

# gvtree

a git version tree browser

Version 1.1-0

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## 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.

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# 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

## Credits

Thanks to Winfried Nöth and Carsten Raufuß for beta testing and hints for improvement.

# 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

For the development Debian 9.4.0 has been used. The usage of Debian 9.4.0 explains the older Qt 4.8 version. The source code can be compiled as well with Qt 5 libraries. The program has been compiled and checked with the following two environments:

### Debian 9.4.0 Environment

- g++ (Debian 6.3.0-18+deb9u1) 6.3.0 20170516
- libqt4-dev 4:4.8.7+dfsg-11+deb9u1
- xorg 1:7.7+19
- vim 2:8.0.0197-4+deb9u3

### 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

## 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-1.1-0.tar.gz
```

Change to the folder `gvtree-1.1-0`

```
cd gvtree-1.1-0
```

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-1.1-0

Tool to display git log graph

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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#%an#%at#%d#"
    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 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 through 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`**

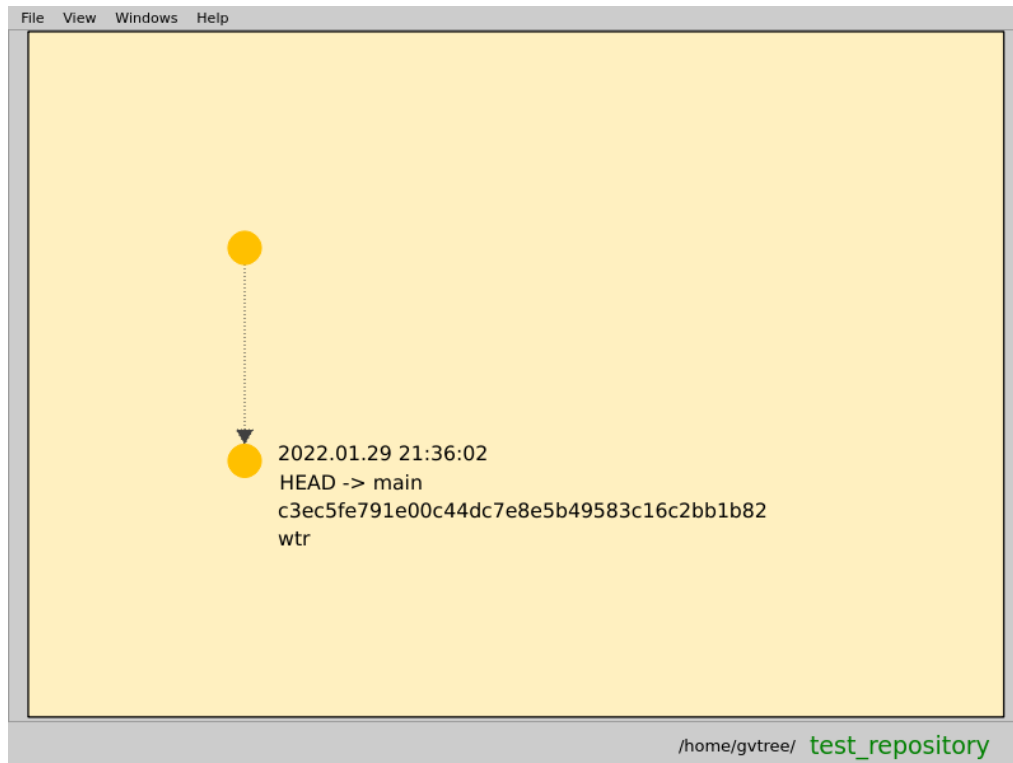
Now just run *gvtree* for the first time.

**`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 Files and Search Version.



*Figure 2: Windows menu*

The main window should look like this, then:

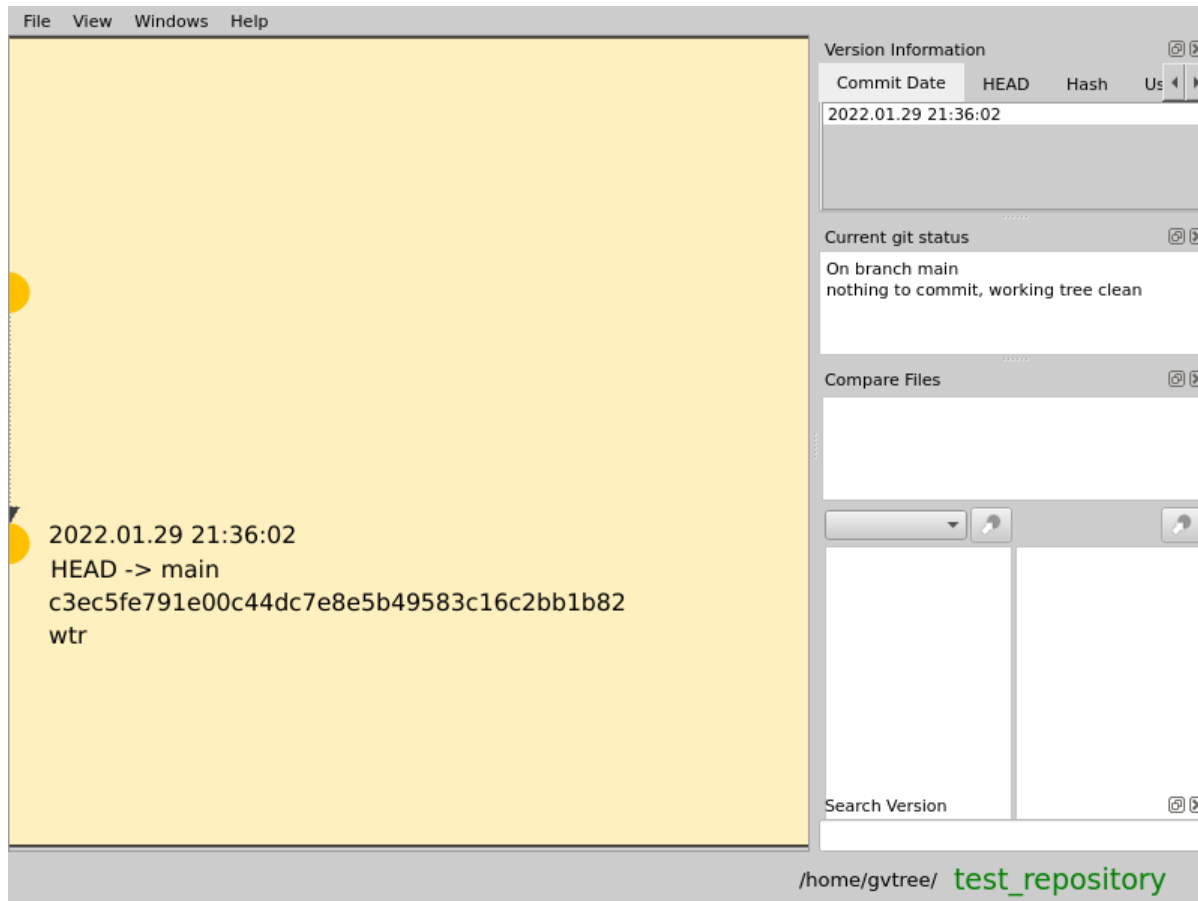


Figure 3: All dock widgets open.

- 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 tab widget with selection options for commit date, commit user, certain git tags and the git hash value.
  - The Current git status section just shows the output of **git status**.
  - The Compare Files section is filled as soon as versions are compared.
  - The last section is Search Version. With this widget, versions with matching tag, branch, hash, date or commit user information is highlighted and focused.

For the moment close all right dock widgets again.

Select the main view and press the key **1** to adjust the graph to fit into the viewport.

Now create a branch

**git branch branch1**

and check out this branch.

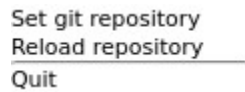
**git checkout branch1**

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

**git add README**

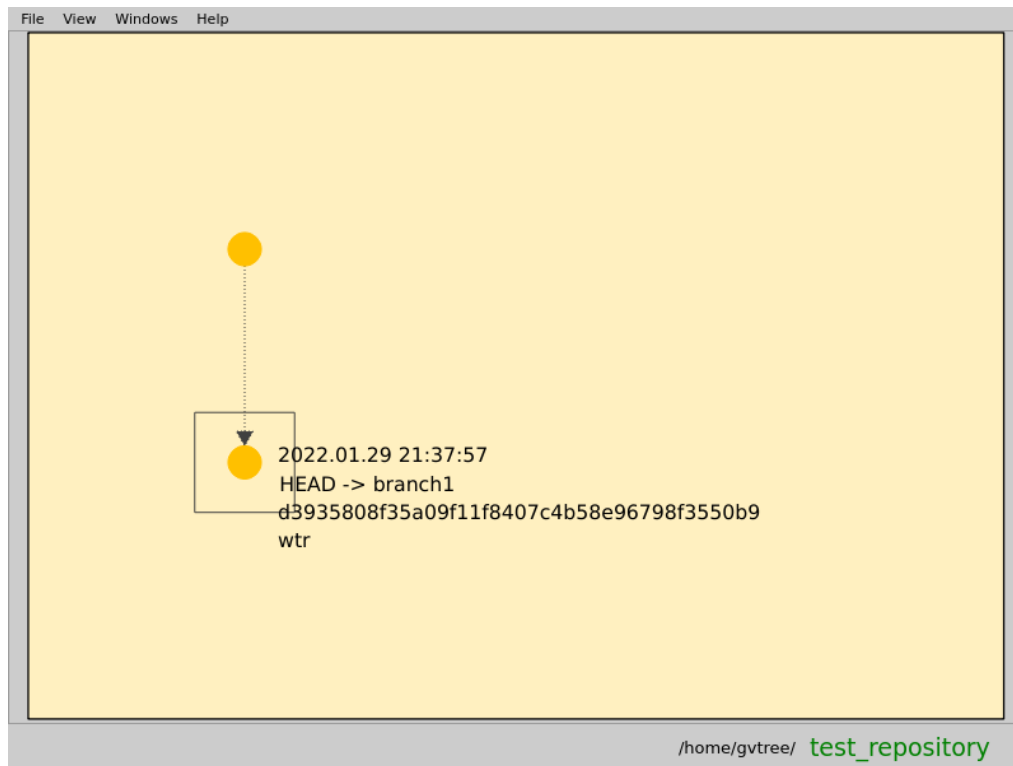
**git commit**

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



*Figure 4: File menu*

After the update the graph looks like this:



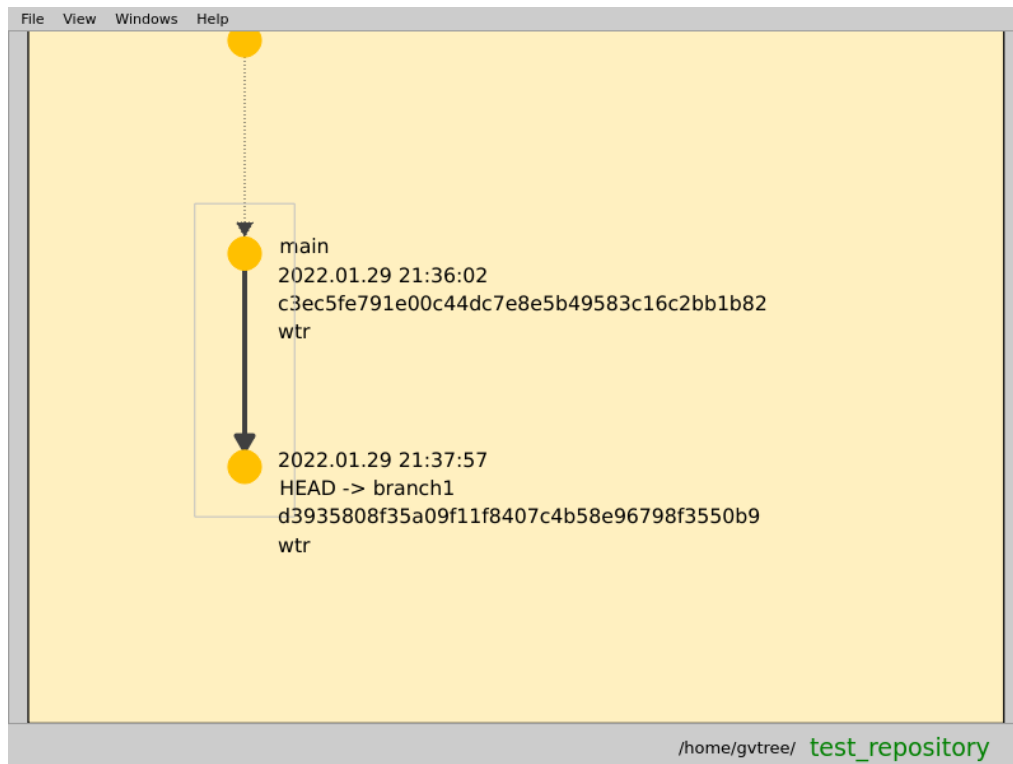
*Figure 5: Update after repository change*

**RMB** click in the box containing the version node and the following context menu will appear:

