

# gvtree

a git version tree browser

Version 1.2-0

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2021



## 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
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

## 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-1.2-0.tar.gz
```

Change to the folder gvtree-1.2-0

```
cd gvtree-1.2-0
```

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-1.2-0

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 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 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`**

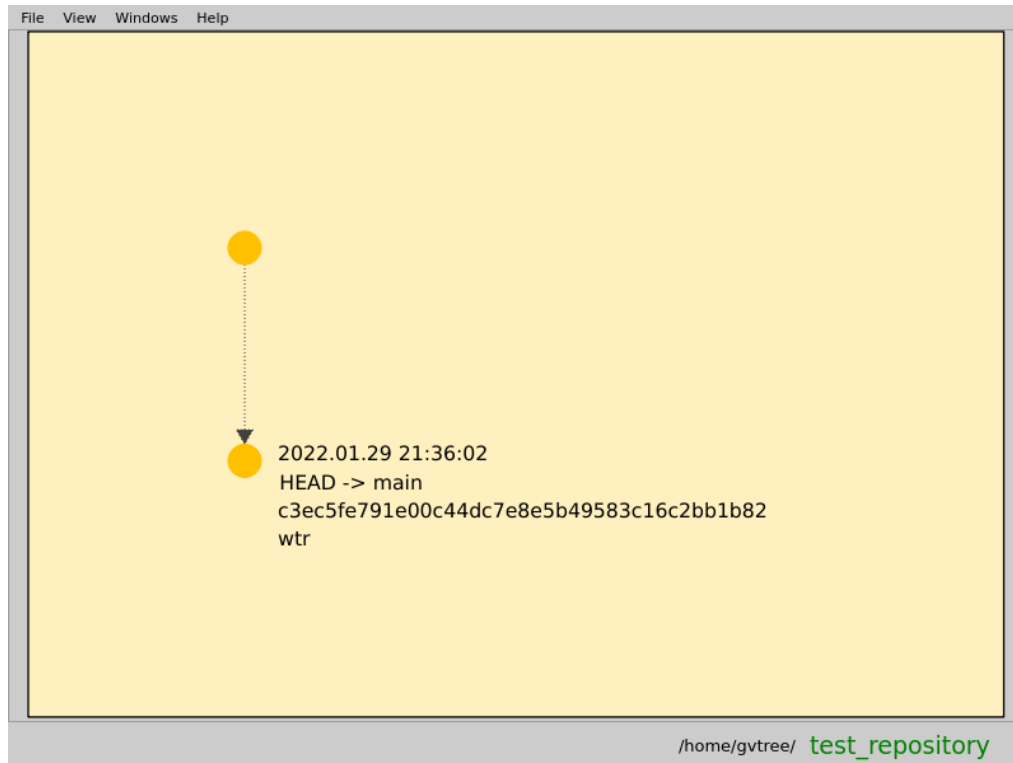
Now just run *gvtree* for the first time.

**`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, Search Version and Branch List.

- Preferences
- 
- ✓ Version Information
  - ✓ Current git status
  - ✓ Compare Files
  - ✓ Search Version
  - ✓ Branch List

*Figure 2: Windows menu*

The main window should look like this, then:

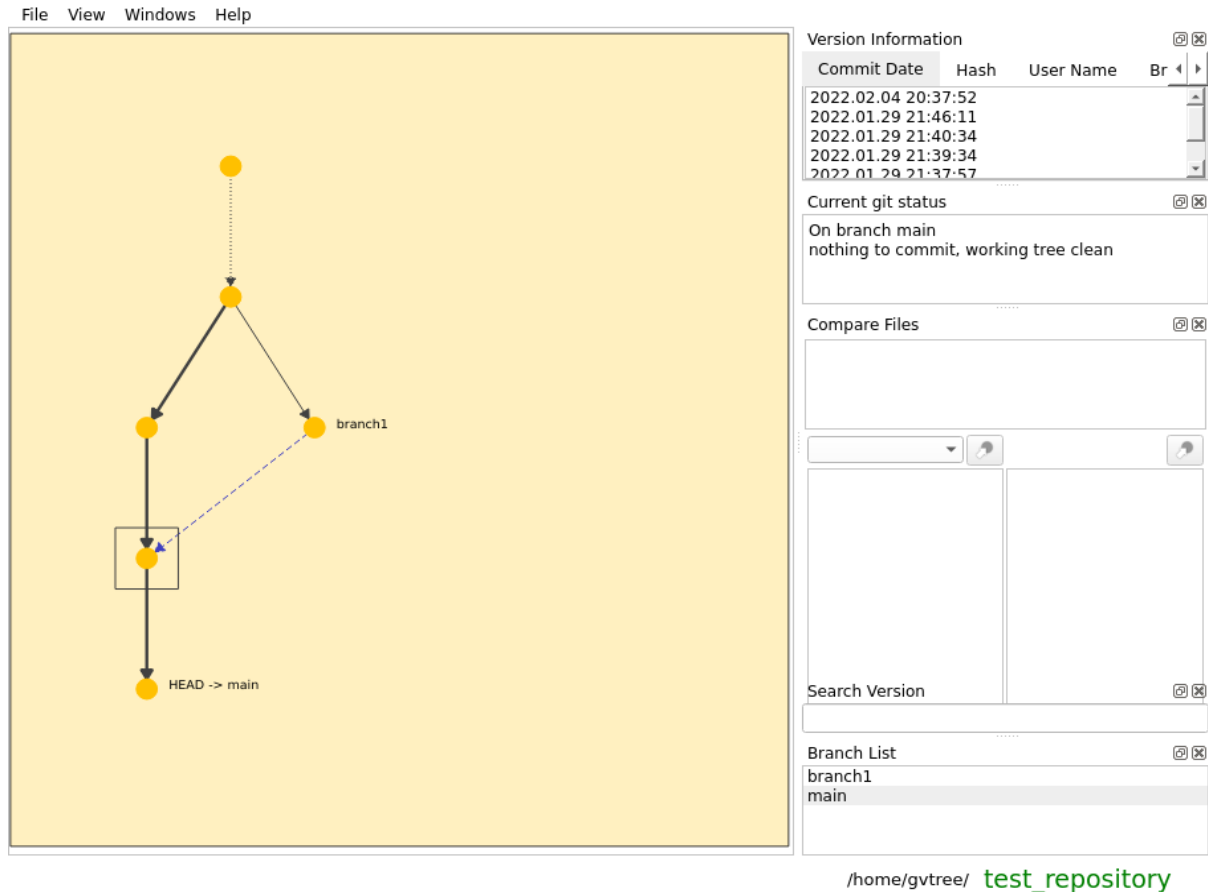


Figure 3: All dock widgets open.

- 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 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 section is Search Version. With this widget, versions with matching tag, branch, hash, date or commit user information is highlighted and focused.
