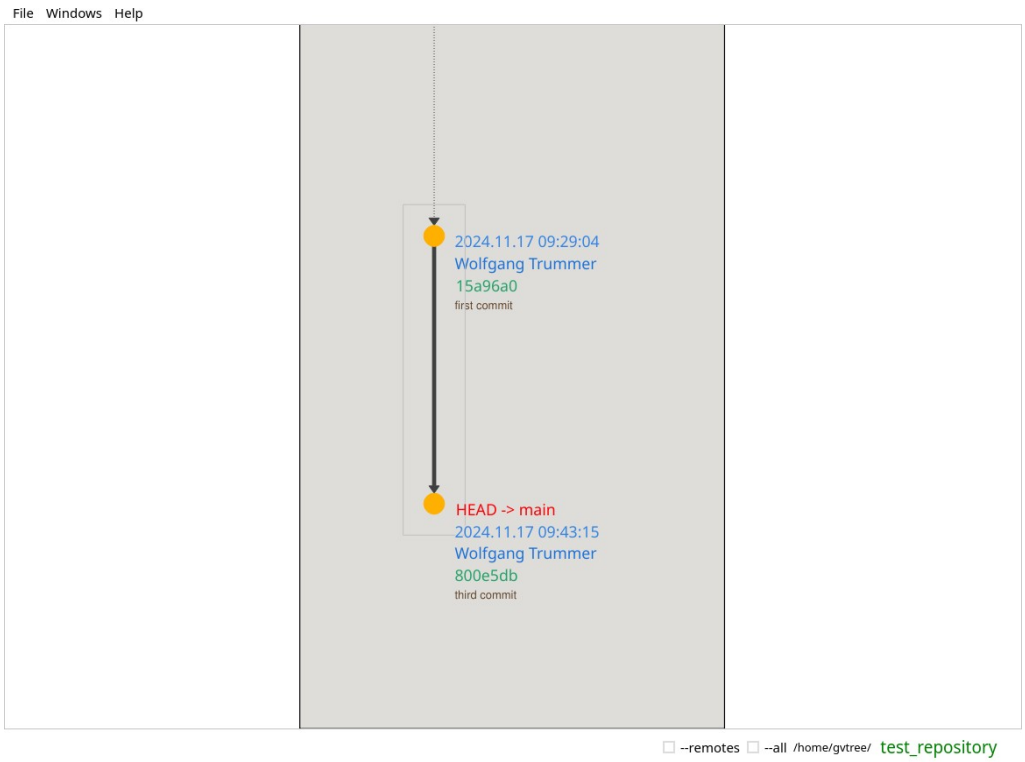

Figure 7: View after expanding a folder

Now merge branch1.

git merge branch1

Solve the merge conflict in README to have two lines "XXX" and "YYY".

git add README

git commit

Perhaps you have recognized the Reload repository button already. It appears if a change of the `.git` directory in the local repository has been recognized. Pressing it has the same effect like File menu and Reload repository.

Figure 8: Reload repository button

After the refresh, the graph should now look like this:

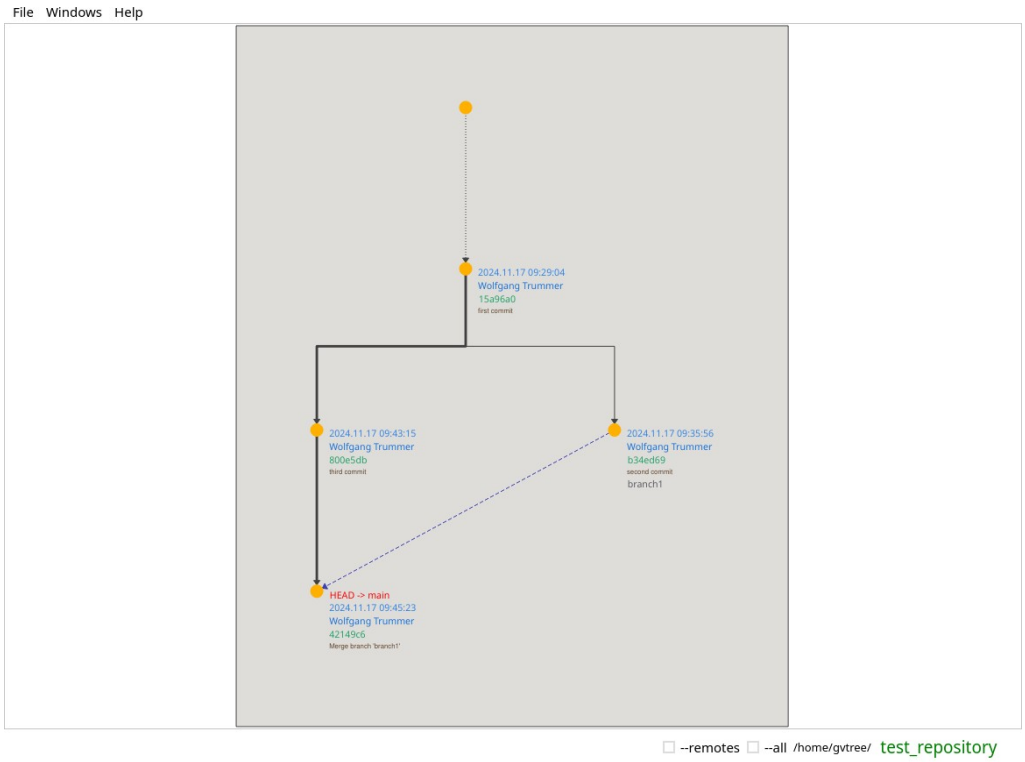

Figure 9: Version graph with merge

The edge representing the merge is displayed dashed and has a different color.

Versions without a real or not displayed predecessor are linked to the zero root node with a dotted edge.

The graph layout can be changed with the Preferences dialog which can be accessed by the top menu. Open Windows menu and select Preferences.

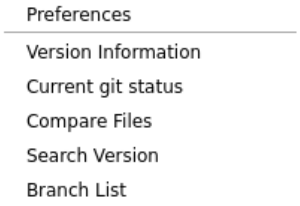

Figure 10: Windows menu

In the dialog select the tab Rendering.

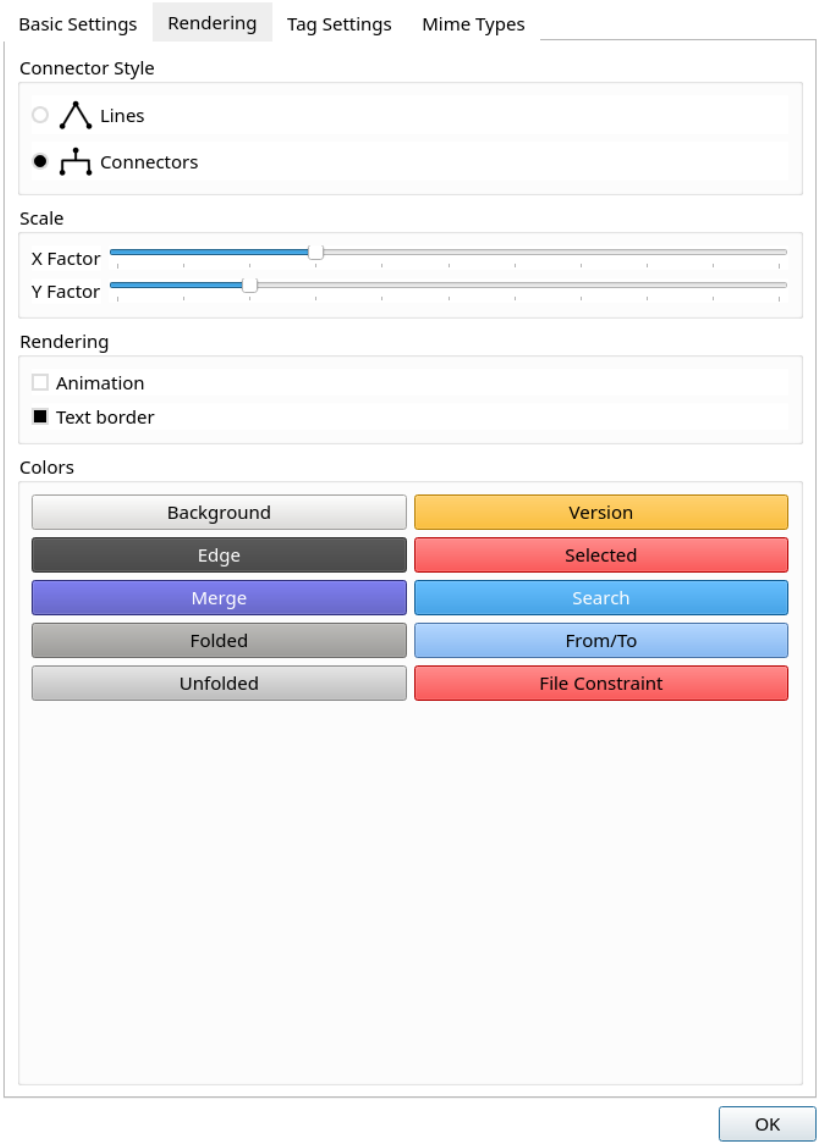

Figure 11: Preferences dialog, page Rendering

With the two sliders X Factor and Y Factor the space between the version nodes can be controlled.

The color of the graphical elements can be changed by pressing the corresponding button. A color selection dialog will appear then.

If the Text Border checkbox is checked, all letters of text elements get a fine border in background color so that overlapping text is still readable.

The Animation checkbox is relevant when changing the current focus. If not checked, the new focus is displayed immediately, if checked the old focus moves within a second to the new focus. This gives an impression where the different versions are located in the version tree.

Change the connector style from Connectors to Line, confirm with OK.

To fit the whole graph into the screen, press key 1 in the main view again.