```
Fold/Unfold
Compare to selected
Compare to previous
View this version
Focus neighbours
```

*Figure 6: Version context menu*

Selecting Fold/Unfold will lead to this update:



*Figure 7: View after expanding a folder*

All versions without incoming merges or outgoing branches are folded automatically.

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.

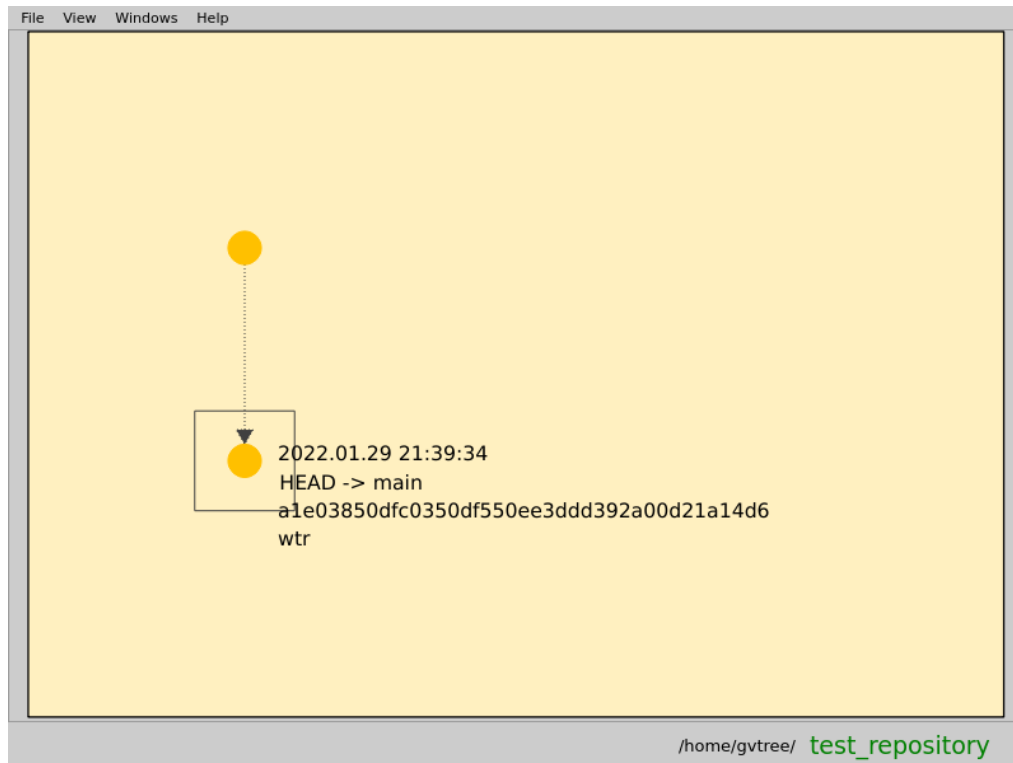


Figure 8: Changed branch back to main

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 Refresh 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 9: Reload repository button



After refresh, the graph should now look like this:

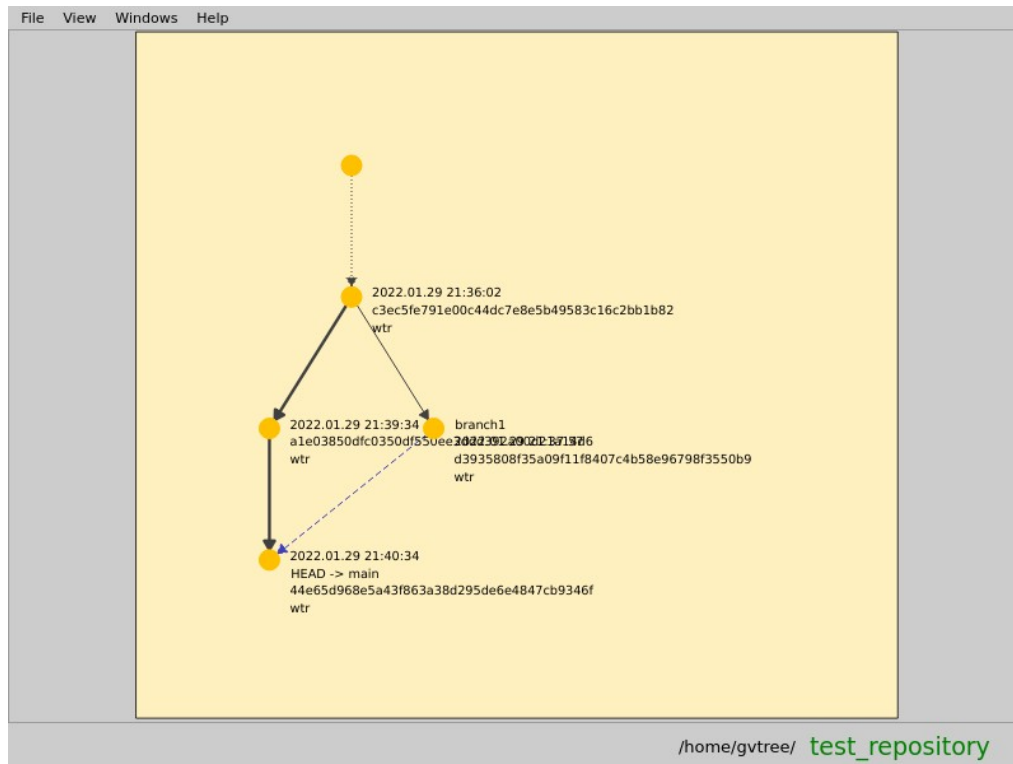


Figure 10: Version graph with merge

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.

Now improve the layout and hide the git hash value:

Open View menu and change the settings to:

- ✓ HEAD
  - ✓ Commit Date
  - User Name
  - Hash
  - ✓ Branch
  - ✓ Release Label
  - ✓ Baseline Label
  - ✓ FIX/PQT Label
  - ✓ HO Label
  - ✓ Other Tags
- 
- Fit in view

Figure 11: View menu

The hash and commit user information is not displayed anymore.

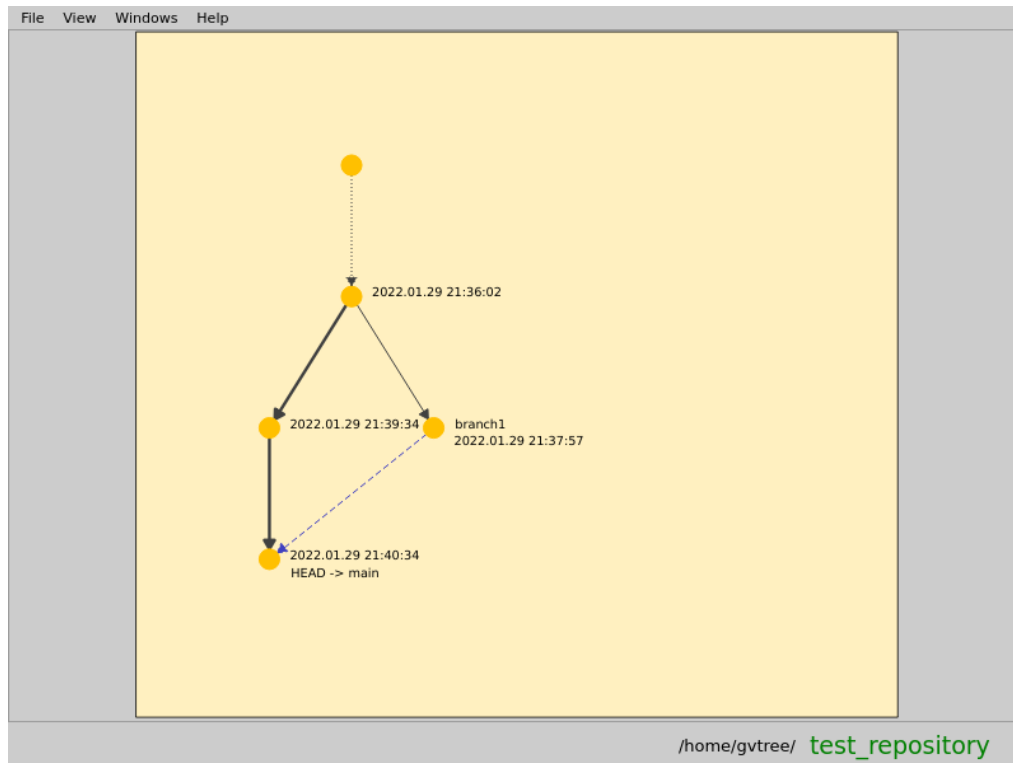