  - 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	<b>1</b>	
Focus HEAD version	<b>h</b>	
Zoom in	<b>+</b>	Wheel up
Zoom out	<b>-</b>	Wheel down
Pan	<b>wasd</b>	<b>MMB</b> + Move
Pan	<b>STRG</b>	<b>LMB</b> + Move
Select version		<b>LMB</b>
Context menu		<b>RMB</b>

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**

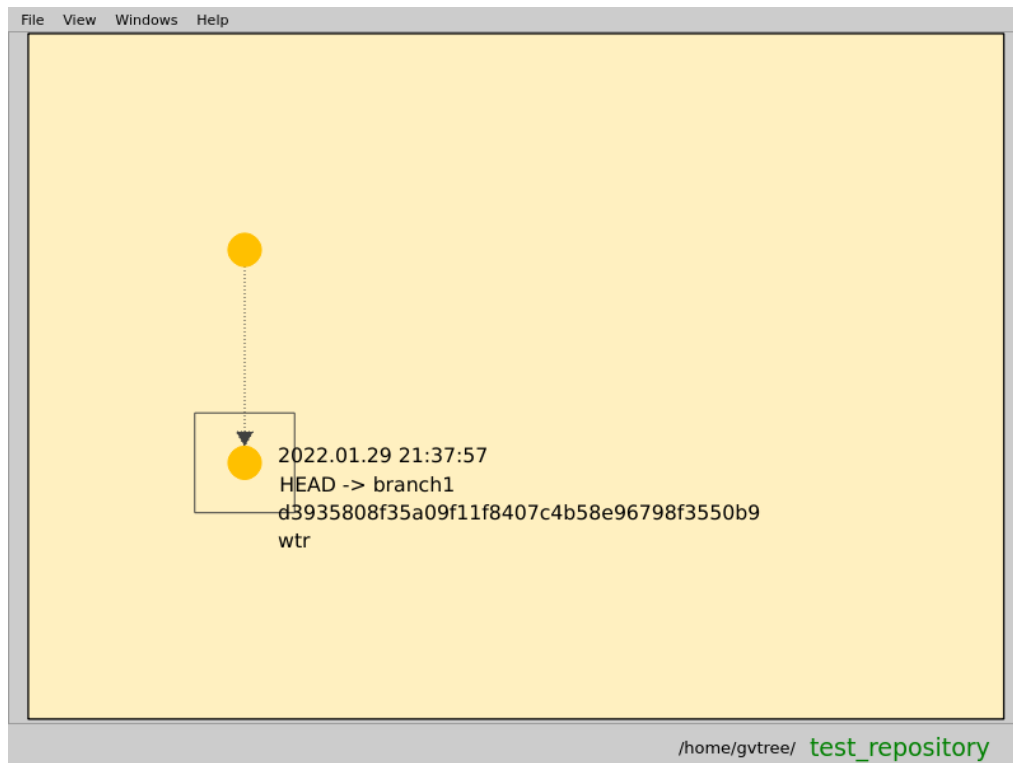
**git commit**

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

Set git repository  
Reload repository  
Quit

*Figure 4: File menu*

After the update the graph looks like this:



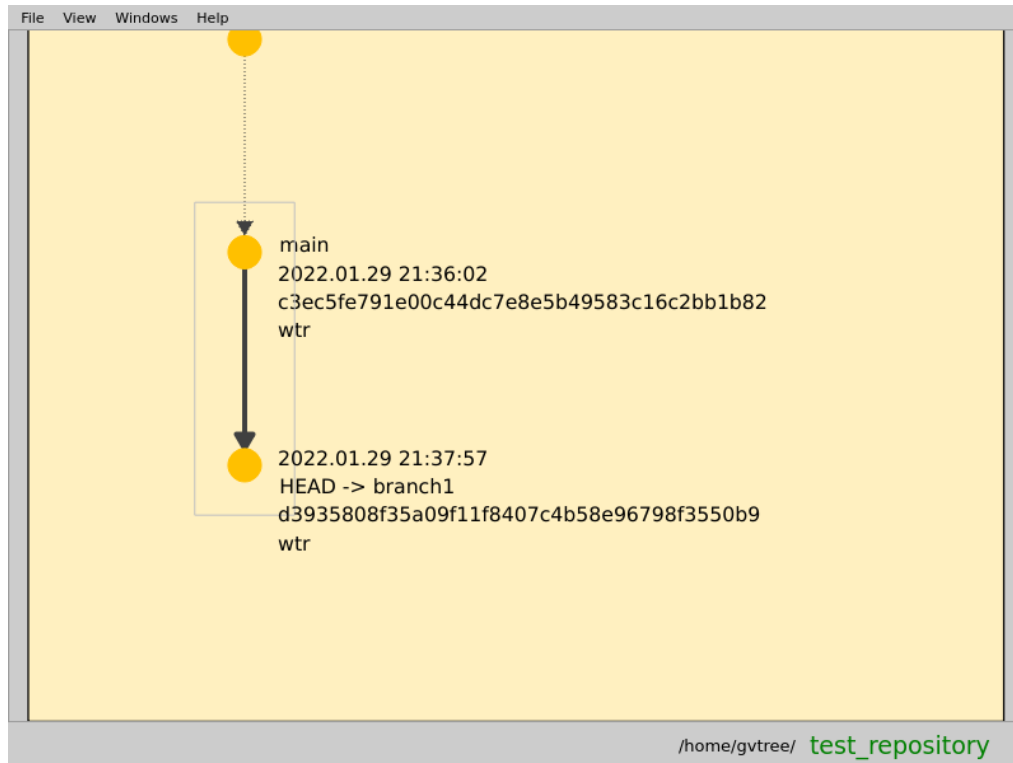
*Figure 5: Update after repository change*

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

Fold/Unfold  
Compare to previous  
Compare to local HEAD  
Compare to branch baseline  
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.