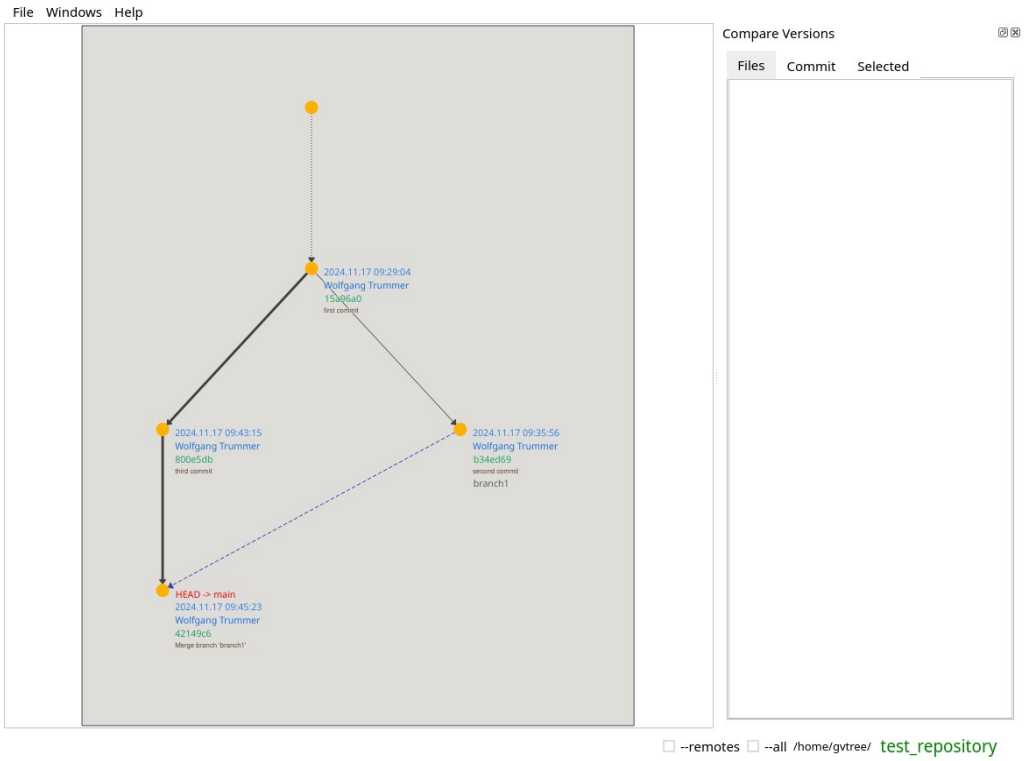

Figure 12: Changed connector style

Step 2 Compare Versions

In the Windows menu, hide all supplemental dock windows.

Now do a RMB click on the version node with the branch1 information.

A markup cursor appears to identify the two versions which are compared and the Compare Versions dock widget is displayed.

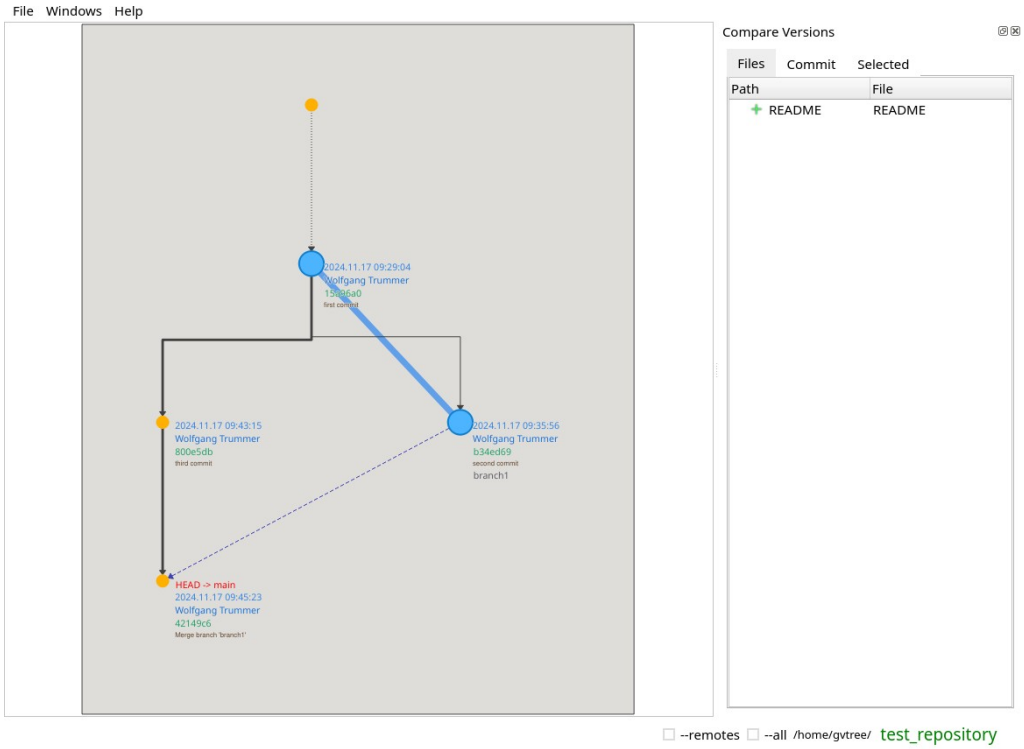

Figure 13: Compare versions markup

The Compare Versions dock should now look like this:

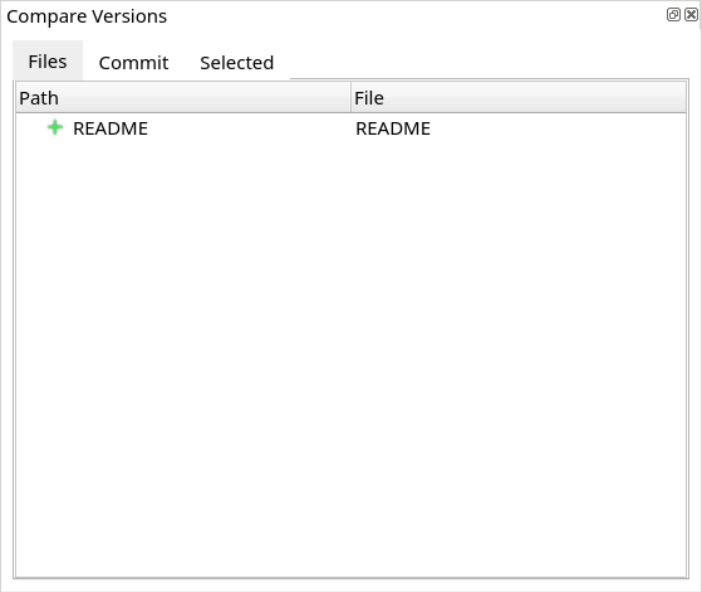

Figure 14: Files tab of the Compare Versions dock window

In a tree view all changed files are listed. In this example it is only the added README file.

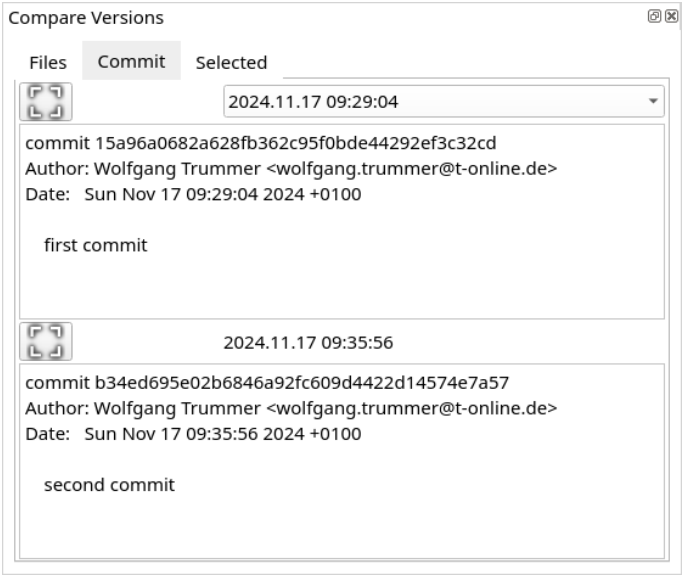

Figure 15: Commit information tab of the Compare Versions dock window

In the Commit tab two text browser windows are displayed. The top text browser contains the commit information of the from-version, the text browser below contains the commit information of the to-version.

By pressing the button above the commit info, the corresponding version in the graph view is focused and is marked up.

Figure 16: Focus version

It will look like this, then:

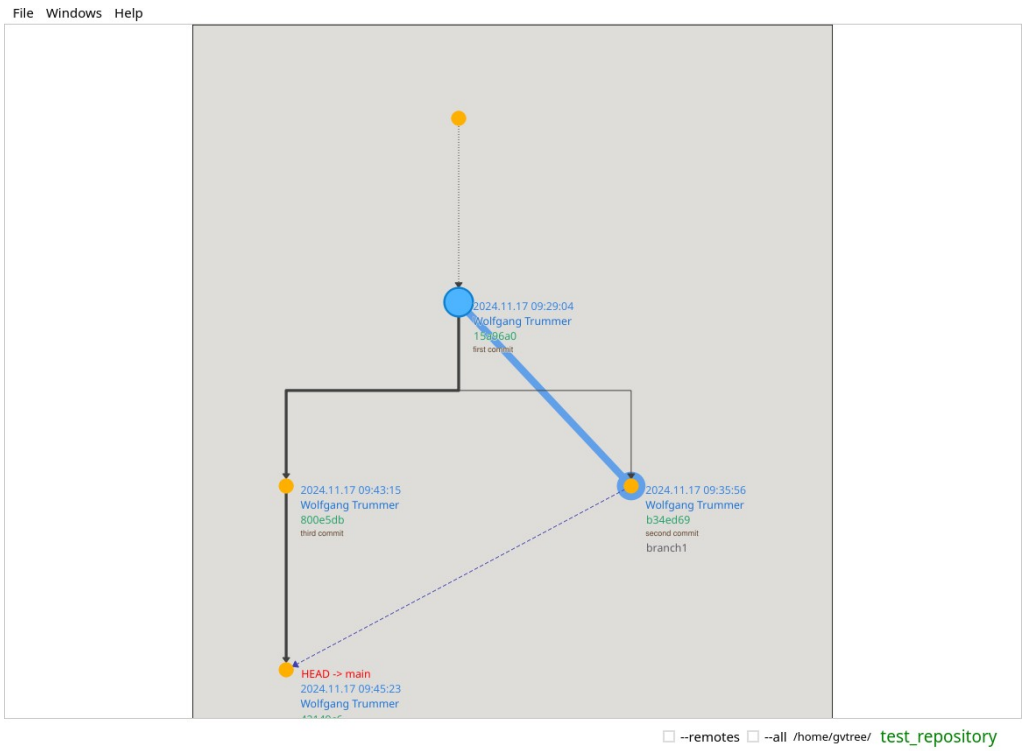

Figure 17: Focused version

Now do the same for the HEAD version.