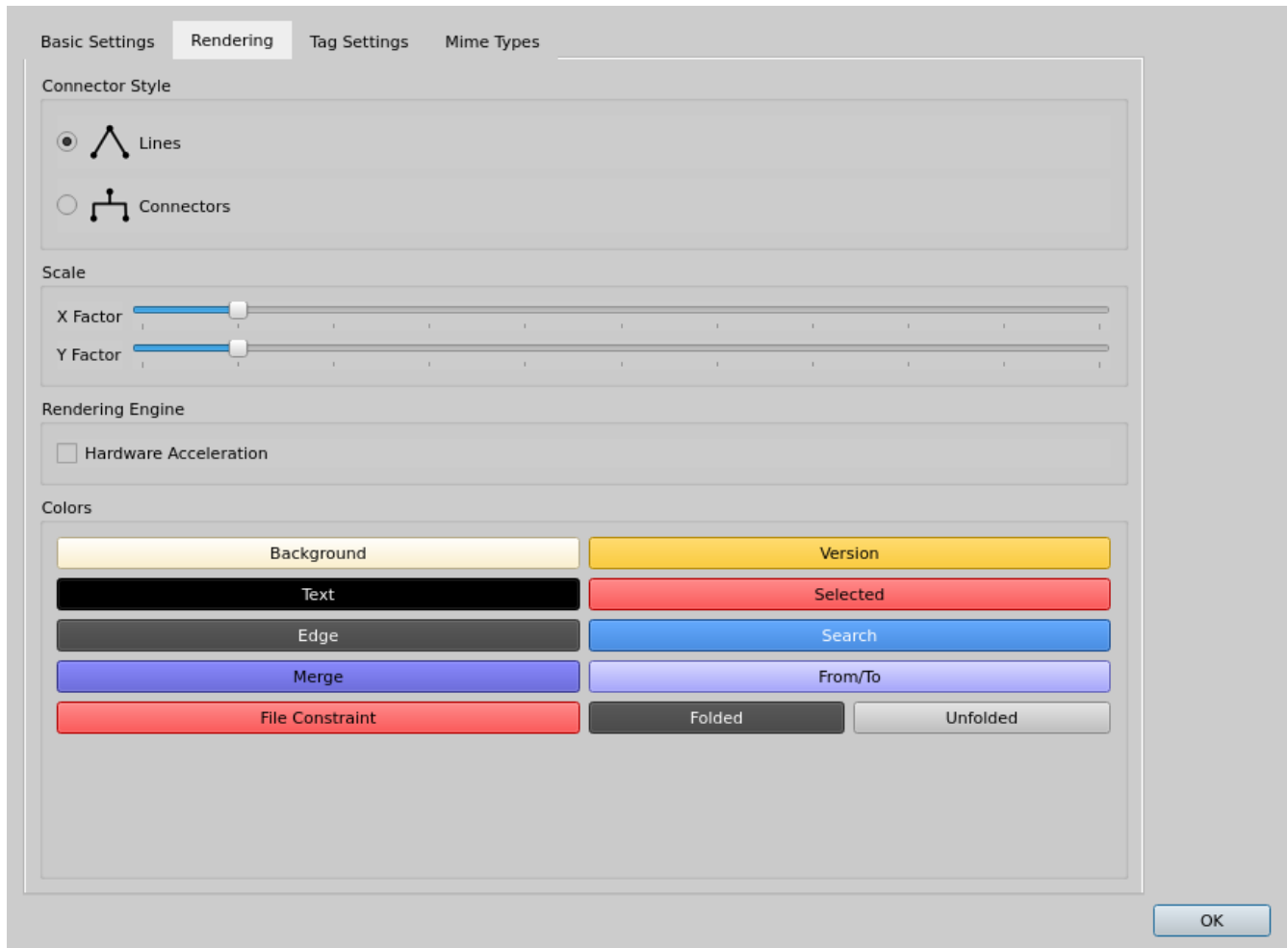
Figure 12: Hidden git hash values

The space between commit date and an other node is still very small. To correct this, open Windows menu and select Preferences.



Figure 13: Windows menu

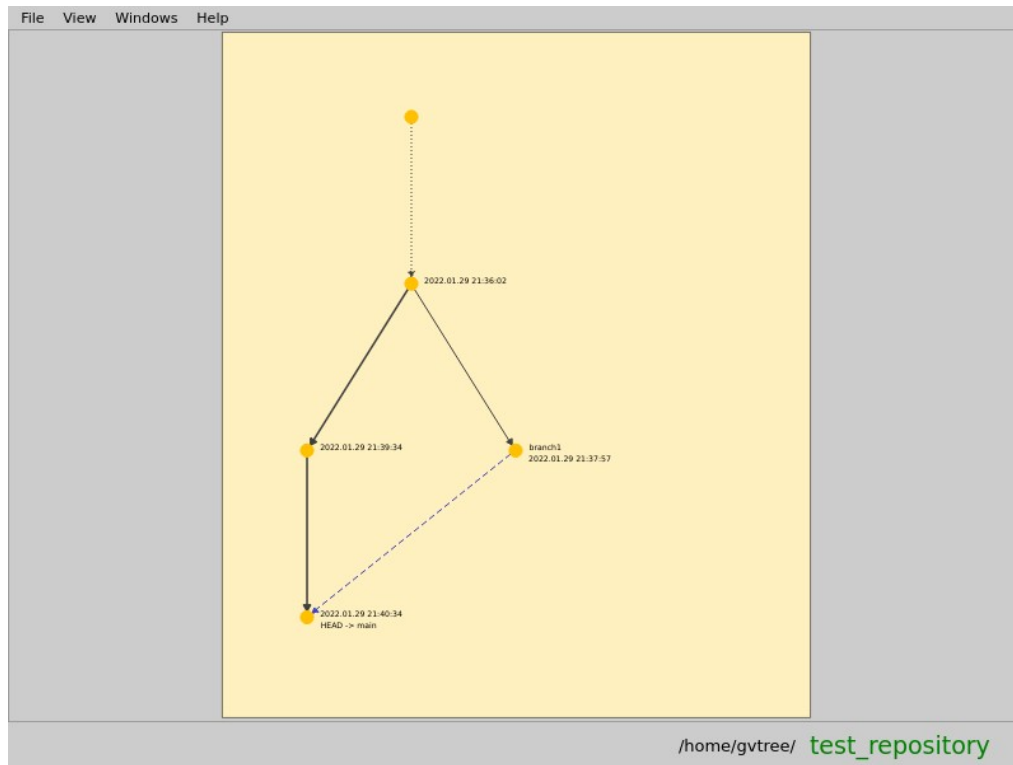
In the dialog select the tab Rendering.



*Figure 14: Preferences dialog, page Rendering*

Increase the value of the two sliders XFactor and YFactor, then press OK.  
To fit the whole graph into the screen, press key **1** in the main view again.

The result should look like this:



*Figure 15: Scaled view*

## Step 2 Compare Files

In the Windows menu, select the dock widget Compare Files. Detach the Compare Files dock from the main window.

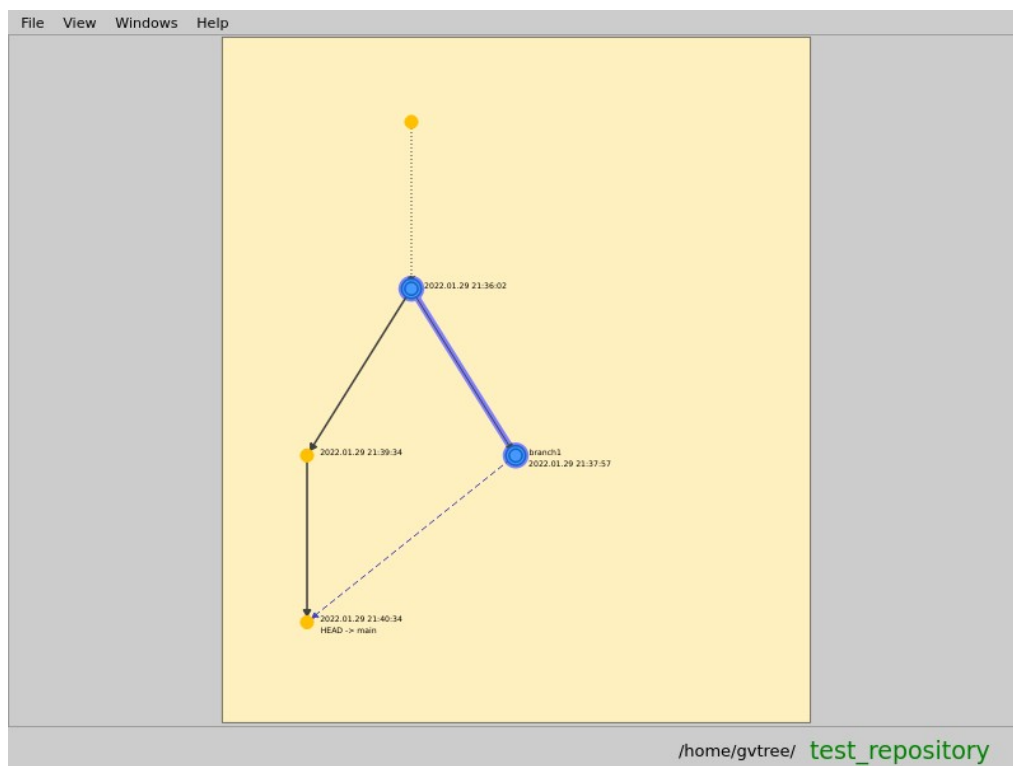
Now do a **RMB** click on the version node with the branch1 information.

Compare to previous  
Compare to local HEAD  
View this version  
Focus neighbours

*Figure 16: Context menu of a version node*

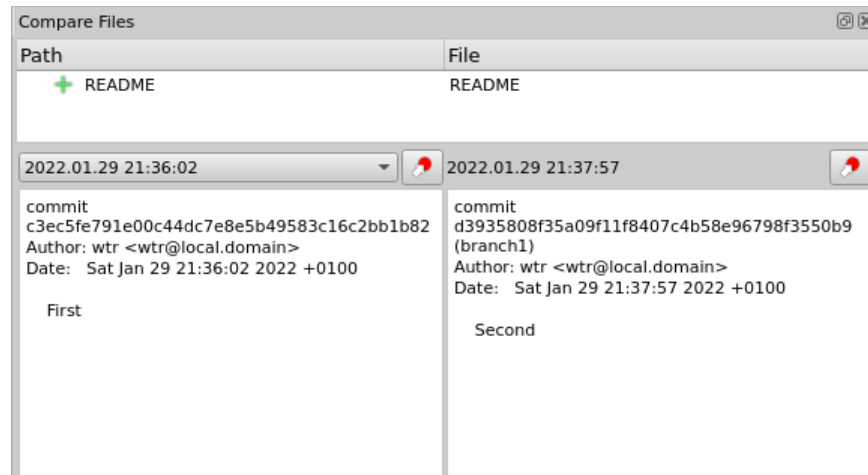
In the context menu select Compare to previous.

A markup cursor appears to identify the two versions which are compared.



*Figure 17: Compare versions markup*