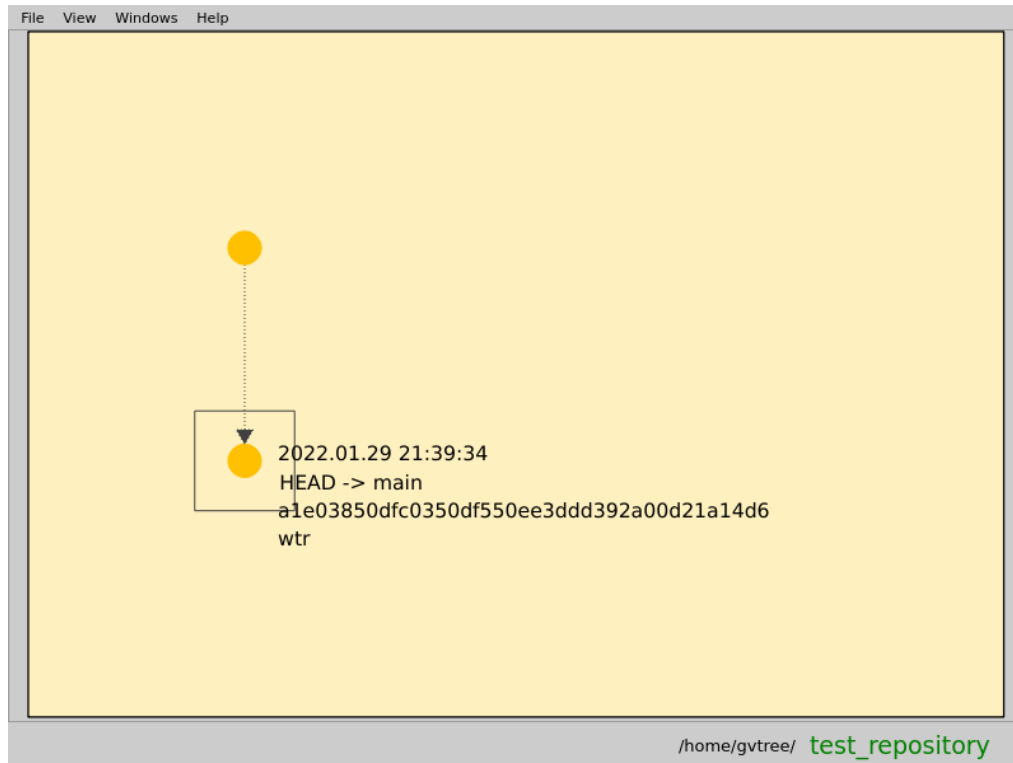


Figure 8: Changed branch back to main

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 the refresh, the graph should now look like this:

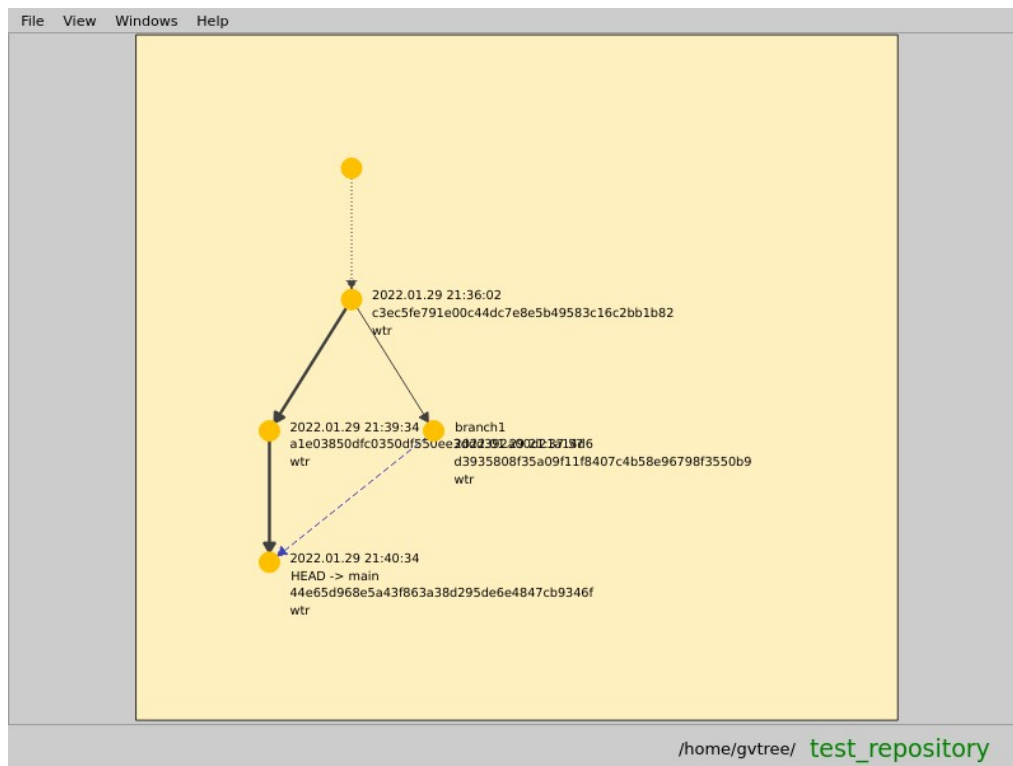


Figure 10: Version graph with merge

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.

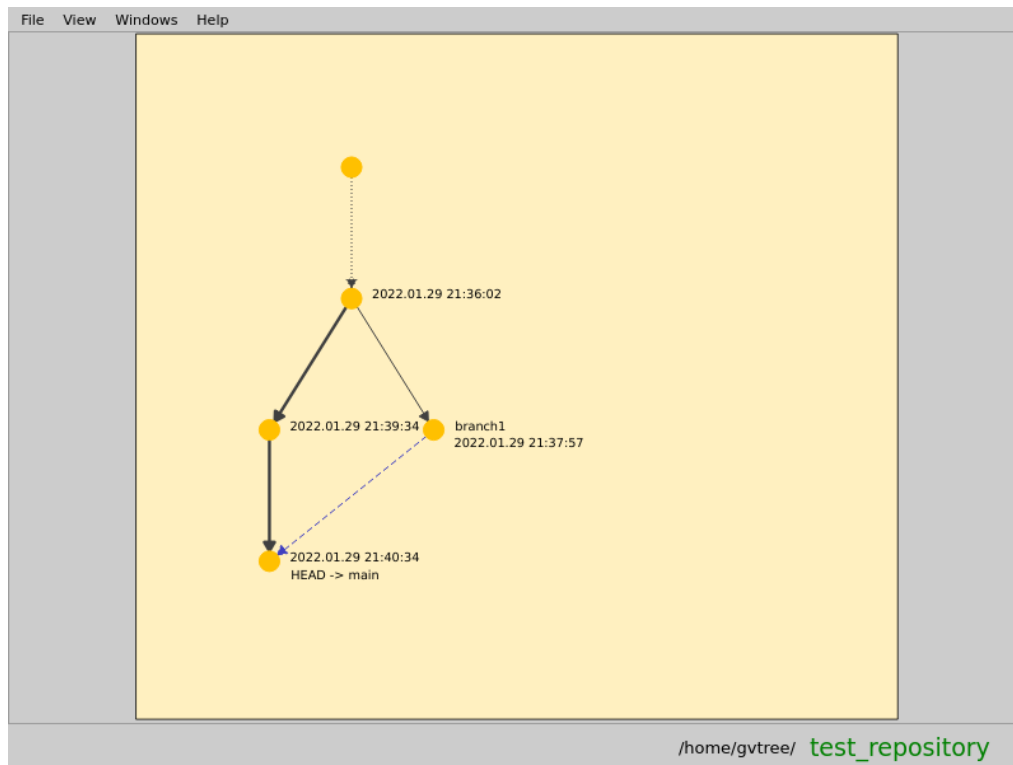
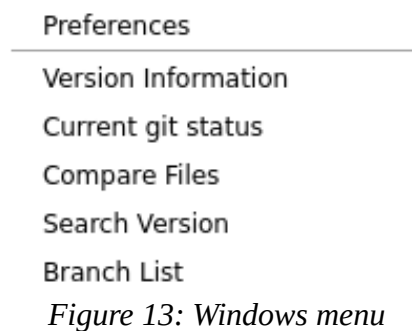
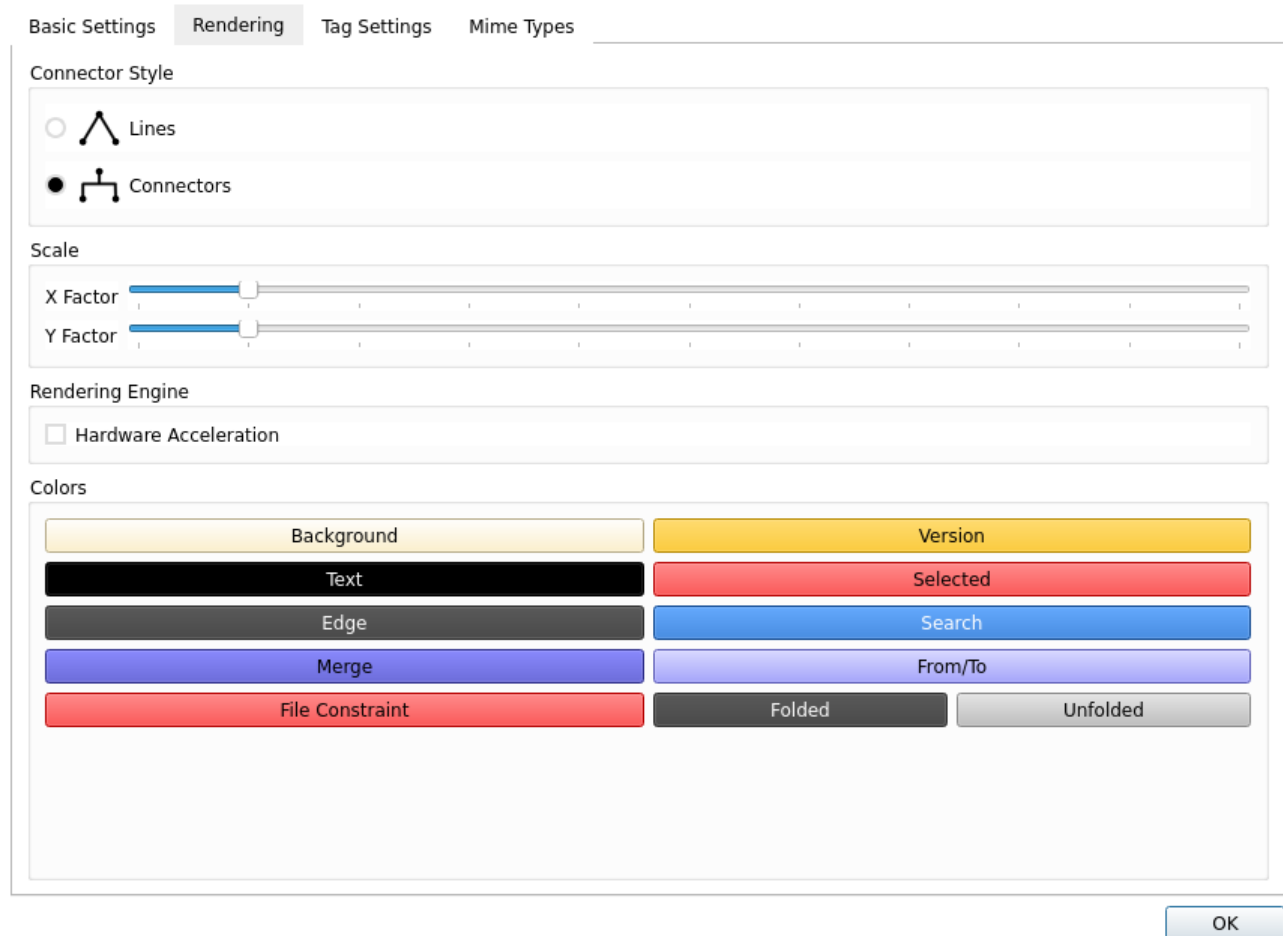


Figure 12: Hidden git hash values