This version has got two predecessors because of the merge.

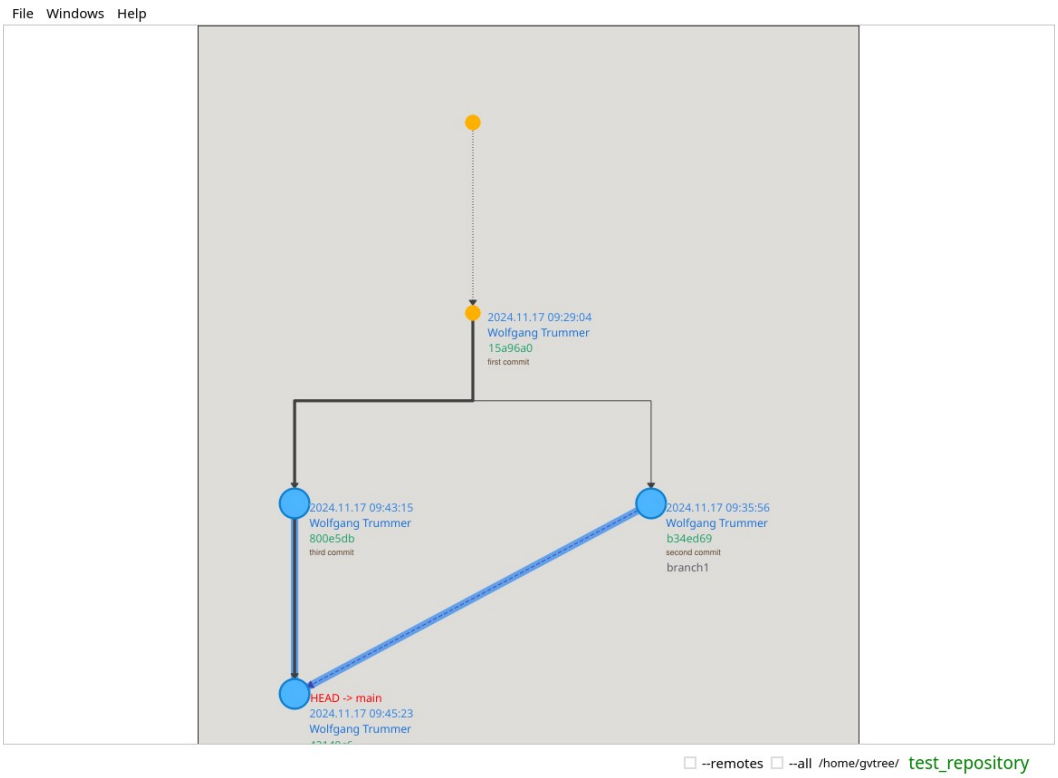

Figure 18: Compare to more than one predecessor

The Compare Versions window has changed, too:

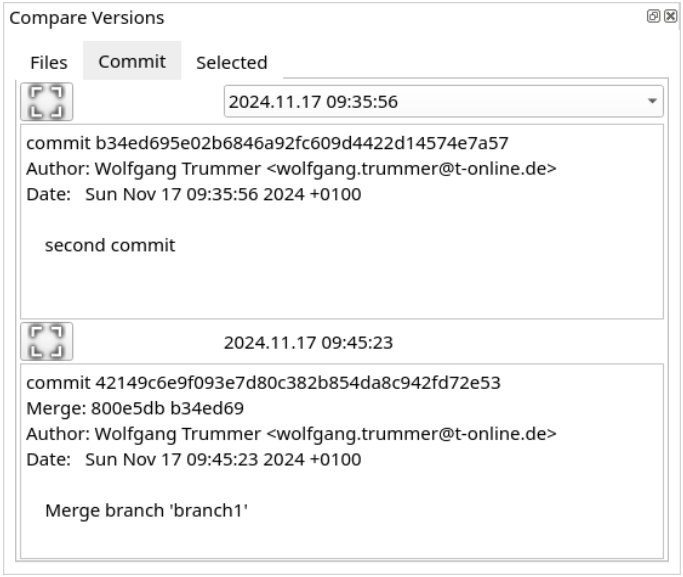

Figure 19: Updated Compare Versions window

In the Files tab of the Compare Versions window the symbol in front of README has changed, too.

	File has changed / modified
	File has been removed
	File has been added
	File has been renamed

The second difference is, that the from-version is selectable by the combo box.

Figure 20: Combo box

The displayed commit info will change accordingly. Pressing the focus version button will focus and markup the selected version.

In the file tree view select the README file and open the context menu with a RMB click.

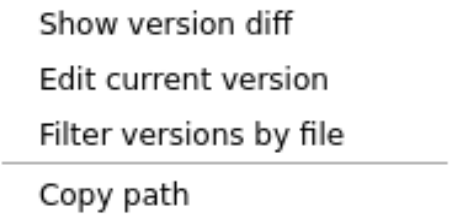

Figure 21: Context menu for a single file.

Select Show version diff.

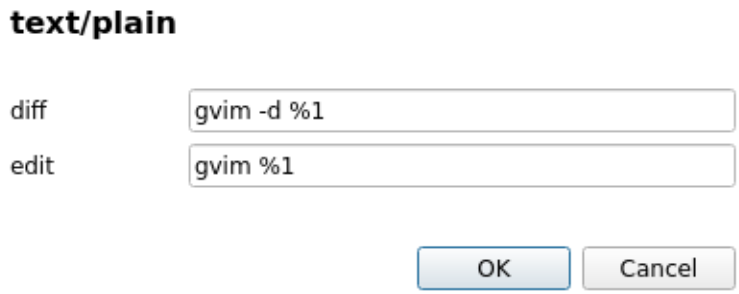

Figure 22: If mime type is unknown the tool selection dialog is opened.

In this case a dialog will open, because so far the mime type of the file `text/plain` is unknown and not linked to a viewer or an editor. The setting can be changed later in the Preferences dialog. The %1 is a placeholder for a list of file names separated by a blank.

Pressing OK now, a *gvim* opens with three columns - two from-versions and one to-version.

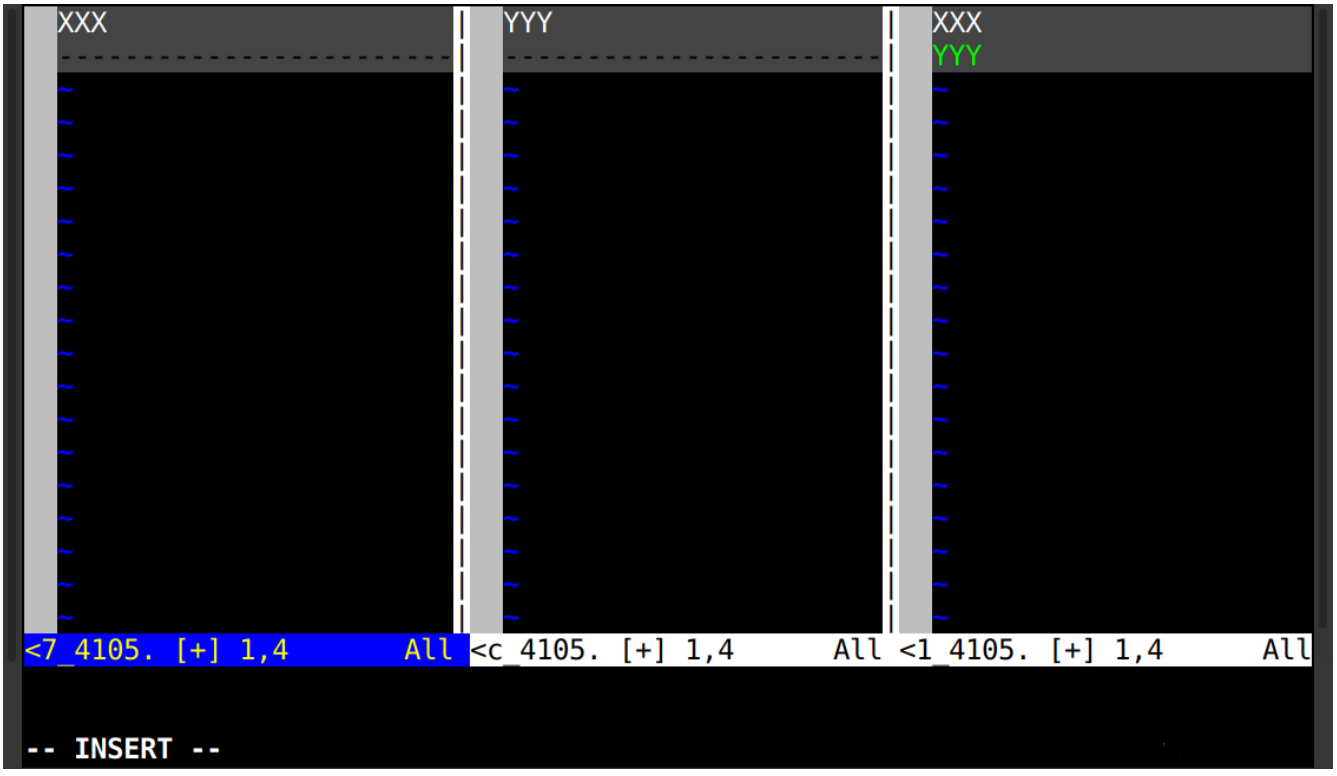

Figure 23: gvim as difftool with three columns.

In case of an image file instead of a text editor *gimp* for example can be specified, for pdf documents *evince* and perhaps for sound files *aplay*.

If you open the RMB menu of the HEAD version again and select Compare to latest branch fork the current version is compared to the first direct parent with more than one child. In the example above it would be the version with the timestamp 21:36:02.

If there is no branch other than main, the reference is the first version displayed after the root node.Now choose again the RMB click context menu of the README file in the tree view. Select Filter versions by file. The effect is, that all versions and edges are marked up, where this file has been changed. The file name constraint README is added to the bottom status bar.