The Compare Files dock should now look like this:



*Figure 18: Compare Files window*

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

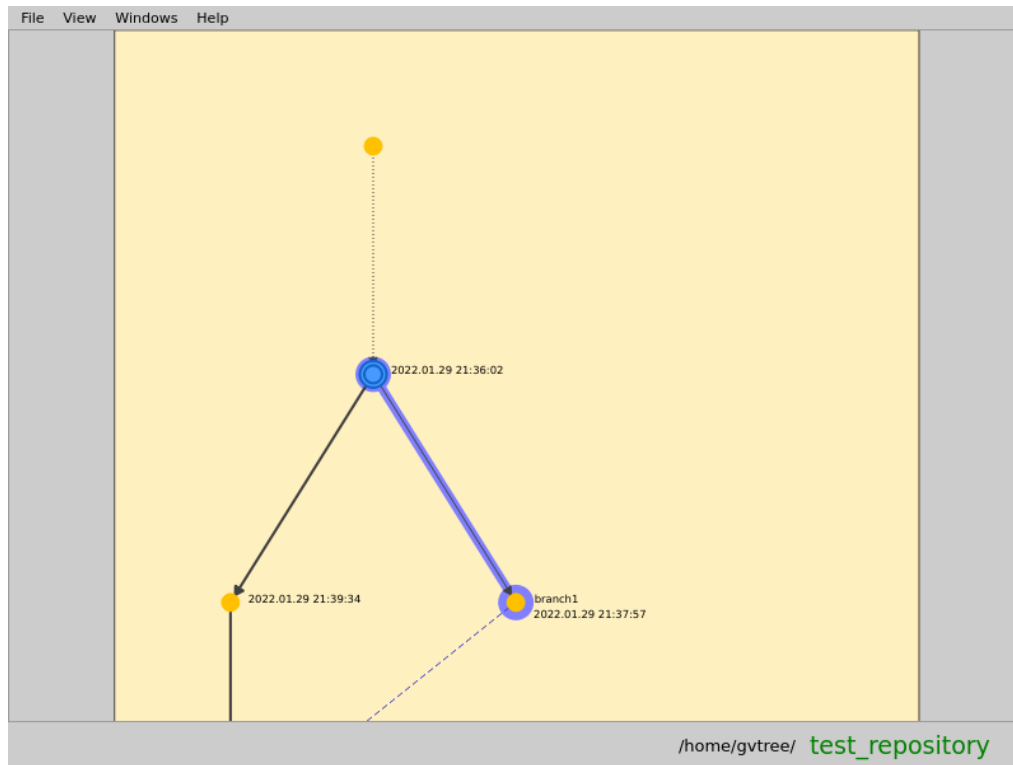
The left text browser below contains the commit information of the from-version, the right text browser contains the commit information of the to-version.

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



*Figure 19: Focus version*

It will look like this, then:



*Figure 20: Focused version*

Now do the same for the HEAD version.

This version has got two predecessors because of the merge.

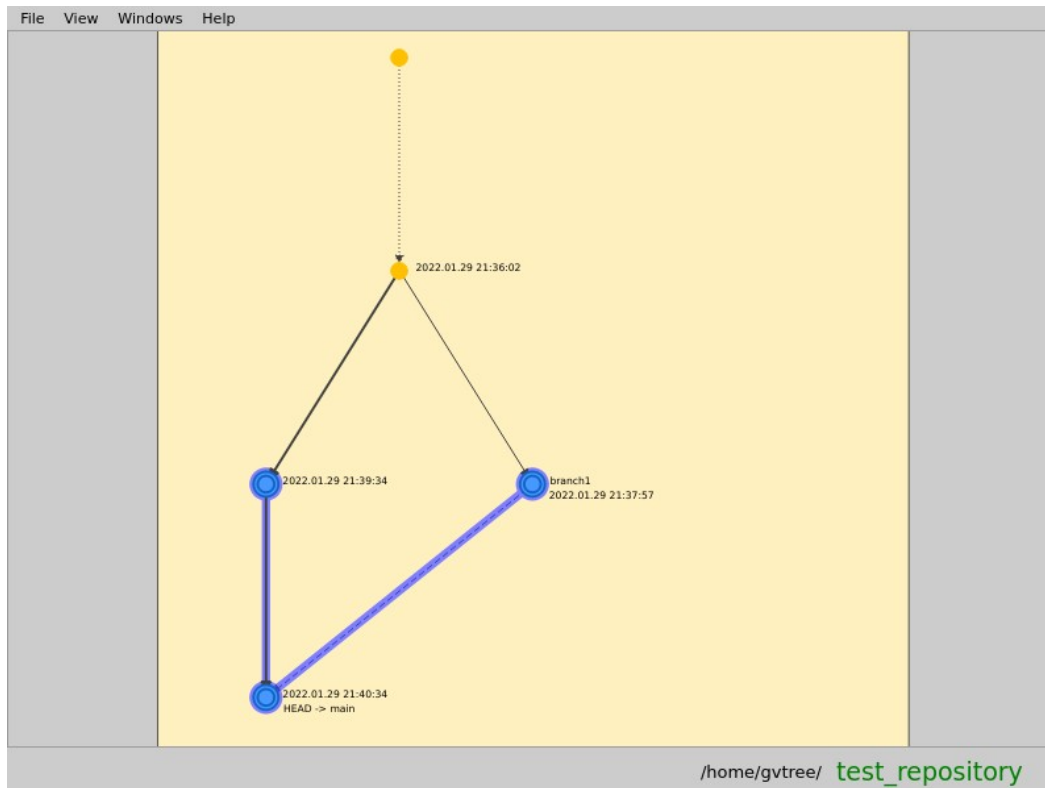


Figure 21: Compare to more than one predecessor





The Compare Files window has changed, too:



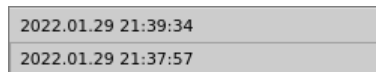
Figure 22: Updated Compare Files window

Now, the symbol in front of README is different.



	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 23: Combo box*

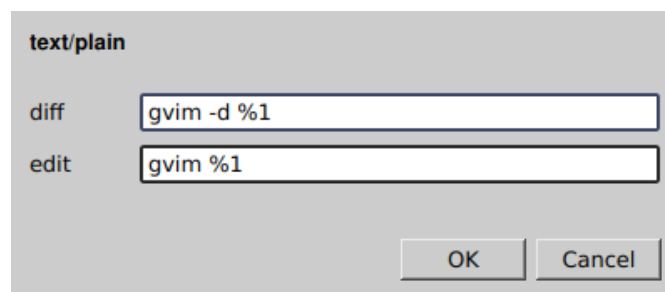
The displayed commit info will change accordingly. Pressing the focus version button will focus and markup the selected version.

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

Show version diff  
Edit current version  