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



In the dialog select the tab Rendering.



*Figure 14: Preferences dialog, page Rendering*

Increase the value of the two sliders X Factor and Y Factor, 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:

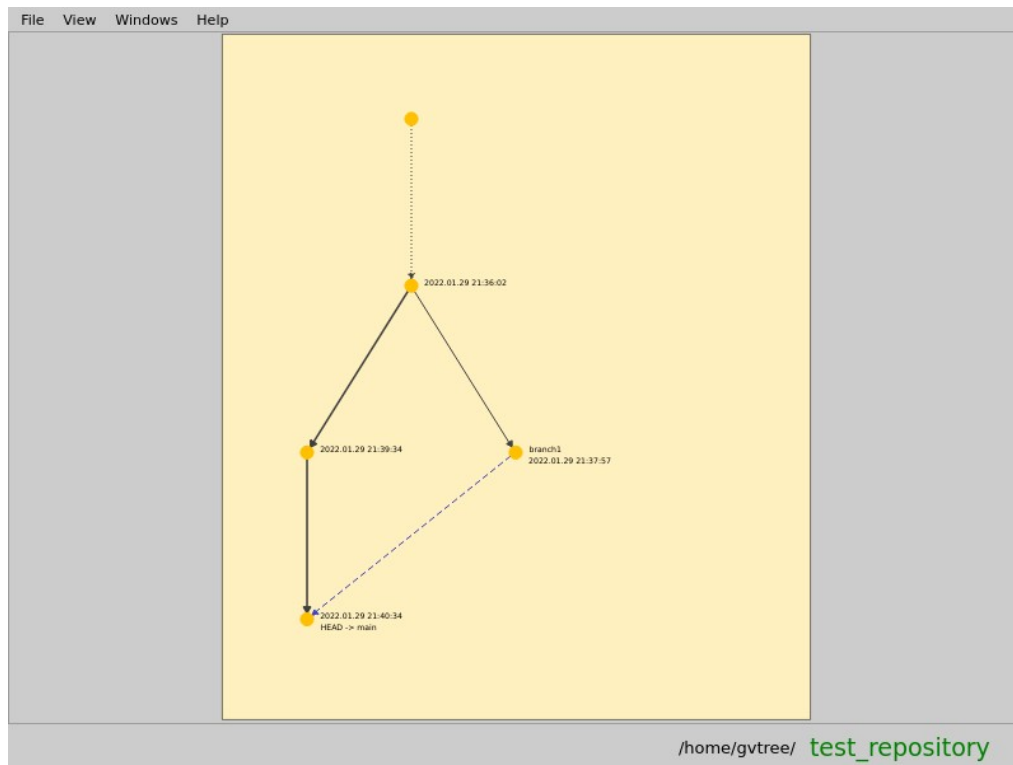


Figure 15: Scaled view

## 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.

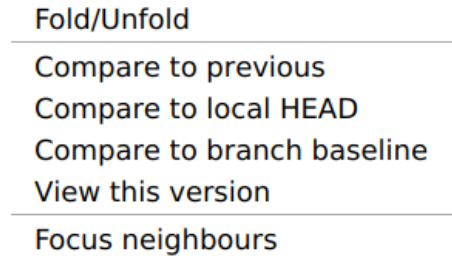


Figure 16: Context menu of a version node

In the context menu select Compare to previous.