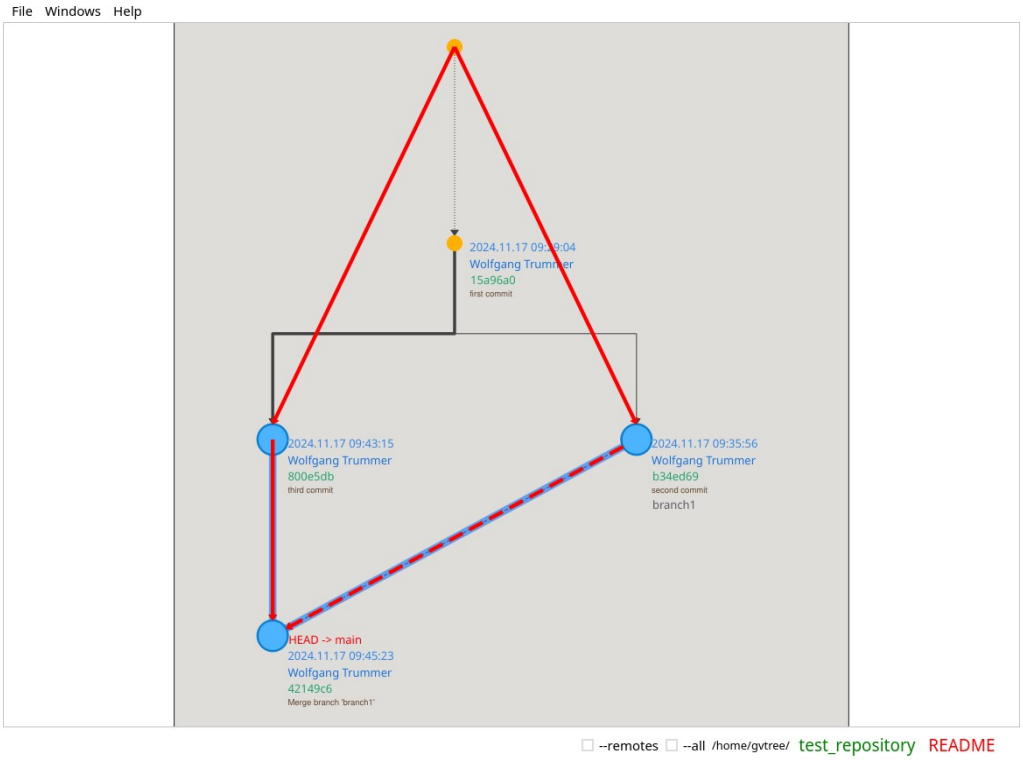

Figure 24: Version graph with file constraint

By changing settings in the **Preferences** it is possible to reduce the tree to contain only the versions the selected file has changed. In this case the additional markup is not used. As long as a file constraint is set, the right click menu of a version node has got a shortcut, to directly open the diff tool.

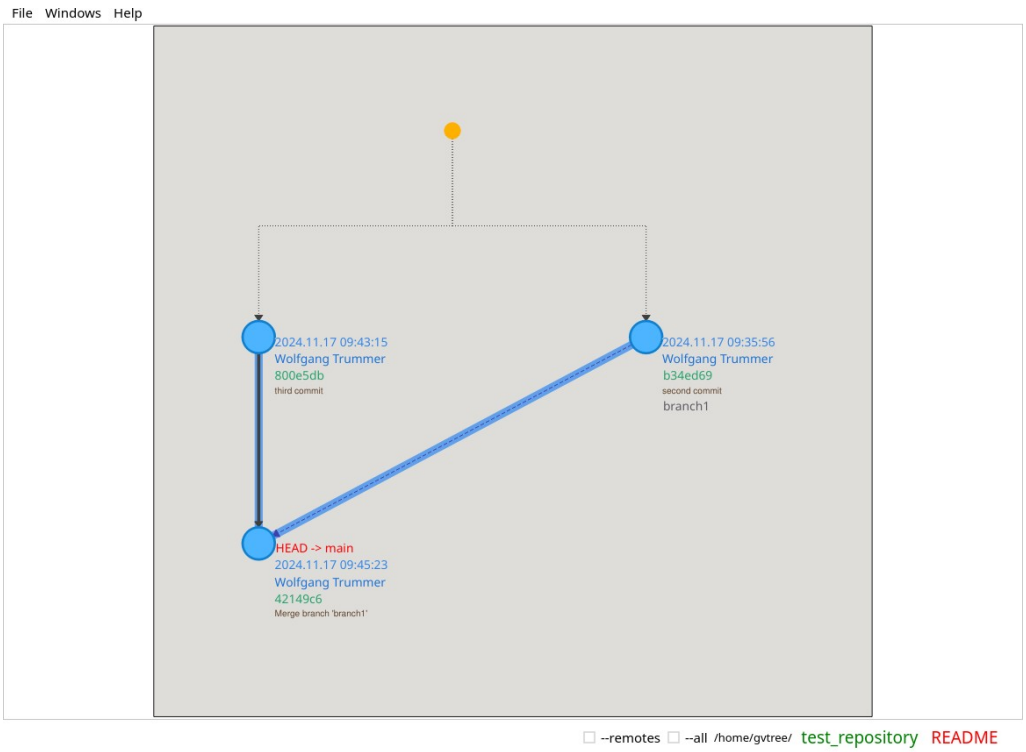

Figure 25: Graph reduced to versions where README is changed

A LMB click on README in the status bar will remove the constraint again. Selecting Remove filter in the tree view context menu has got the same effect. In a larger version tree it is more simple then to find out, where a file has been altered.

The last item in the context menu Copy path just copies the file path to the desktop's clipboard.

Now exit *gvtree* by selecting Quit in the File menu.

A file constraint can be added when starting *gvtree*, too.

In a new terminal window change to `/home/gvtree/test_repository`

cd /home/gvtree/test_repository

gvtree README

Remove the file constraint like above.

The changed settings and the window state have been restored. The Compare Files dock should be detached and visible. The spacing between the version tree nodes should not have changed.

Step 3 Preferences

Now open the Preferences dialog again.

Rendering

The Rendering tab has already been visited. Feel free to change your color settings or change to the other connector style. The Animation checkbox is set by default. When the view is re-focused it is hopefully scrolling and zooming smoothly to the version nodes of interest. If too slow, without the checkbox set, the view is changed directly.

Basic Settings

The Current Repository Path can be set and changed here. The Initial Repository Path setting defines if the current path is used to look for the git repository. The other option is to display the repository which was used in the last session.

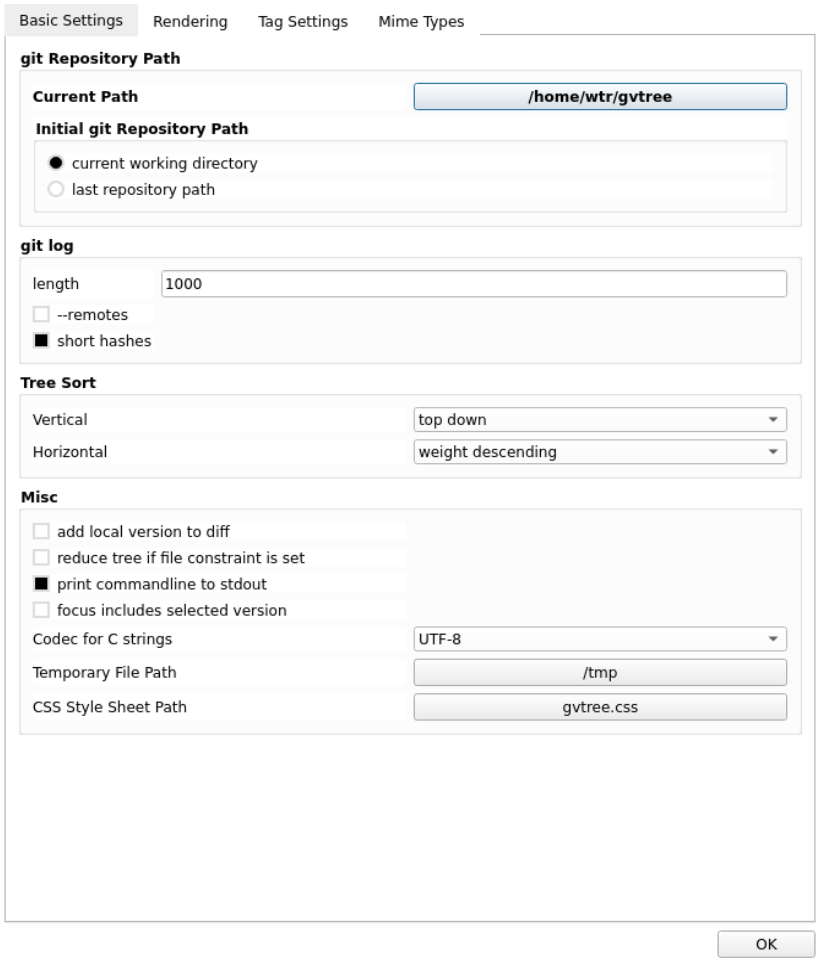

Figure 26: Preferences Basic Settings

The tree information is imported from a git log output. This input can be truncated to the last n versions. The tree will be smaller and less complex, then. A good value for git log length is 1000. Initialization of a huge tree graph takes some seconds.

git log –remotes adds the –remotes switch to git log actions.

The short git hashes check switches between %h and %H output of git log.

In case of top down view is checked in the Vertical Tree Sort section, the HEAD version is printed on the top. The Horizontal sort takes just the git log --graph order in case of natural. The weight of the subtrees can be used as sorting criteria, or the commit date.

If add local version to diff is set the local file version is displayed if it is not equal to one of the other versions to compare.

If reduce tree if file constraint set is checked, only version nodes where the selected file has changed are displayed (see previous chapter).

With print command line to stdout, every command line to run git or a compare tool is printed to stdout.

The focus contains selected version will ensure that the selected version is always contained in the view when searching other versions.

The Codec for C Strings is only relevant for *gvtree* compiled with a Qt version < 5.0.

The css file located in the source tree `css/gvtree.css` is included when compiled. In case no path to a different style sheet file is set this default is used. The default can be changed by referencing a file in the CSS Style Sheet Path. (An empty file for no style sheet is allowed.)

Temporary files are created when comparing different versions. This files are erased if gvtree is quit and the location is specified in the Temporary File Path setting.