Filter versions by file

*Figure 24: Context menu for a single file.*

Select Show version diff.



*Figure 25: 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.

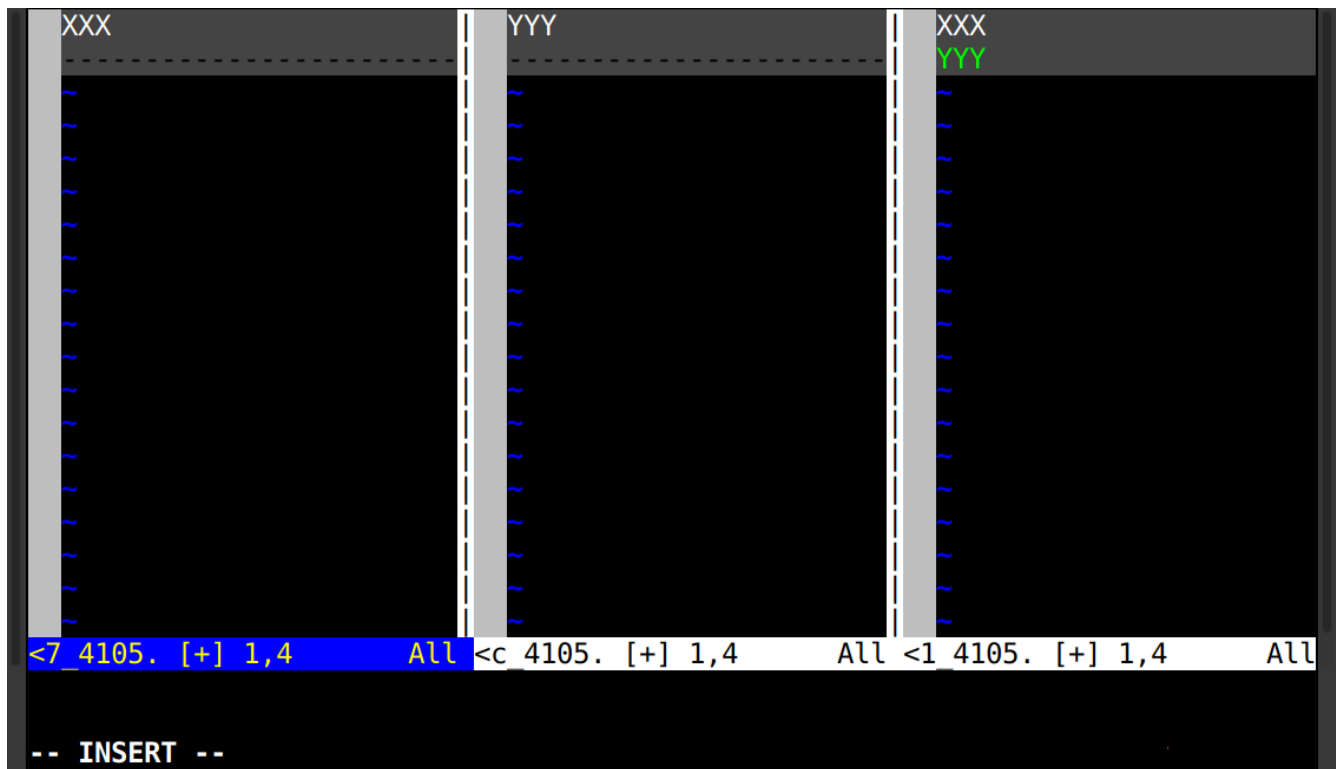


Figure 26: *gvim* as difftool with three columns.

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*.

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.

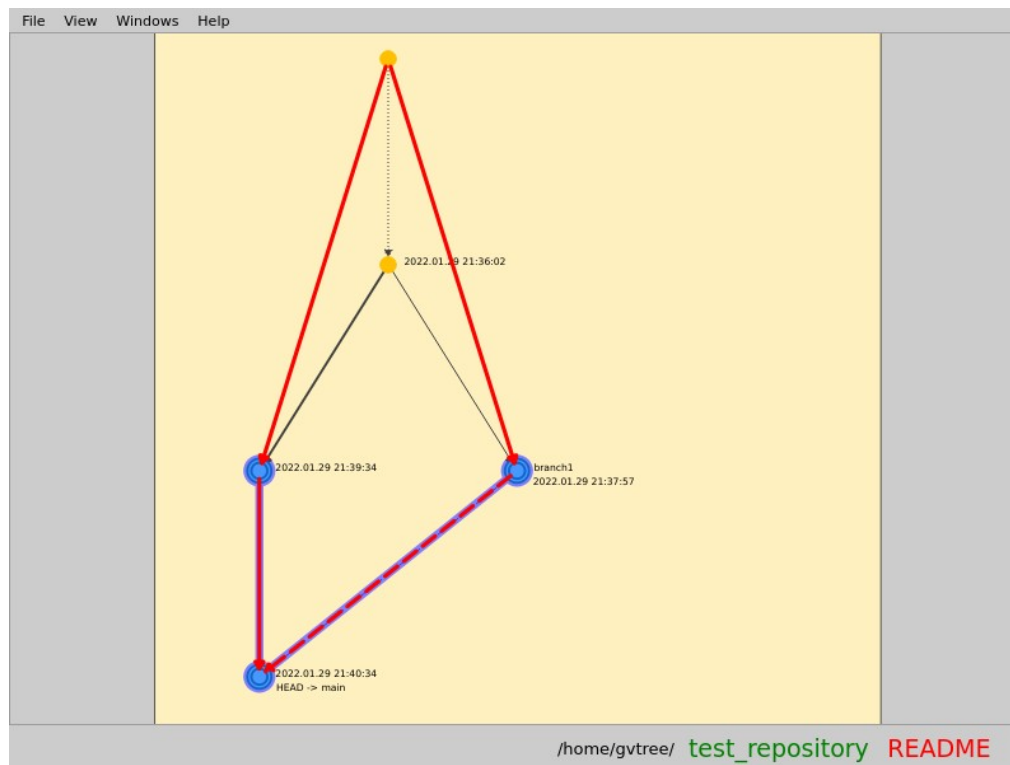


Figure 27: Version graph with file constraint

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.

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.

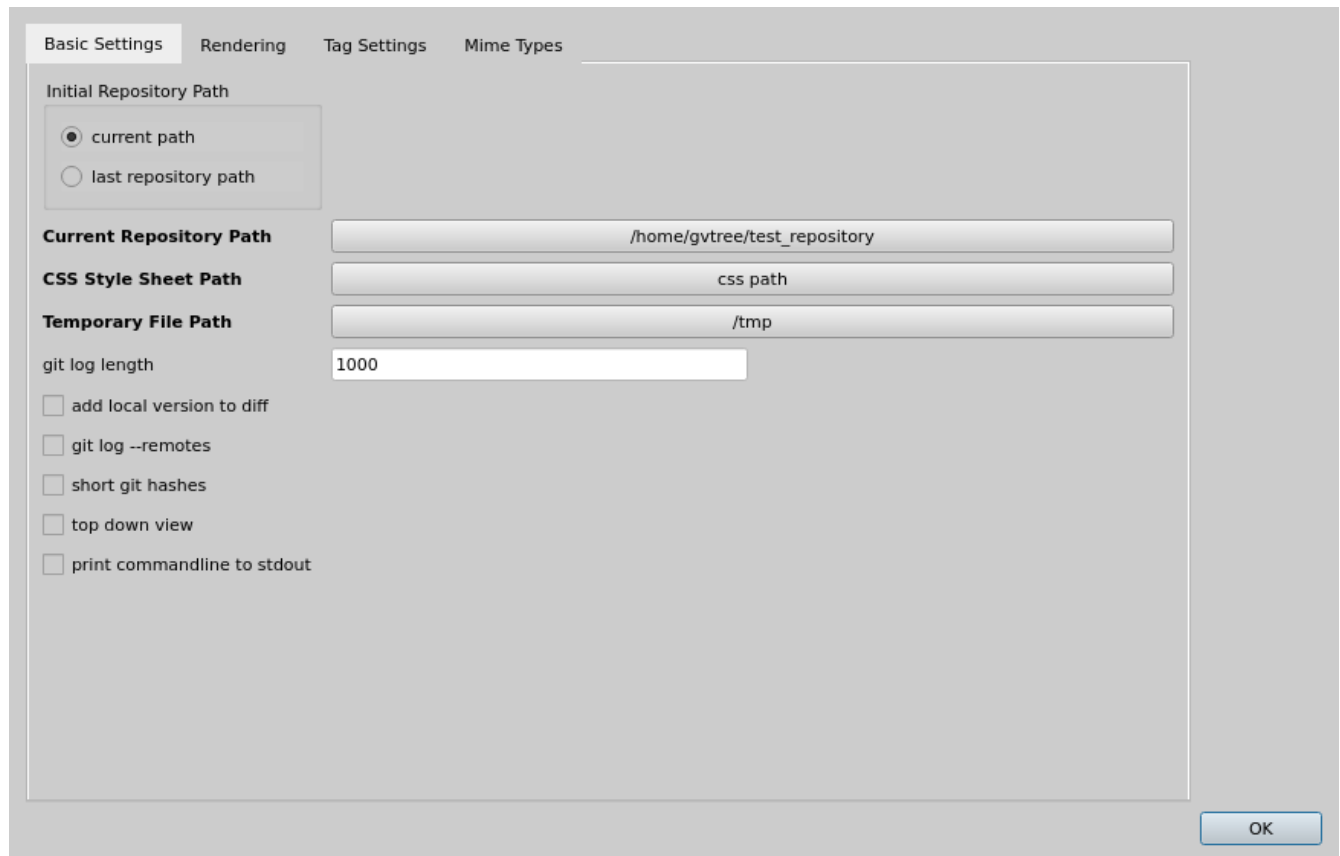
## Step 3 Preferences

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 Hardware Acceleration will try to use a `QGLWidget` for the graph view, if possible.

### Basic Settings



*Figure 28: Preferences Basic Settings*

## Tag Settings

Tag Name	Configuration	Pattern
HEAD	Courier,10,-1,5,50,0,0,0,0,0	(HEAD.*)
Commit Date	Courier,10,-1,5,50,0,0,0,0,0	([0-9]+)
User Name	Courier,10,-1,5,50,0,0,0,0,0	\[([0-9a-zA-Z ]*)\]
Hash	Courier,10,-1,5,50,0,0,0,0,0	([0-9a-f]+)
Branch	Courier,10,-1,5,50,0,0,0,0,0	^((?!.*tag: )b([V0-9a-zA-Z_]*)\b)\$