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

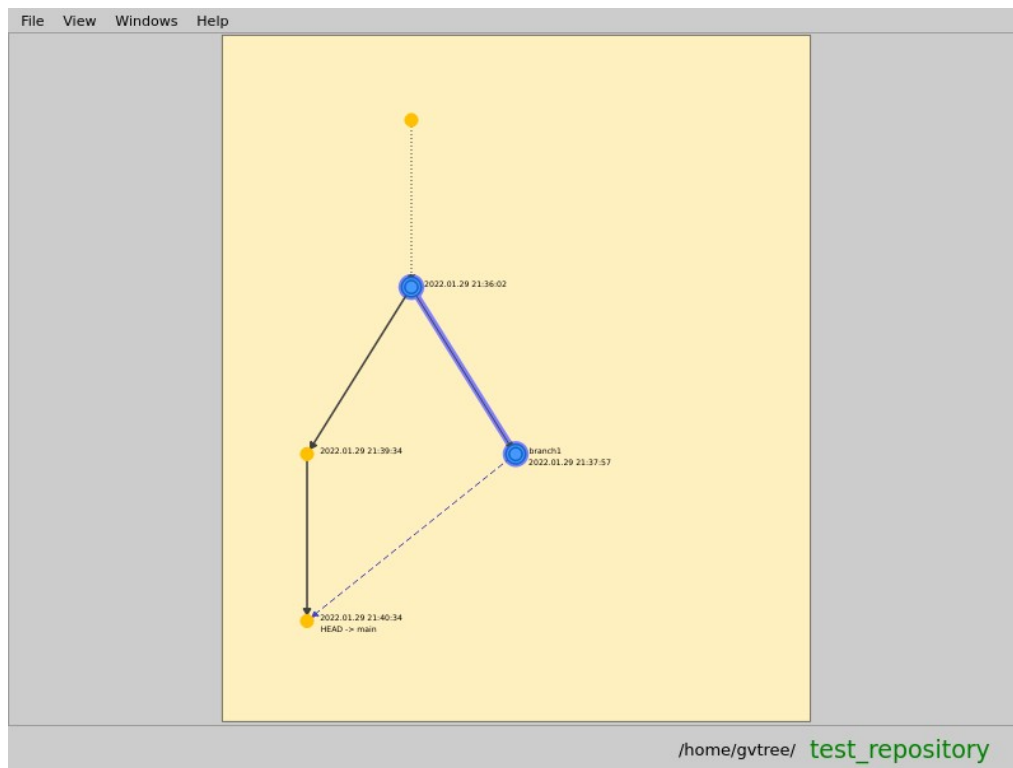
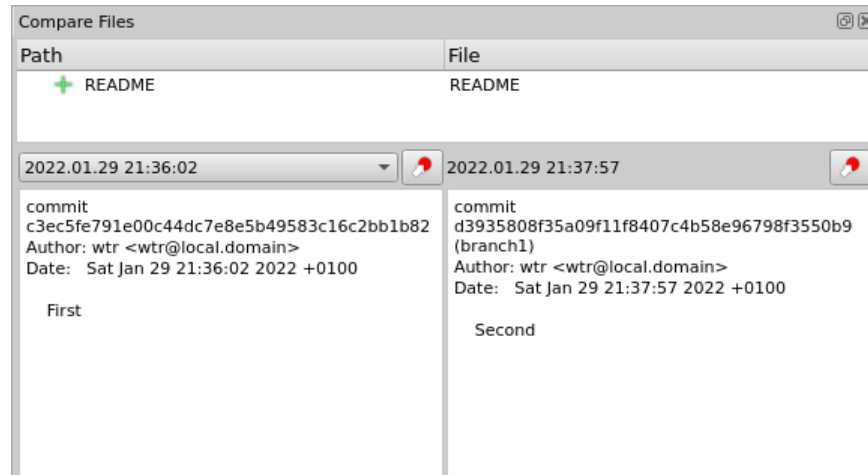


Figure 17: Compare versions markup

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.

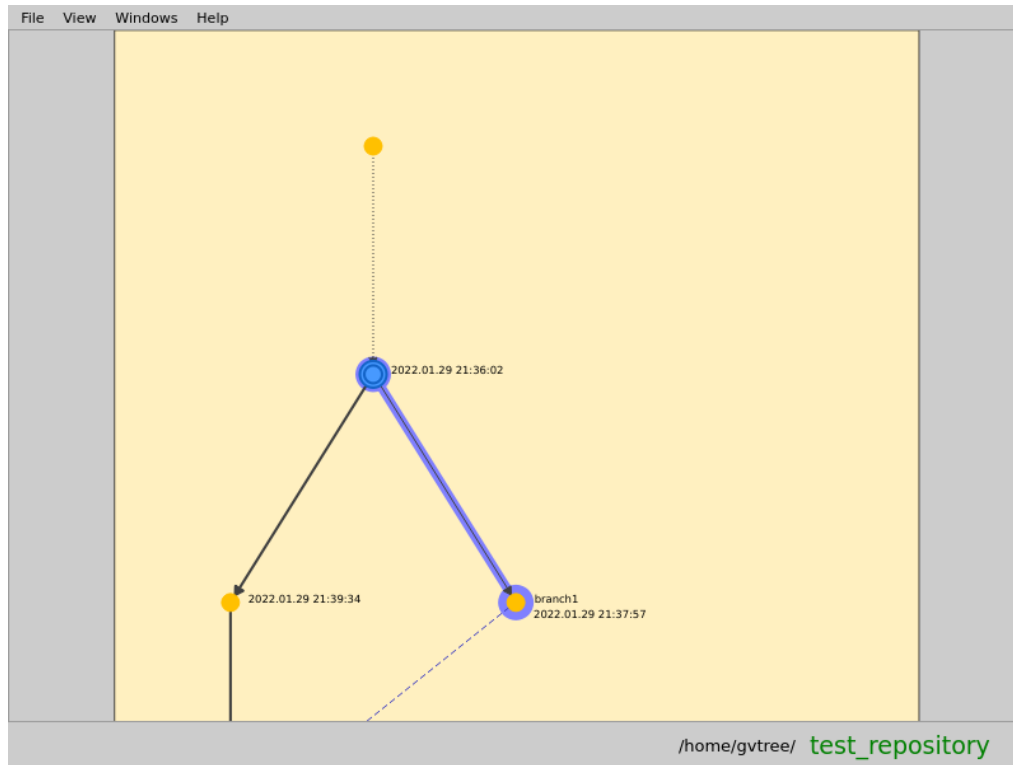
The left text browser below contains the commit information of the from-version, the right text browser contains the commit information of the to-version.

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.