Tag Settings

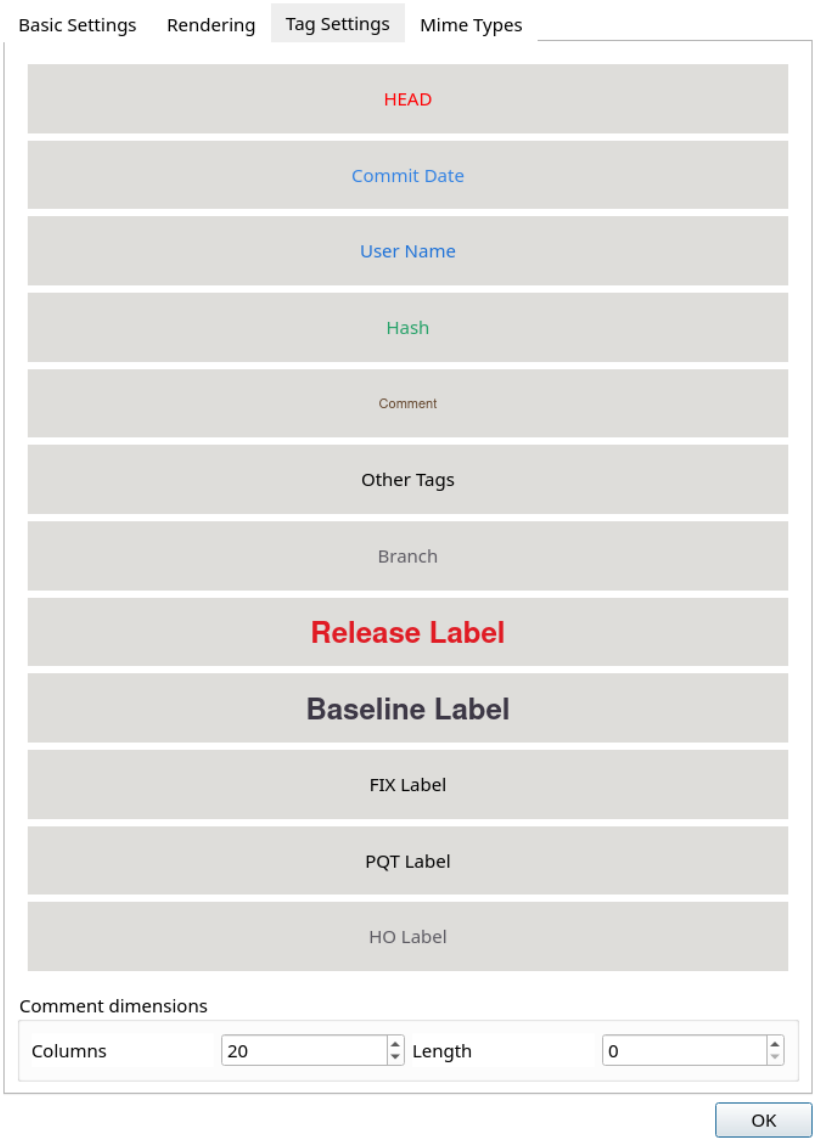

Figure 27: Preferences Tag Settings

In the upper section color and font style for certain version information is defined. To change it, open the RMB context menu. The options which are not available for all items are:

- Visibility
- Foldable
- Add New
- Change
  - Color

    - Font
    - RegExp
- Delete
- Up
- Down

For some tag information it is possible to change the regular expression to match git log data. Depending on how a working flow for a project is defined it is possible to adapt baseline, release or QA label information. In this example, a Release Label looks like **R1.2-3-4** or similar. A baseline label e.g. **BASELINE_1.2-3**.

FIX, **PQT** (preliminary quality test) and **HO** (handoff) are perhaps project or company specific and are related to a QA work flow. Additional label patterns are possible, unused patterns can be deleted.

If commit Comment information is displayed in the graph the maximum Length of the comment and the number of characters per line Columns can be defined in the section Comment dimensions.

In the local repository, add a tag named **STR1234_HO**.

```
git tag -a -m "STR1234_HO" STR1234_HO
```

Update the graph view.

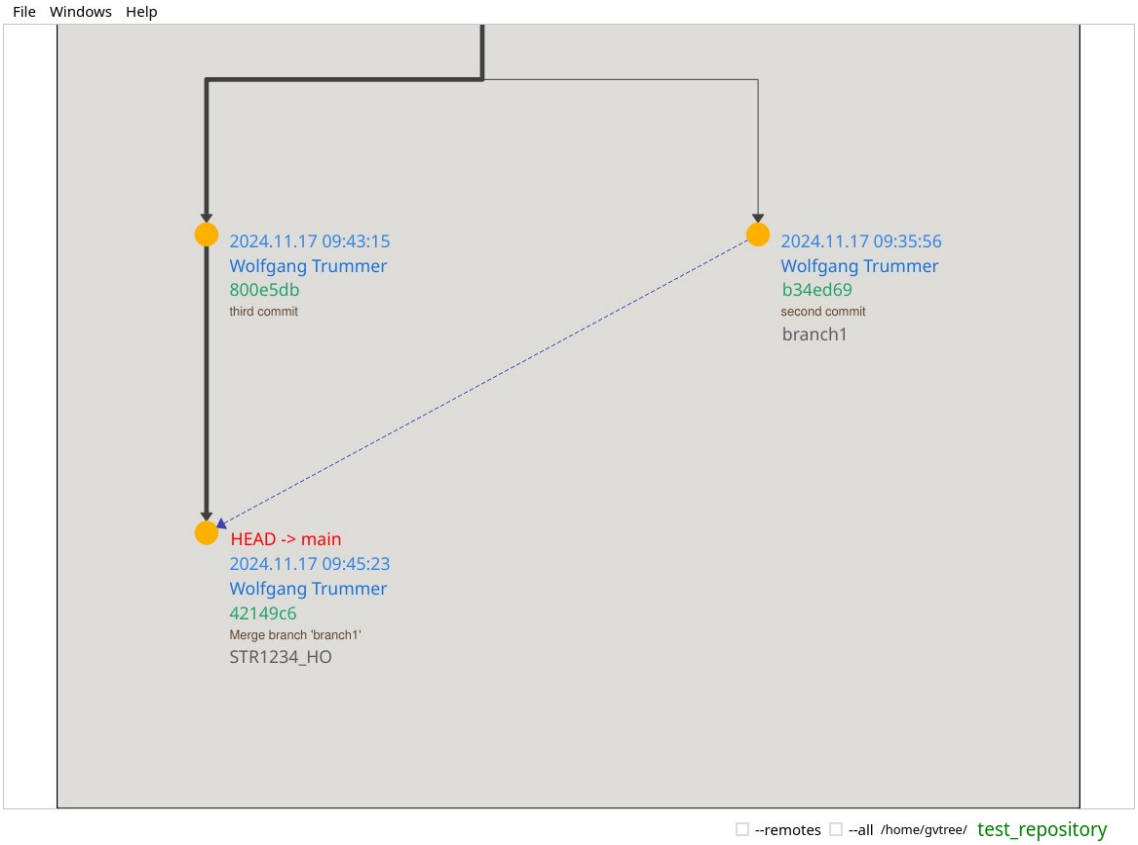

Figure 28: Handoff Tag

Mime Types

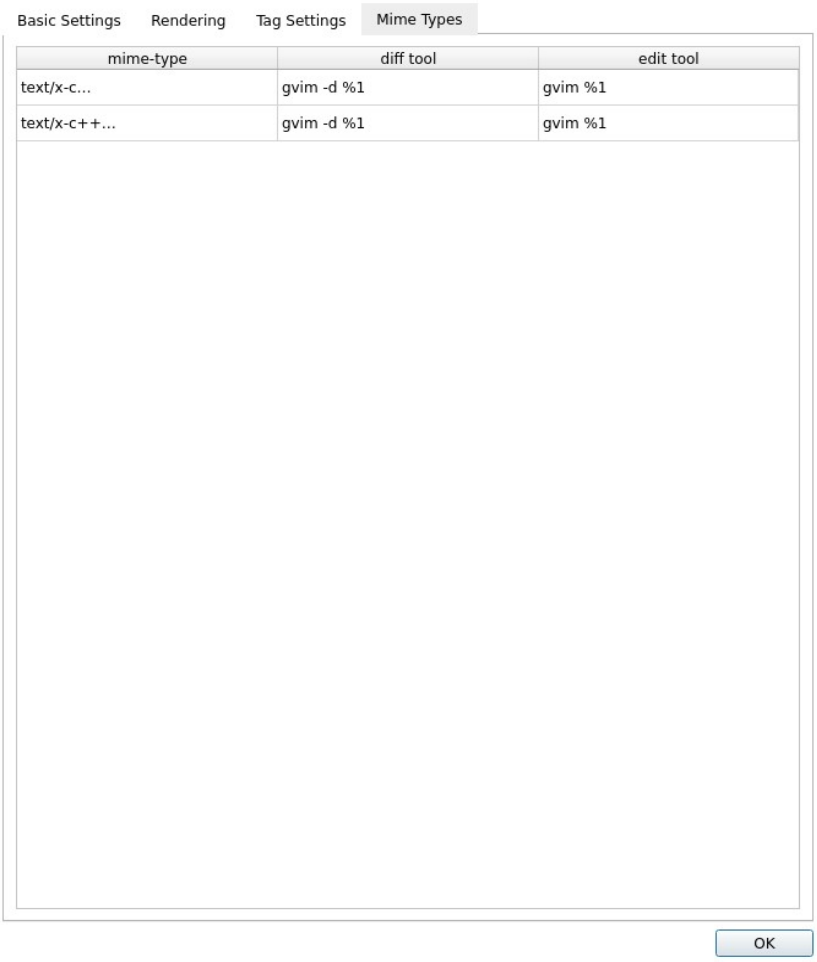

Figure 29: Preferences Mime Types

In Step 2 the diff tool and edit tool preference for `text/plain` files has been added. The columns diff tool and edit tool can be changed here, if necessary.

Step 4 Some more features

The current local repository can be changed by:

- A file dialog which is opened by the File menu Set git repository.
- The same file dialog which appears when pressing the repository name in the status bar of the main window.
- It can be opened by pressing the Current Repository Path button in the Preferences on the page Basic Settings.
- When starting *gvtree* the local repository path can be handed over with the command line argument **-r** followed by the path.
- If the **-r** parameter is not specified when starting, depending on the Preferences Basic Settings Initial Repository Path the current path is checked for a git repository. If last repository path is selected the repository of the last session is used.

The Help menu offers three selections.