Release Label	Courier,10,-1,5,50,0,0,0,0,0	tag: \b(R[0-9.\-]+)\$
Baseline Label	Courier,10,-1,5,50,0,0,0,0,0	tag: \b(BASELINE_[0-9.\-]+)\$
FIX/PQT Label	Courier,10,-1,5,50,0,0,0,0,0	tag: \b((FIX_STR[0-9]+) (PQT_STR[0-9]+))\$
HO Label	Courier,10,-1,5,50,0,0,0,0,0	tag: \b(STR[0-9]+_HO[0-9]*)\$
Other Tags	Courier,10,-1,5,50,0,0,0,0,0	

Figure 29: Preferences Tag Settings

Here are patterns defined to extract special tag information. In this example, a Release Label looks like **R1.2-3-4** or similar. A baseline label e.g. **BASELINE\_1.2-3**. Other patterns are perhaps possible, but tricky.

**FIX**, **PQT** (preliminary quality test) and **HO** (handoff) are perhaps project or company specific and are related to a QA work flow.

At the moment it is not possible to add more patterns by config, but in the code it is simple to add more tags (look for `gridLayout->addTagPreference( . . . )`).

In the local repository, add a tag named **STR1234\_HO**.

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

Update the graph view.

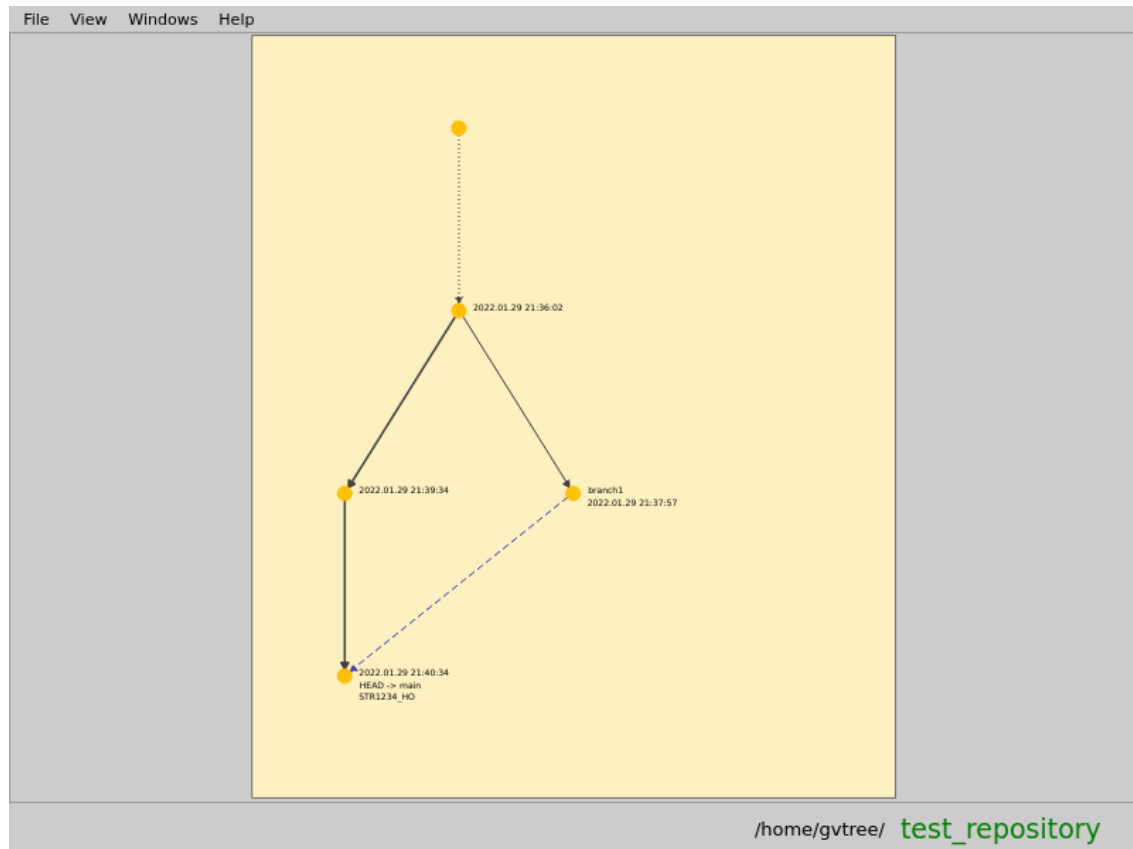
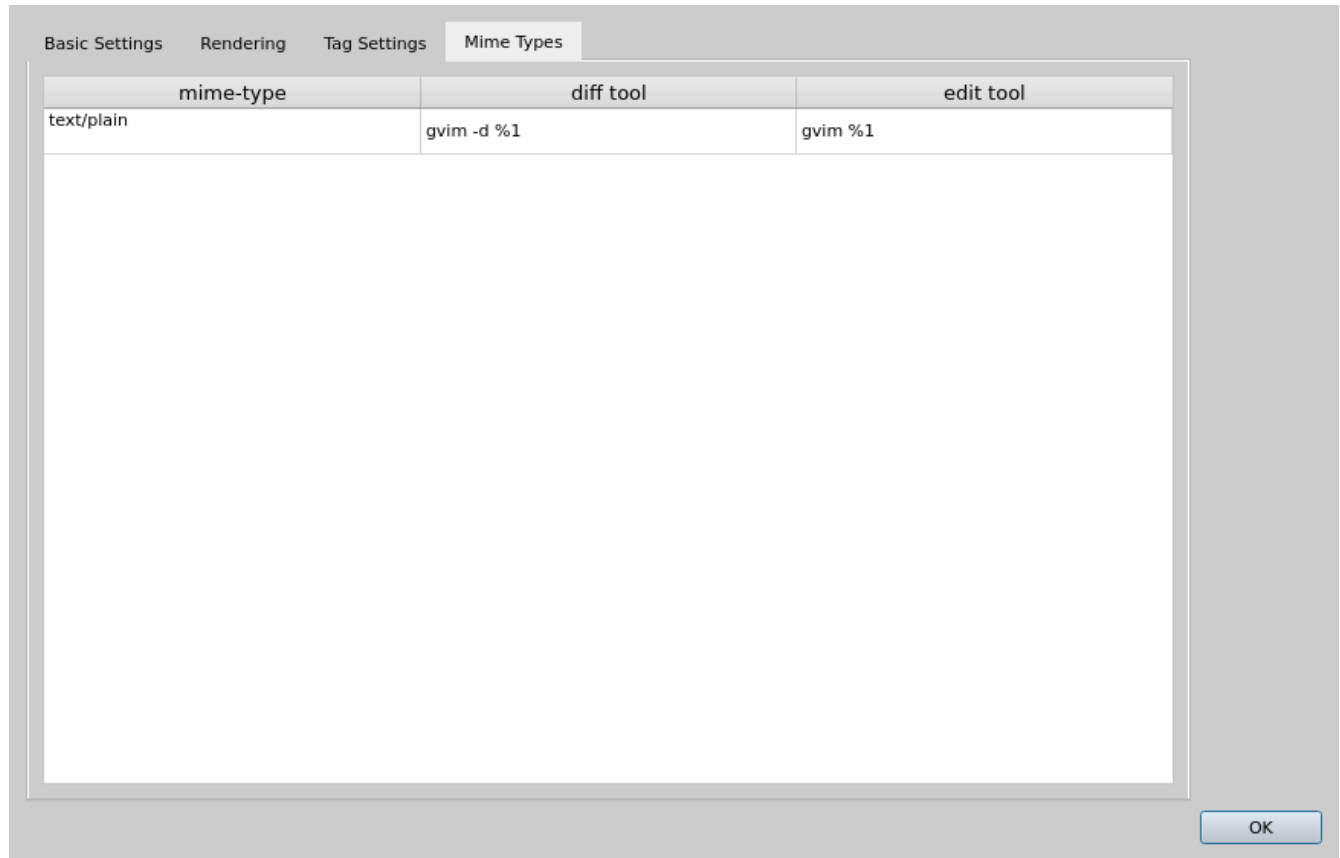


Figure 30: Handoff Tag

The visibility of the HO Label can be controlled with the View menu. Switch off HO Label.