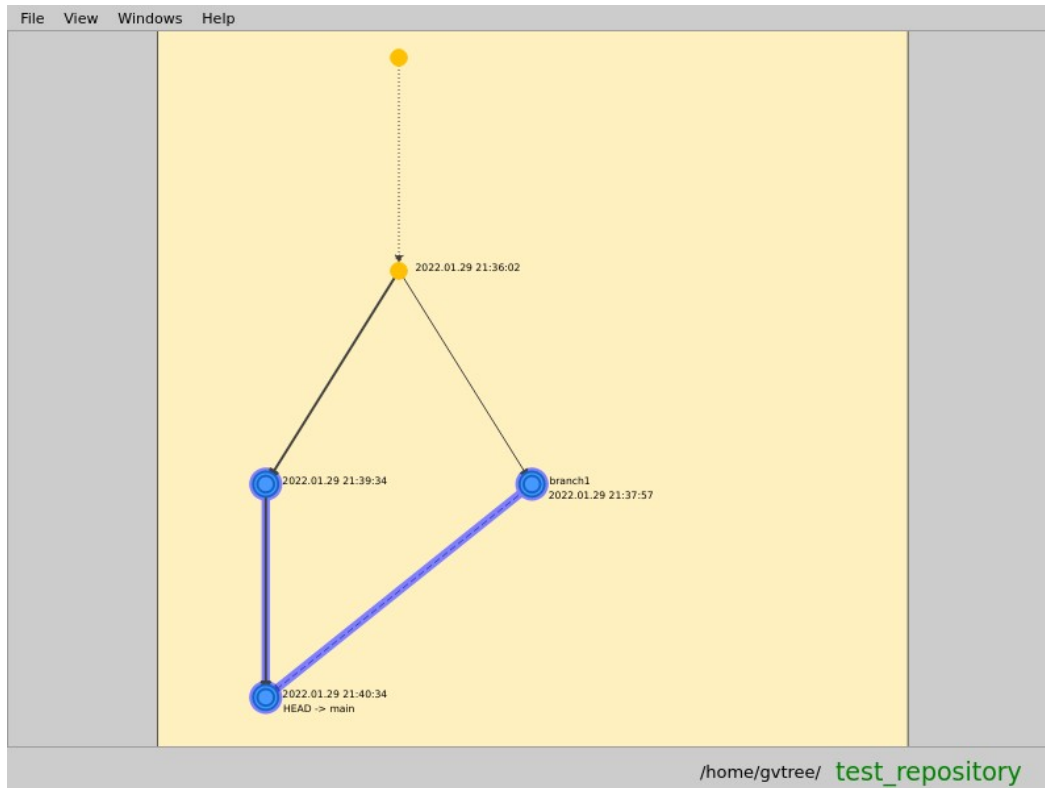






Figure 21: Compare to more than one predecessor

The Compare Files window has changed, too:

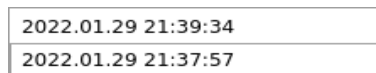


Figure 22: Updated Compare Files window

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*

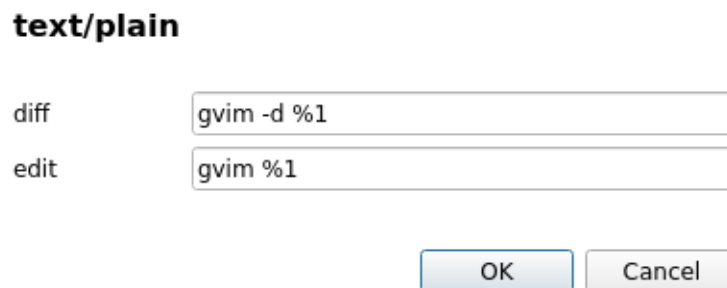
The displayed commit info will change accordingly. Pressing the focus version button will focus and markup the selected version.

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.

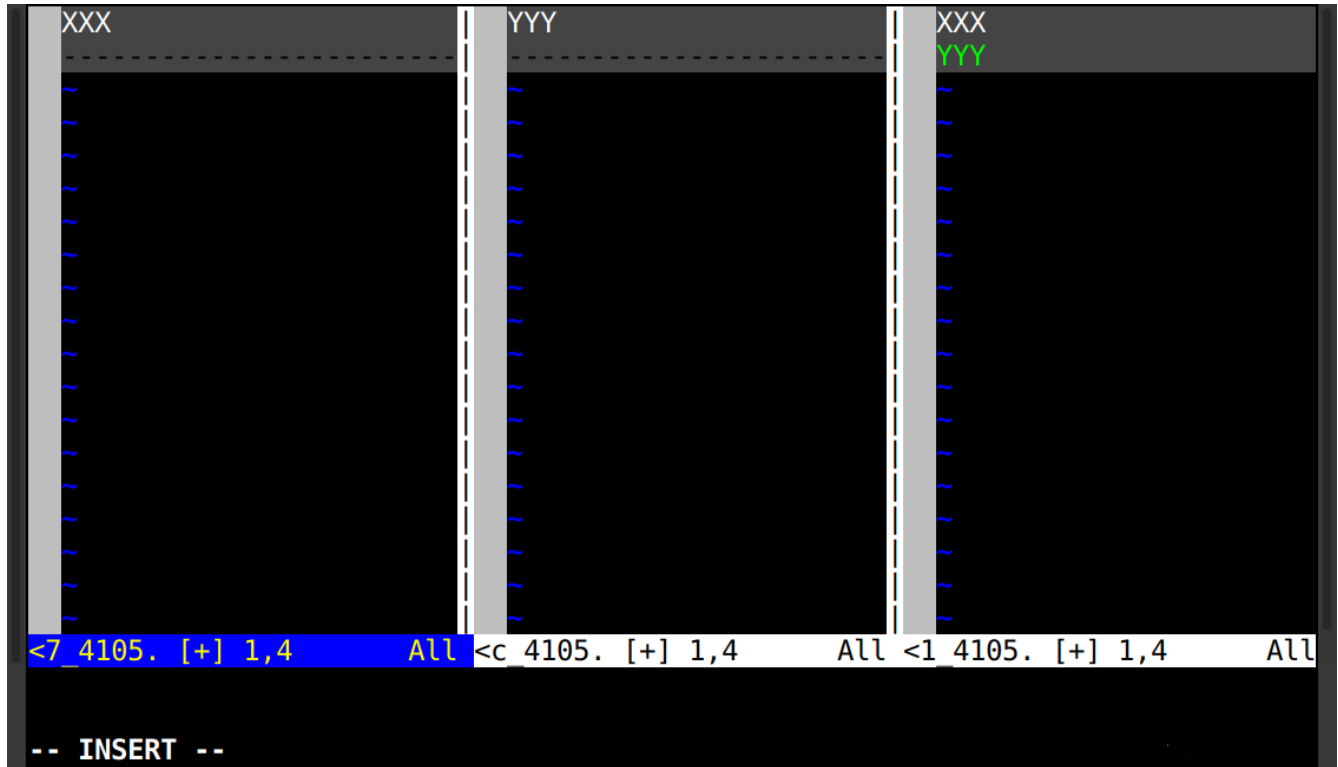


Figure 26: *gvim* as difftool with three columns.

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*.

If you open the **RMB** menu of the HEAD version again and select Compare to branch baseline 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 branch baseline 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.

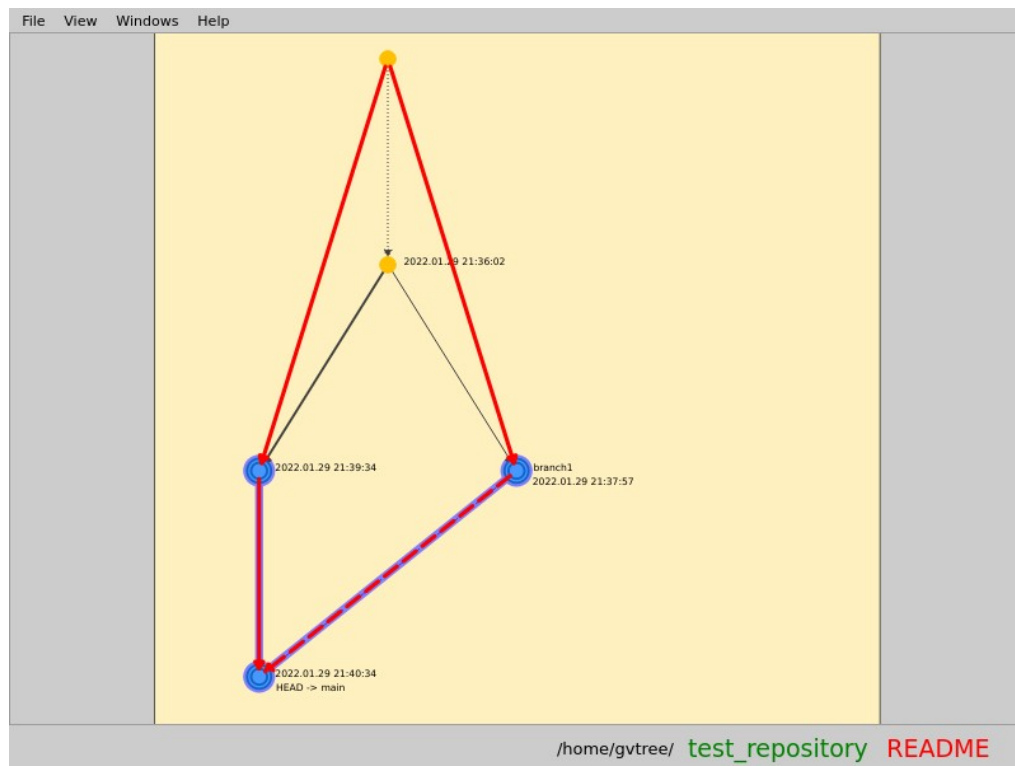


Figure 27: Version graph with file constraint

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

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.