- Help will show where to find this document ($INSTALL_PATH/share/doc/gvtree/gvtree-1.9-0.pdf).
- About shows a nice splash screen with the project icon.
- License contains the HTML copy of the GPL V3.0

Step 5 Folder

In the Windows - Preferences - Basic Settings set the tag fold HEAD version.

Now just add a file TODO to the repository.

git add TODO

git commit

Refresh the graph view.

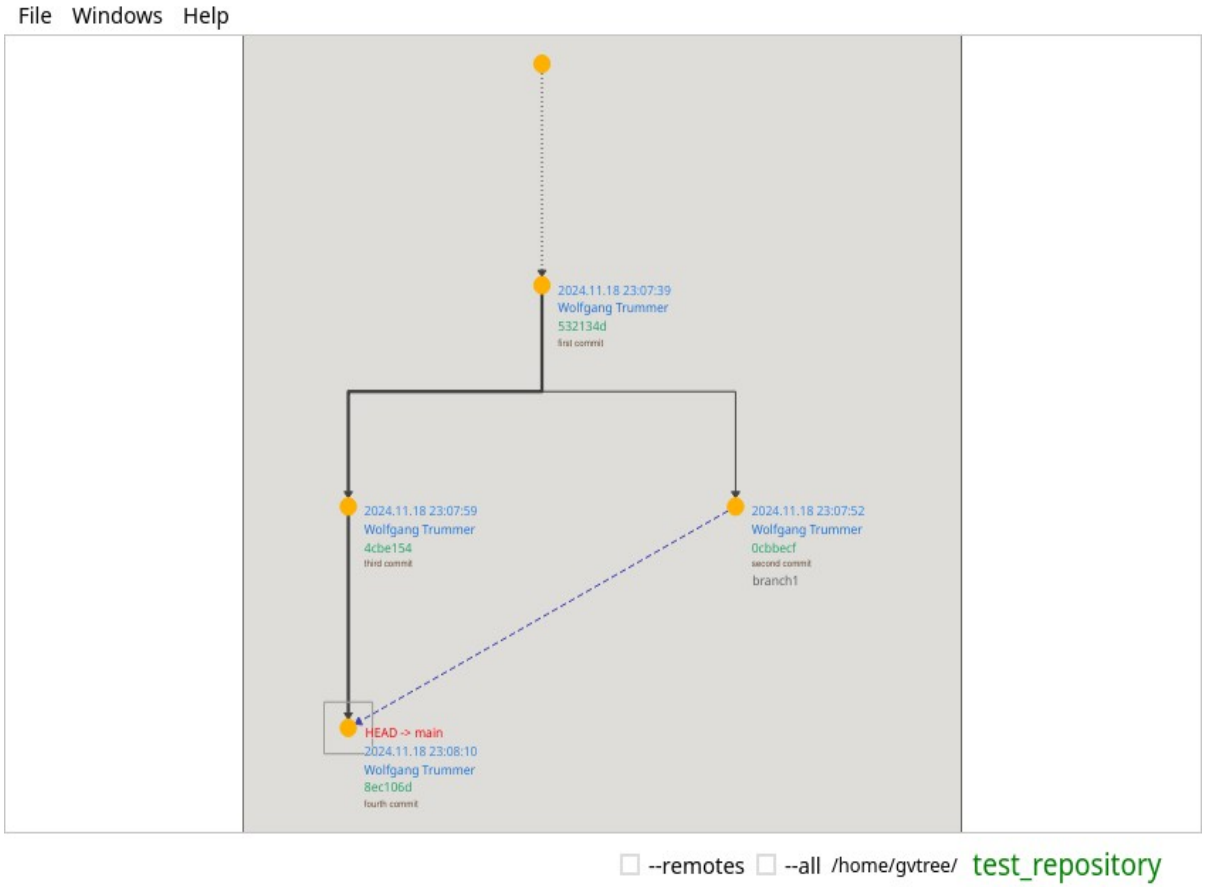

Figure 30: Folded version

The folder box now contains two versions. Versions are folded and only the last version node of the folder is displayed, if no merge arrow or branch exists. Versions can be excluded from folding in the Preferences Tag Settings.

Do a RMB click in the graph view background and open the following context menu:

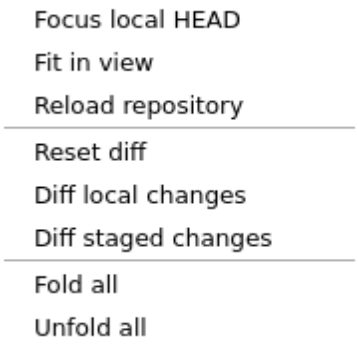

Figure 31: Global background context menu

Fold all and Unfold all are global actions in this context menu. With the context menu of a single folder the action will only affect the one element.

Focus local HEAD is helpful in case of bigger version trees. To do the test, just zoom into the view with the mouse wheel or pan with the MMB middle mouse button pressed.

Fit in view ensures visibility of the complete version tree.

The Reload repository is the same like the option in the File menu.

Open the context menu again and select Focus local HEAD.

The result should be:

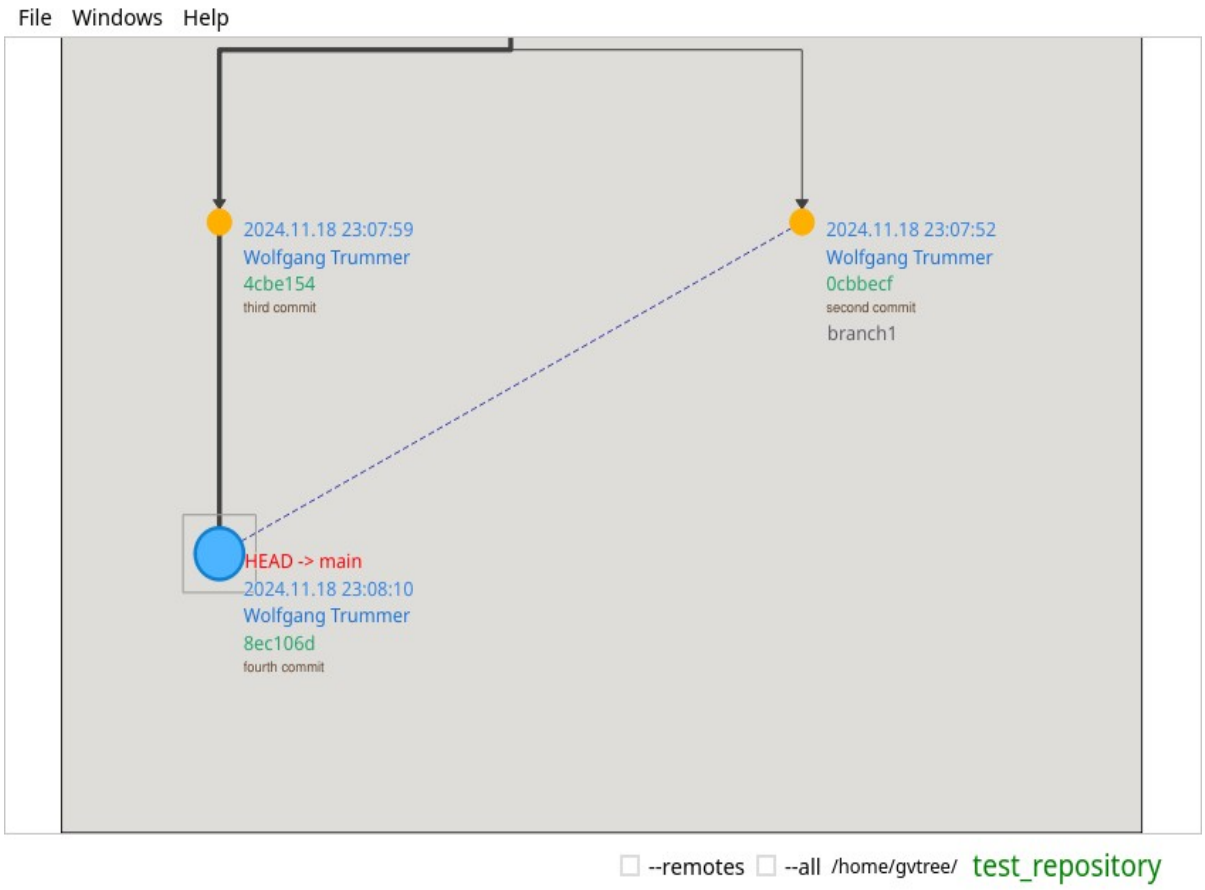

Figure 32: Focus HEAD version

To focus the HEAD version there is the additional keyboard shortcut h.

Now edit the TODO file. Add the line "This is a local change.".

In the RMB click context menu select Diff local changes. The Compare Files dock will open.

Open the context menu of the file TODO and select Show version diff. Now the local changes are compared to the current local HEAD version.

Files already staged with git add are not visible in the Diff local changes. The difference between the latest commit and the staged files can be done by the menu item Diff staged changes.

In the graph view select Reset diff in the RMB context menu. The markup of the local HEAD version disappears and the content of the Compare Files window is removed.

Step 6 Selecting a version

With a LMB click a version can be selected. The node will appear in a different color.