## Mime Types



*Figure 31: 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-1.1-0.pdf).
- About shows a nice splash screen with the project icon.
- License contains the HTML copy of the GPL V3.0



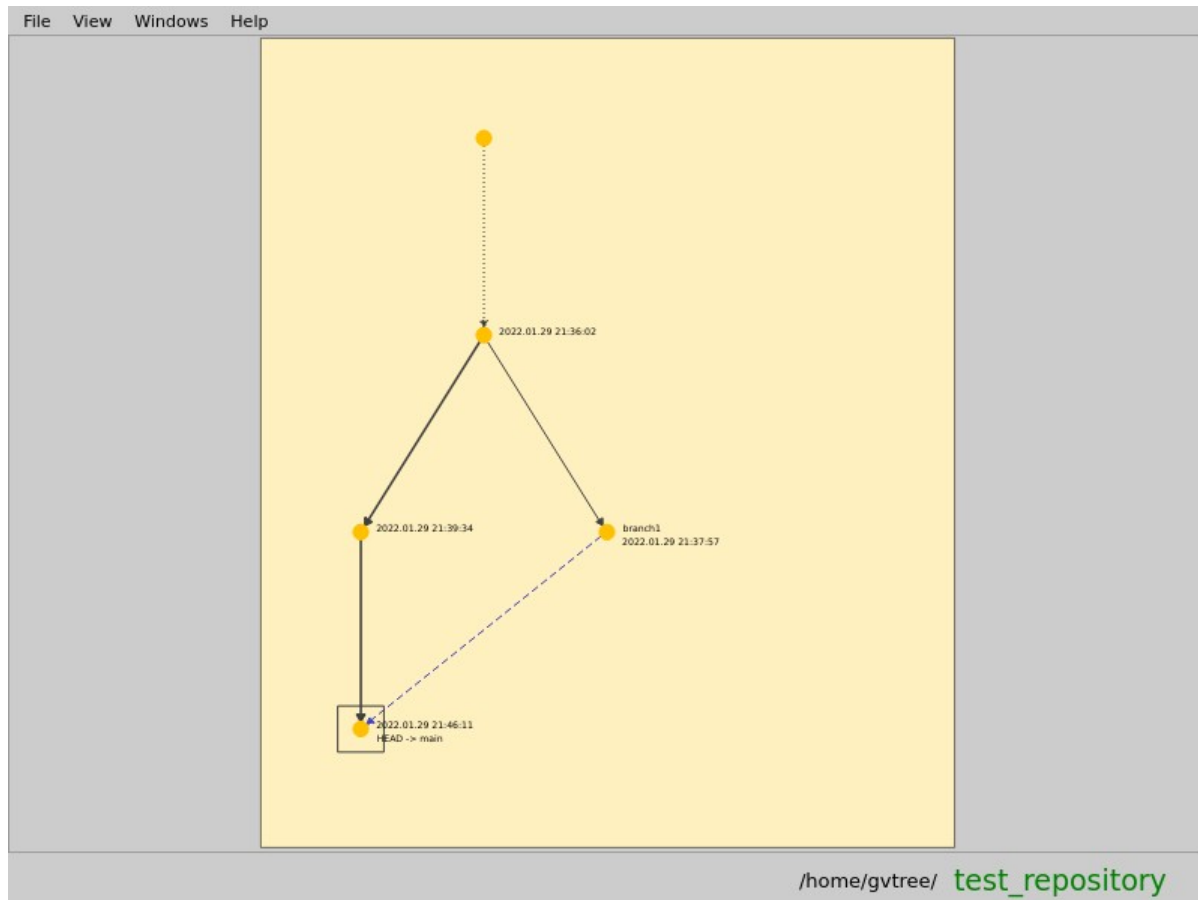
## Step 5 Folder

Now just add a file TODO to the repository.

**git add TODO**

**git commit**

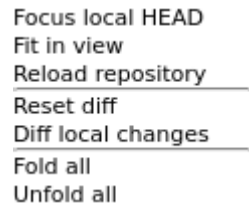
Refresh the graph view.



*Figure 32: Folded version*

The folder box now contains two versions. If there is no branch or merge, versions are folded and only the last version node of the folder is displayed.

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



- Focus local HEAD
- Fit in view
- Reload repository
- Reset diff
- Diff local changes
- Fold all
- Unfold all

*Figure 33: 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:

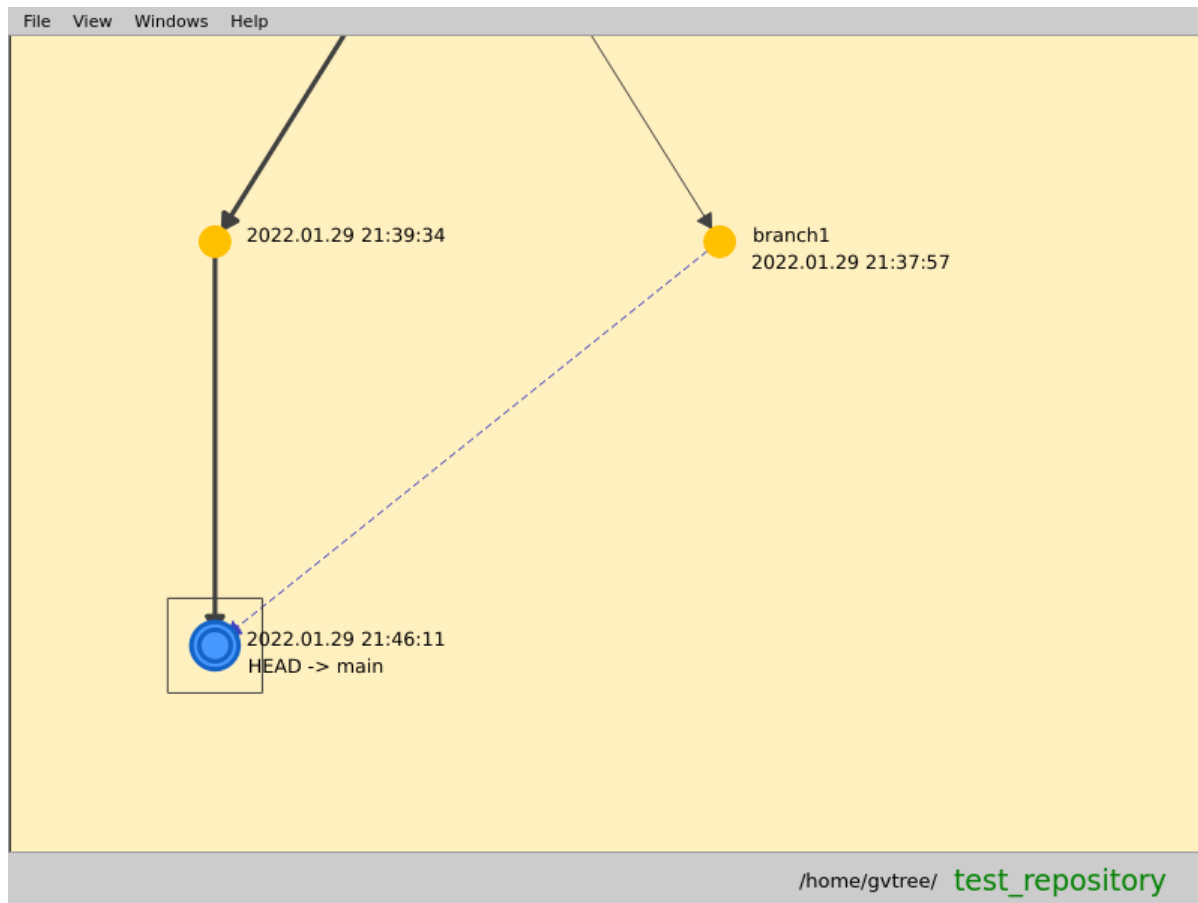


Figure 34: Focus HEAD version

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.

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.

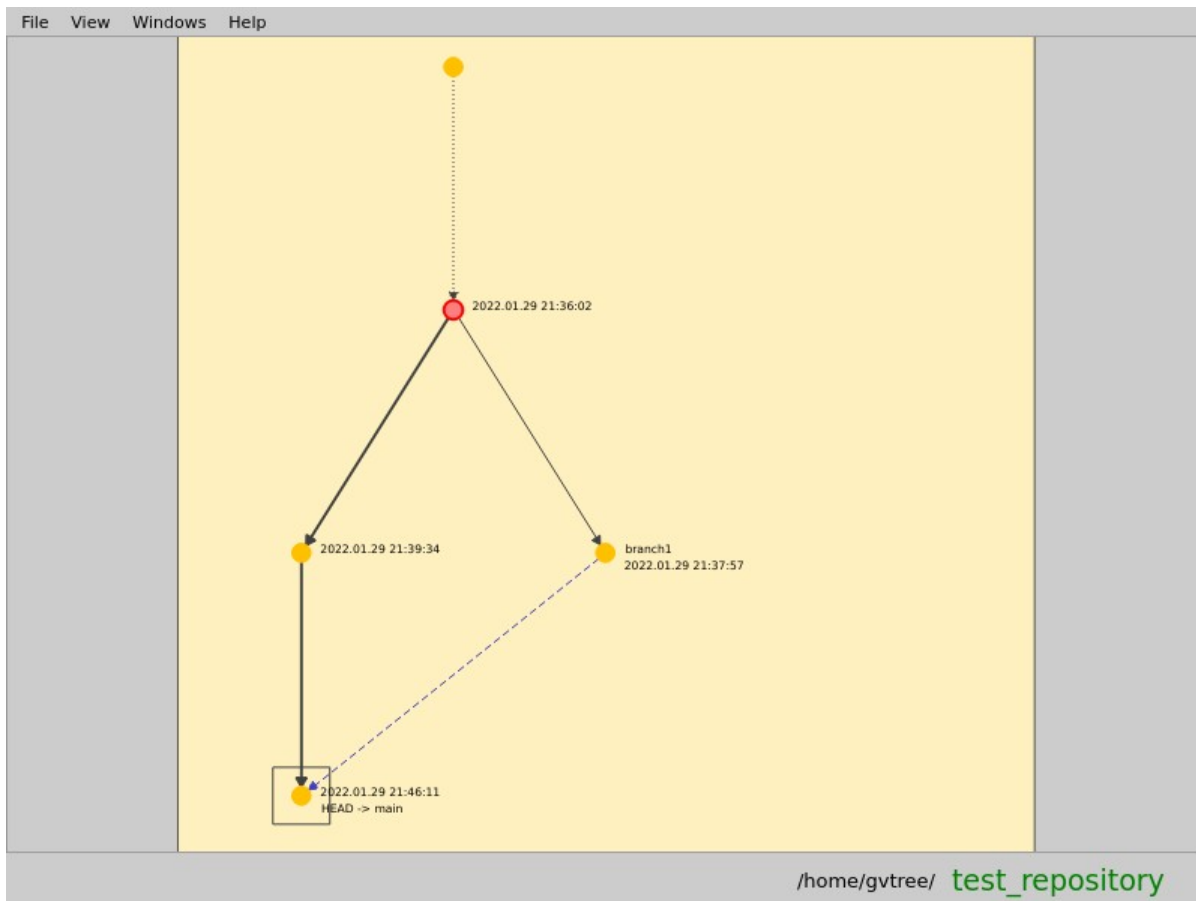


Figure 35: LMB version selection

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