The screenshot shows the 'Basic Settings' tab of a preferences dialog. At the top are four tabs: 'Basic Settings' (selected), 'Rendering', 'Tag Settings', and 'Mime Types'. The 'Initial Repository Path' section has two radio buttons: 'current path' (selected) and 'last repository path'. Below this are four text input fields: 'Current Repository Path' with the value '/home/wtr/gvtree', 'CSS Style Sheet Path' with the value 'css path', 'Temporary File Path' with the value '/tmp', and 'Codec for C strings' with a dropdown menu showing 'UTF-8'. Below these is a 'git log length' input field with the value '1000'. At the bottom left are six unchecked checkboxes: 'git log --remotes', 'short git hashes', 'fold HEAD version', 'top down view', 'add local version to diff', and 'print commandline to stdout'. An 'OK' button is located at the bottom right.

*Figure 28: Preferences Basic Settings*

The Current Repository Path can be set and changed here.

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. These files are erased if gvtree is quit and the location is specified in the Temporary File Path setting.

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

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.

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.

If fold HEAD version is set this version is handled like any other. If not set, the HEAD version will not be added to a folder, so that it is more easy to get the diff to the last version.

In case of top down view is checked, the HEAD version is printed on the top.

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.

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

## Tag Settings

Basic Settings   Rendering   **Tag Settings**   Mime Types

HEAD	DejaVu Sans,11,-1,5,50,2,0,0,0,0	(HEAD.*)
Commit Date	Sans,9,-1,5,50,0,0,0,0,0	([0-9]+)
User Name	Sans,9,-1,5,50,0,0,0,0,0	\\([0-9a-zA-Z]*)\\
Hash	Sans,9,-1,5,50,0,0,0,0,0	([0-9a-f]+)
Branch	Sans,9,-1,5,50,0,0,0,0,0	^((?!.*tag: )\\b([\\0-9a-zA-Z_]*)\\b)\$
Release Label	Sans,9,-1,5,50,0,0,0,0,0	tag: \\b(R[0-9\\.]+)\$
Baseline Label	Sans,9,-1,5,50,0,0,0,0,0	tag: \\b(BASELINE_[0-9\\.]+)\$
FIX/PQT Label	Sans,9,-1,5,50,0,0,0,0,0	tag: \\b((FIX_STR[0-9]+) (PQT_STR[0-9]+))\$
HO Label	Sans,9,-1,5,50,0,0,0,0,0	tag: \\b(STR[0-9]+_HO[0-9]*)\$
Other Tags	Sans,9,-1,5,50,0,0,0,0,0	

OK

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.

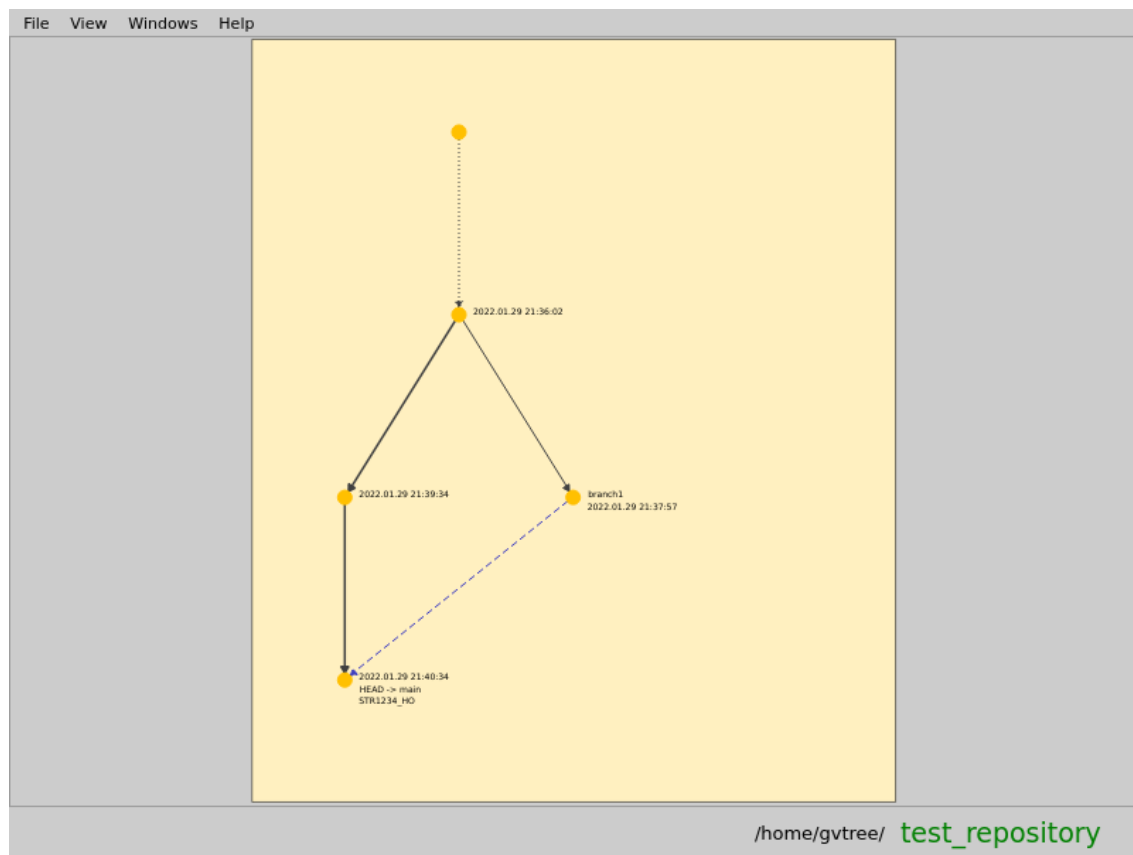
**FIX**, **PQT** (preliminary quality test) and **HO** (handoff) are perhaps project or company specific and are related to a QA work flow.