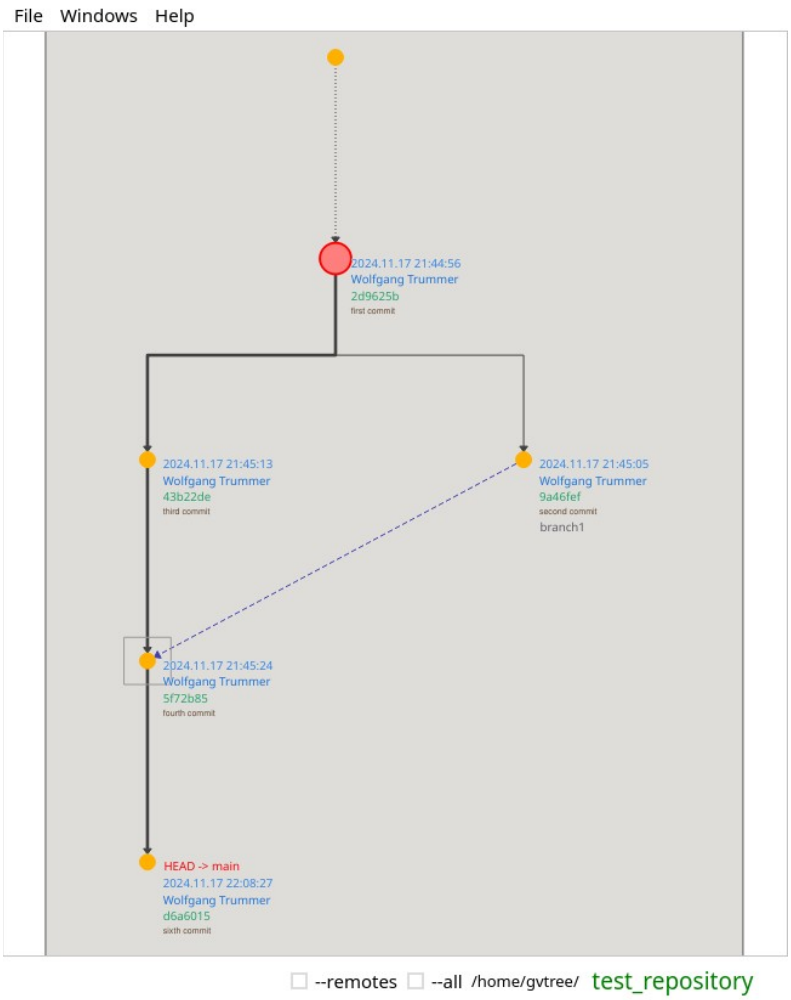

Figure 33: LMB version selection

Now open the RMB click context menu of the version with **branch1** information attached.

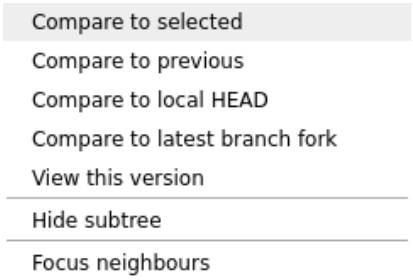

Figure 34: Compare context menu when a version is selected.

The option Compare to selected is displayed. In this case Compare to previous would have the same effect, but in a larger tree it is possible to compare more distant versions.

The option Compare to local HEAD is just a shortcut without selecting the local HEAD version before.

The option Compare to latest branch fork is trying to find something like a baseline for the comparison.

With Focus neighbours the visibility of all version nodes linked by normal edge is ensured.

If right click is not performed on a leaf node, Hide subtree or Show subtree is displayed. A hidden subtree is visualized by a dotted line.

To change the selected version, LMB to a different version node.

To remove the selection, RMB to the main view background and select Reset Selection.

A selection is kept even if not visible after changing the displayed version tree via Branch List. This helps comparing different branch versions.

Step 7 Context menu of edges

Now move the mouse pointer over an edge. The RMB click context menu should look like this, then:

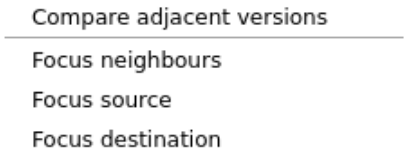

Figure 35: Context menu of a graph edge

With Compare adjacent versions the two versions connected by the edge are compared.

The three focus options are helpful especially if the versions are connected by a very long merge edge.

Step 8 Lookup version information

Open the Version Information dock window in the Windows menu.

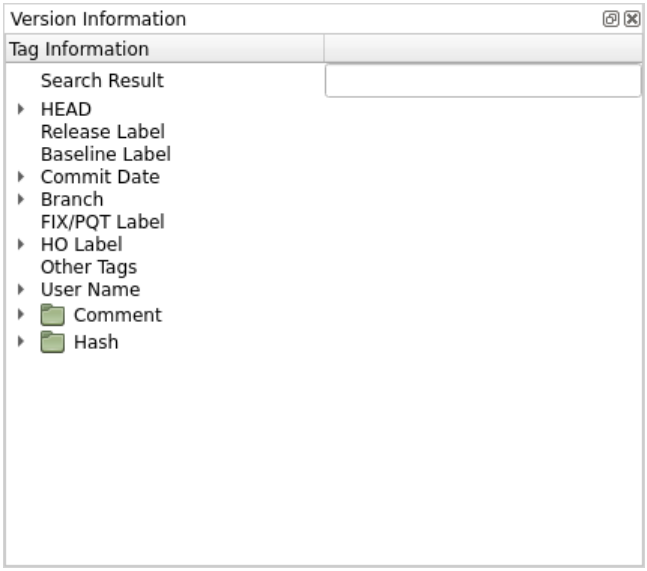

Figure 36: Version Information dock widget

In earlier releases this window contained its information in tabs and lists. This has been changed to a tree. The top level nodes have been the tabs before.

- Search Result
  In the second column a line edit is visible where a search pattern can be entered. The versions matching the search pattern will be listed under this node. When changing the search pattern the Search Result is updated on the fly.
- HEAD
  All versions matching the corresponding regular expression pattern defined in the Preferences - Tag Settings page.
- Release Label
  All versions matching ...
- Baseline Label
  All versions matching ...
- Commit Date
  The commit date is split into YYYY, MM, DD, HH:MM:SS. This item has 4 tree levels then. It is easy to markup all versions created in a year, month or on a day.
- Branch
  All versions matching ...
- FIX/PQT Label
  All versions matching ...

- HO Label
  All versions matching ...
- User Name
- Comment
- Hash

Change to the HO Label row.

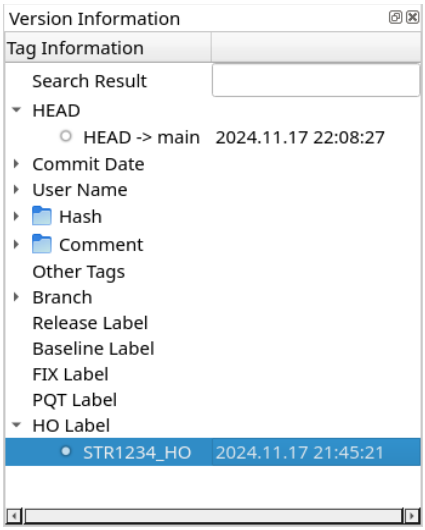

Figure 37: Version Information dock widget page HO Label

Select STR1234_HO with a LMB.
In the graph view the version with the tag STR1234_HO is focused and gets a markup. If this version is contained in a folder, it is ensured that the folder is open so that this version is visible.

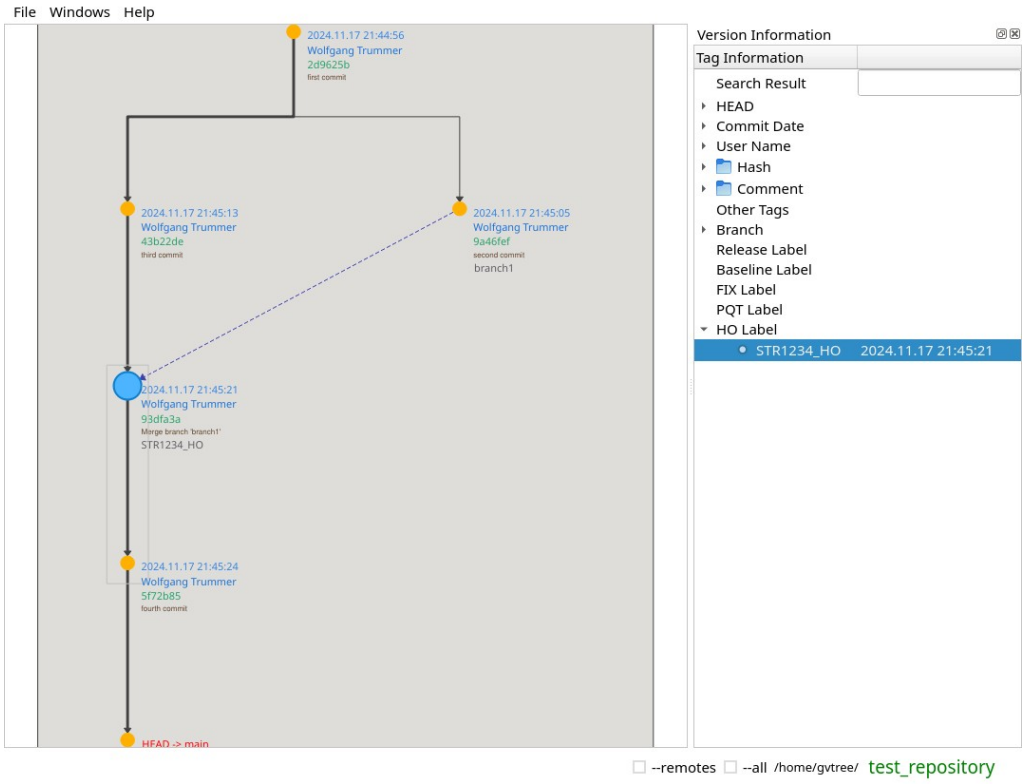

Figure 38: Search by Version Information widget.

Now press STRG + f and the cursor focus is set to the Version Information dock window to the line edit to enter a search pattern. Just type the year in the field. In this example 2022. Expressions with less than 3 characters are ignored. Regular expressions are allowed.

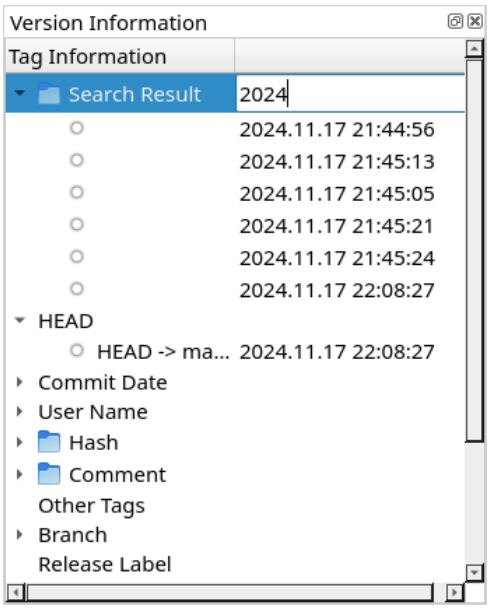

Figure 39: Simple search with results printed under the Search Result node.