```
Compare to selected
Compare to previous
Compare to local HEAD
View this version
Focus neighbours
```

Figure 36: Compare context menu when a version is selected.

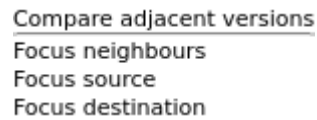
The option Compare to selected is displayed. In this case Compare to previous would have the same effect, but in a larger tree it is possible to compare more distant versions.

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

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

## Step 7 Context menu of edges

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

A screenshot of a context menu for a graph edge. The menu is a vertical list of four items: 'Compare adjacent versions' (which is underlined), 'Focus neighbours', 'Focus source', and 'Focus destination'.

- Compare adjacent versions
- Focus neighbours
- Focus source
- Focus destination

*Figure 37: 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.

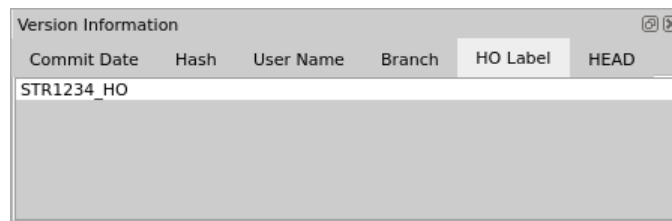


The screenshot shows a dock window titled "Version Information" with a close button in the top right corner. It contains a table with six columns: Commit Date, Hash, User Name, Branch, HO Label, and HEAD. The Commit Date column is selected, and it displays five entries, all with the date 2022.01.29 and various times.

Commit Date	Hash	User Name	Branch	HO Label	HEAD
2022.01.29 21:46:11					
2022.01.29 21:40:34					
2022.01.29 21:39:34					
2022.01.29 21:37:57					
2022.01.29 21:36:02					

Figure 38: Version Information dock widget page Commit Date

The tabs Commit Date, Hash, User Name and HEAD should always be present. Change to the tab HO Label.



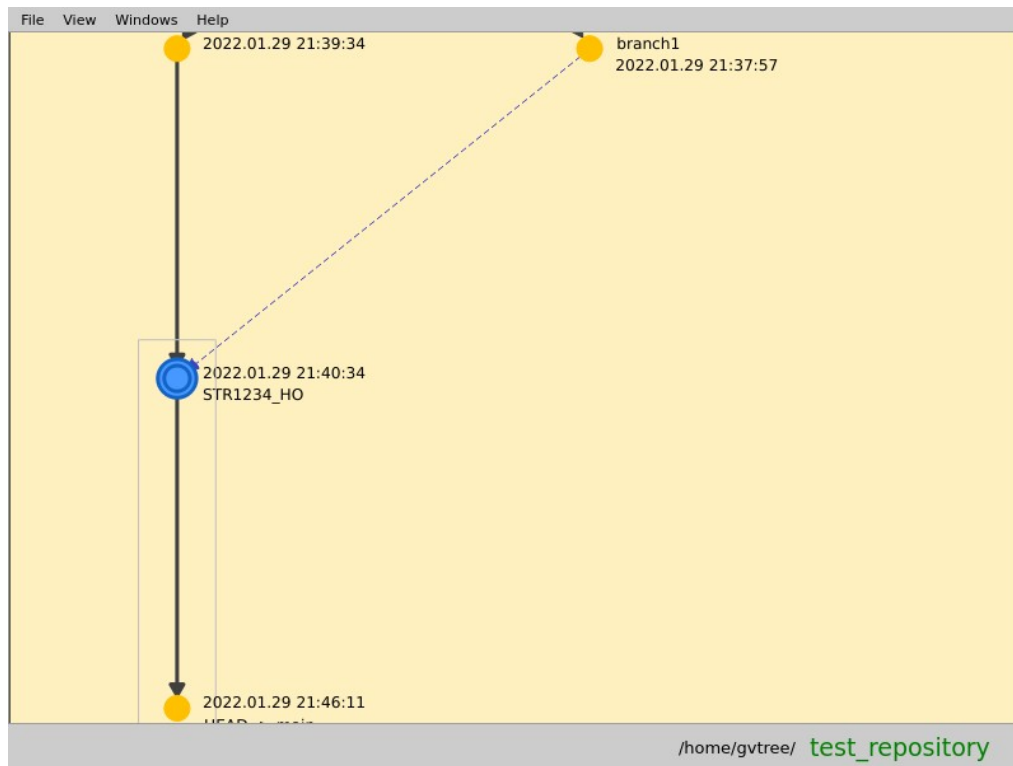
The screenshot shows the same "Version Information" dock window, but now the "HO Label" tab is selected. The table displays a single entry, "STR1234\_HO", in the HO Label column. The other columns are empty.

Commit Date	Hash	User Name	Branch	HO Label	HEAD
				STR1234_HO	

Figure 39: Version Information dock widget page HO Label

Do a **LMB** click on the entry STR1234\_HO.

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 40: Search by Version Information widget.*

## Step 9 Search dialog

In the View menu, hide all tag, branch, hash and commit date information.

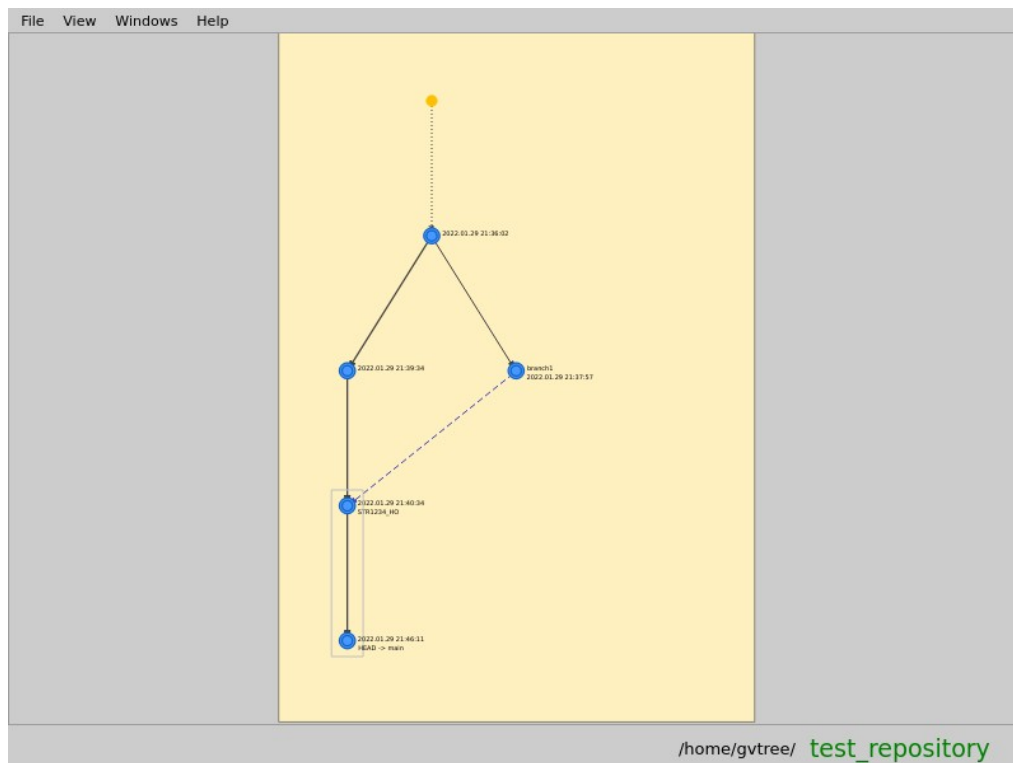
Now open the Search dock widget.

Now enter the year in the search widget. In this example 2021. Expressions with less than 3 characters are ignored. Regular expressions are allowed.



*Figure 41: Simple search dialog.*

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



*Figure 42: All matches for the search pattern 2022*

All matching nodes are visible. The tag information matching is displayed automatically.



# Appendix A License

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Version 3, 29 June 2007

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