The markup and focus in the graph view will look like this, then:

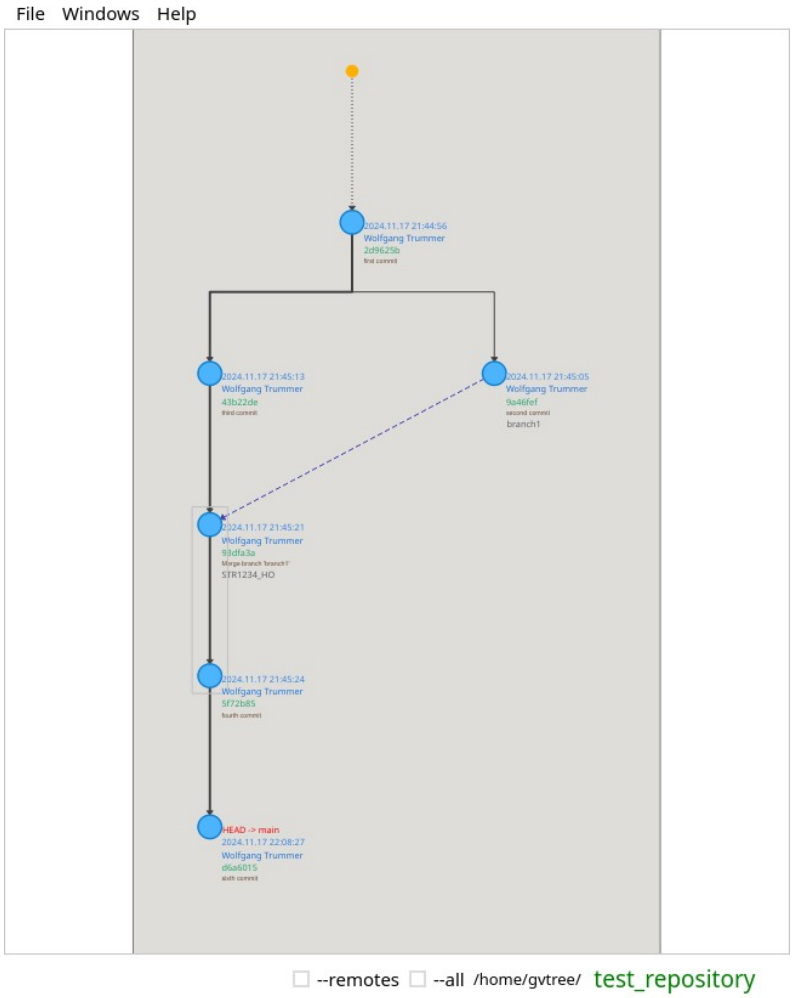

Figure 40: All matches for the search pattern 2022

All matching nodes are visible. The tag information causing the match is displayed automatically (commit date).

The Version Information window has got a tree node Search Result. Under this node all current matching versions are displayed with their commit date timestamp. If the matches are distributed all over a big version tree, it is easier to access individual versions with the Version Information window.

Step 9 The Branch List widget

If **--all** at the bottom of the window is checked, selecting a branch in the the Branch Table widget will just focus the latest branch version. If it is not checked, the graph will change when selecting different branches. In this case versions on different branches can be compared, too.

In the example there is only one branch **branch1** beside the **main** branch. Just add one more branch **branch2** in the following way:

git checkout STR1234_HO

git branch branch2

git checkout branch2

To create a new version, just add a ChangeLog file to the repository.

echo "ChangeLog" > ChangeLog

git add ChangeLog

git commit

git checkout main

Now run **gvtree** again or press reload and open the dock widget Branch Table. In the main view, select the **HEAD→main** version.

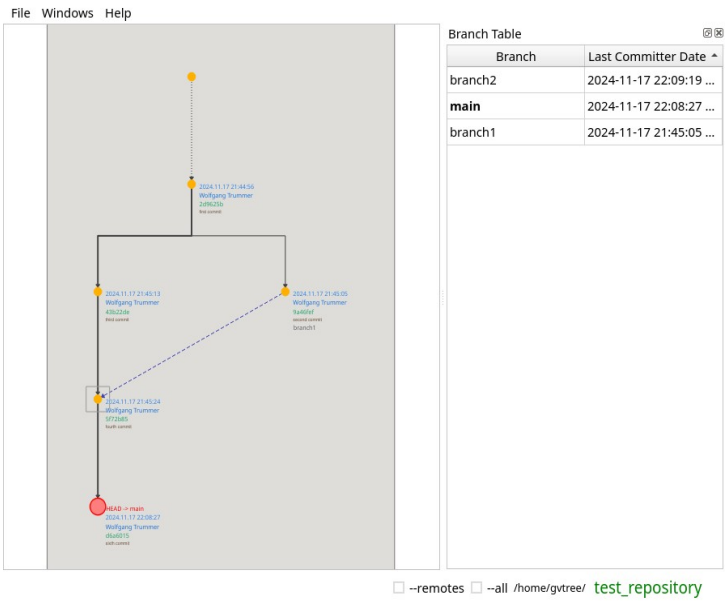

Figure 41: Branch List widget

There are now three row entries visible in the table. The current checked out branch **main** is selected. With Sort by committer date (up) the latest branch is on top of the list. A sort by name is possible, too.

In the Branch Table widget, select **branch2**.

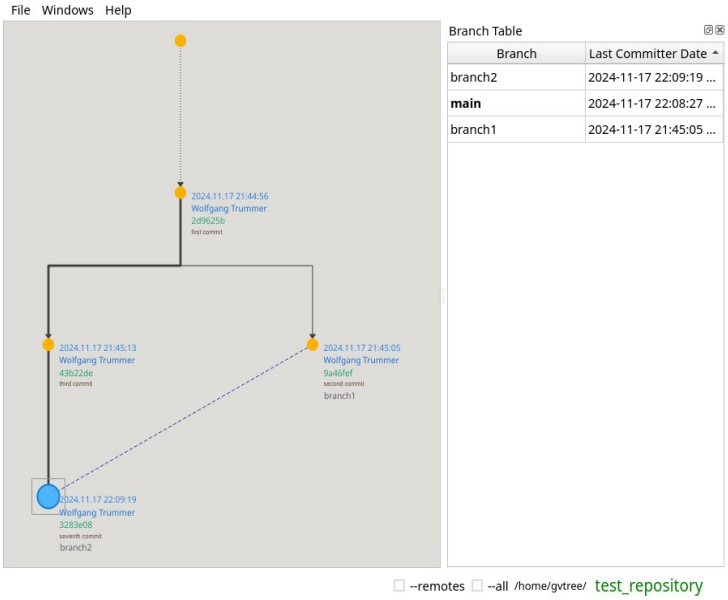

Figure 42: Selected branch2

Zoom out and perform a right click on the **branch2** version to open the context menu.

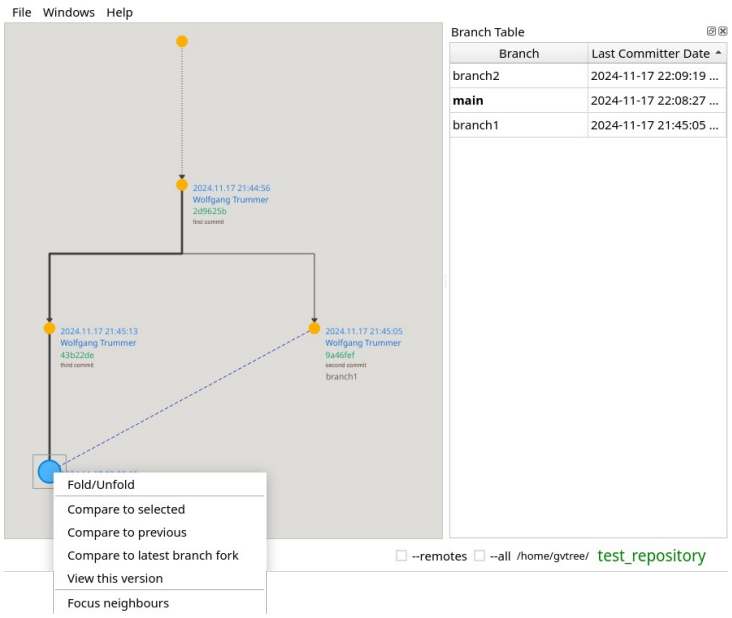

Figure 43: Compare versions between different branches

The **HEAD→main** version is still selected and the **branch2** version can now be compared to it.

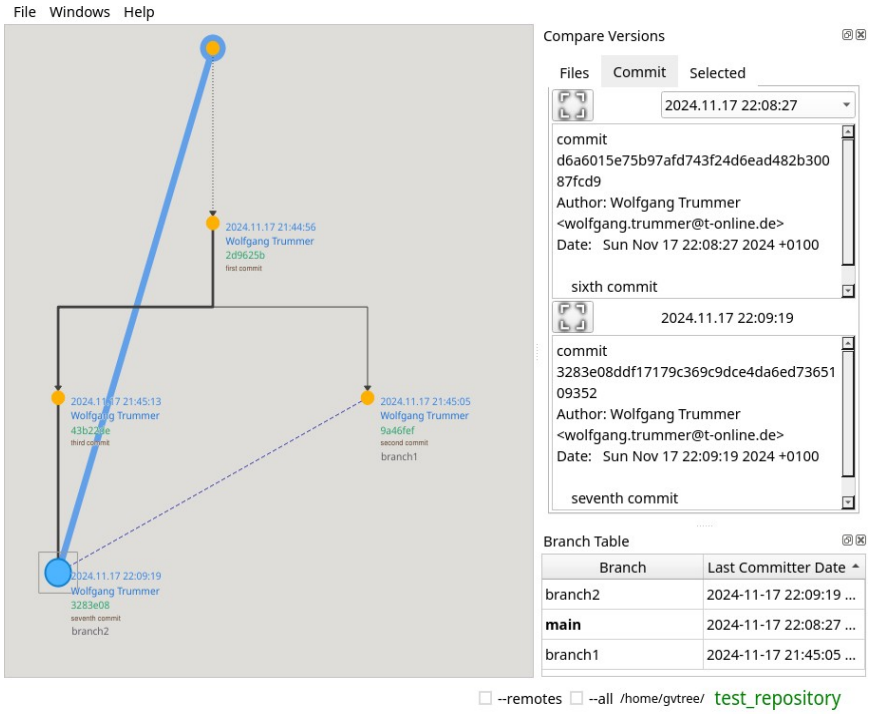

Figure 44: Compare HEAD→main and branch2

Pressing Current Branch of the Branch Table context menu will restore the main view and show the current checked out branch.

Appendix A License

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Version 3, 29 June 2007

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