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

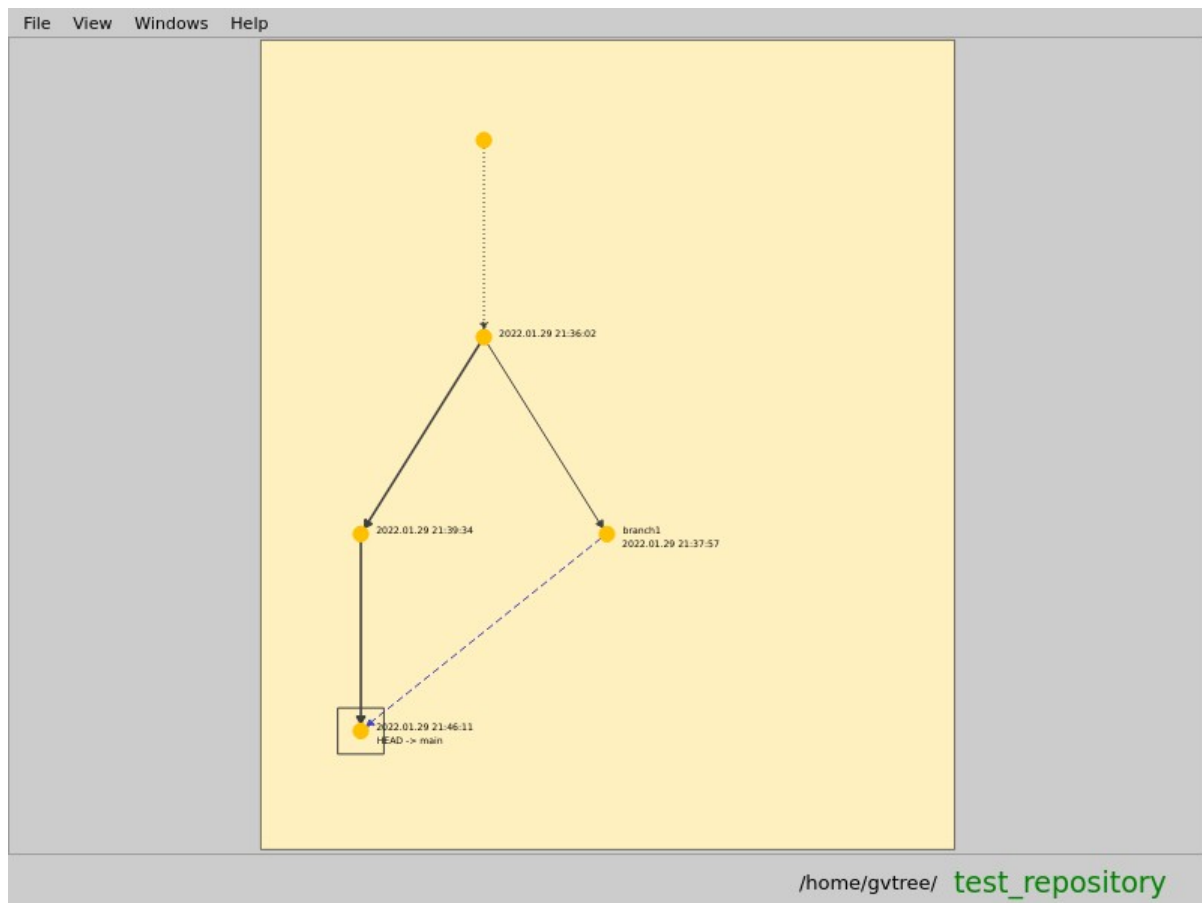
In the Windows - Preferences - Basic Settings set the tag fold HEAD version.

Now just add a file TODO to the repository.

**git add TODO**

**git commit**

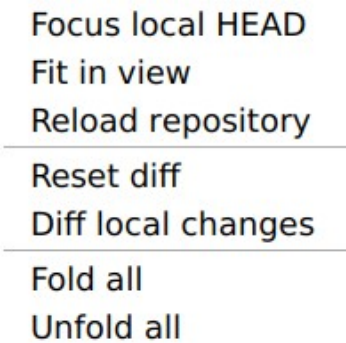
Refresh the graph view.



*Figure 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:



*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:

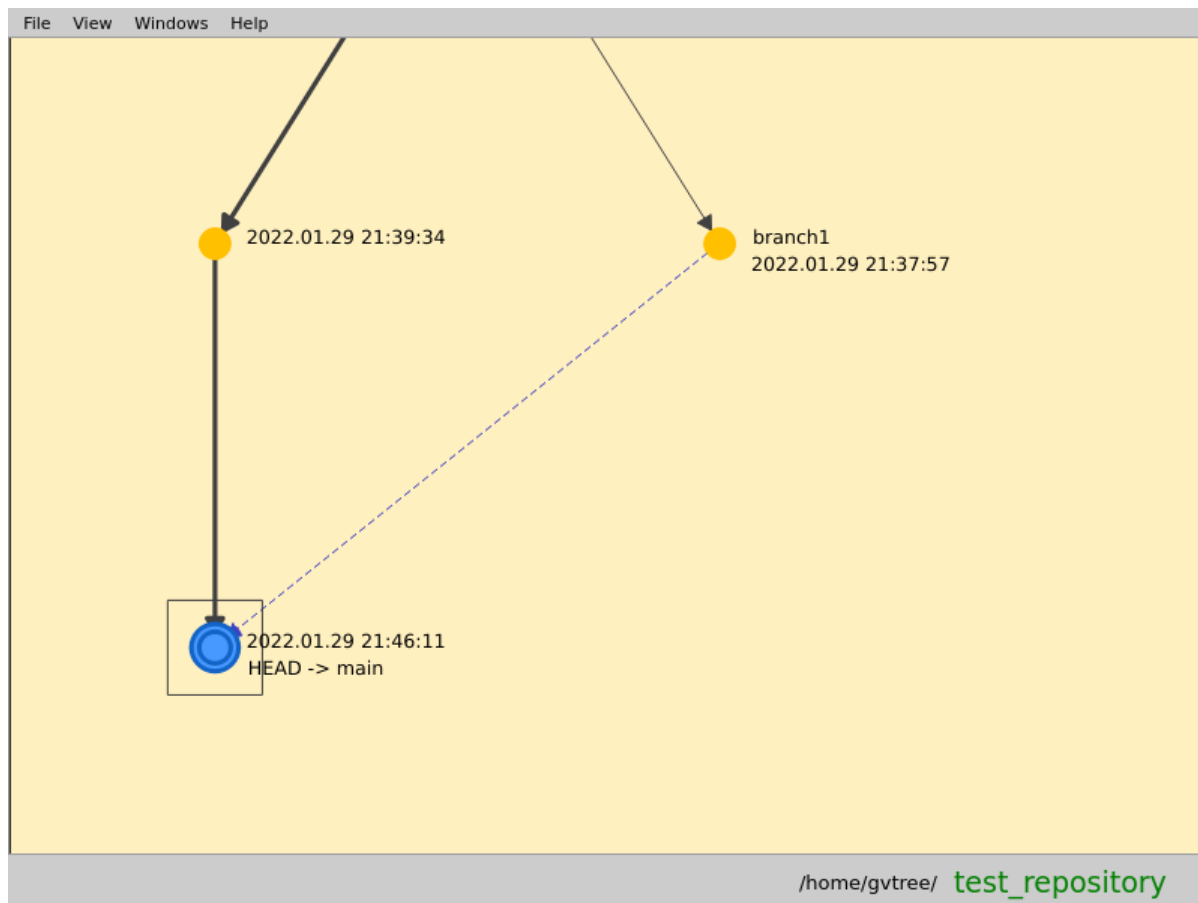


Figure 34: Focus HEAD version

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.

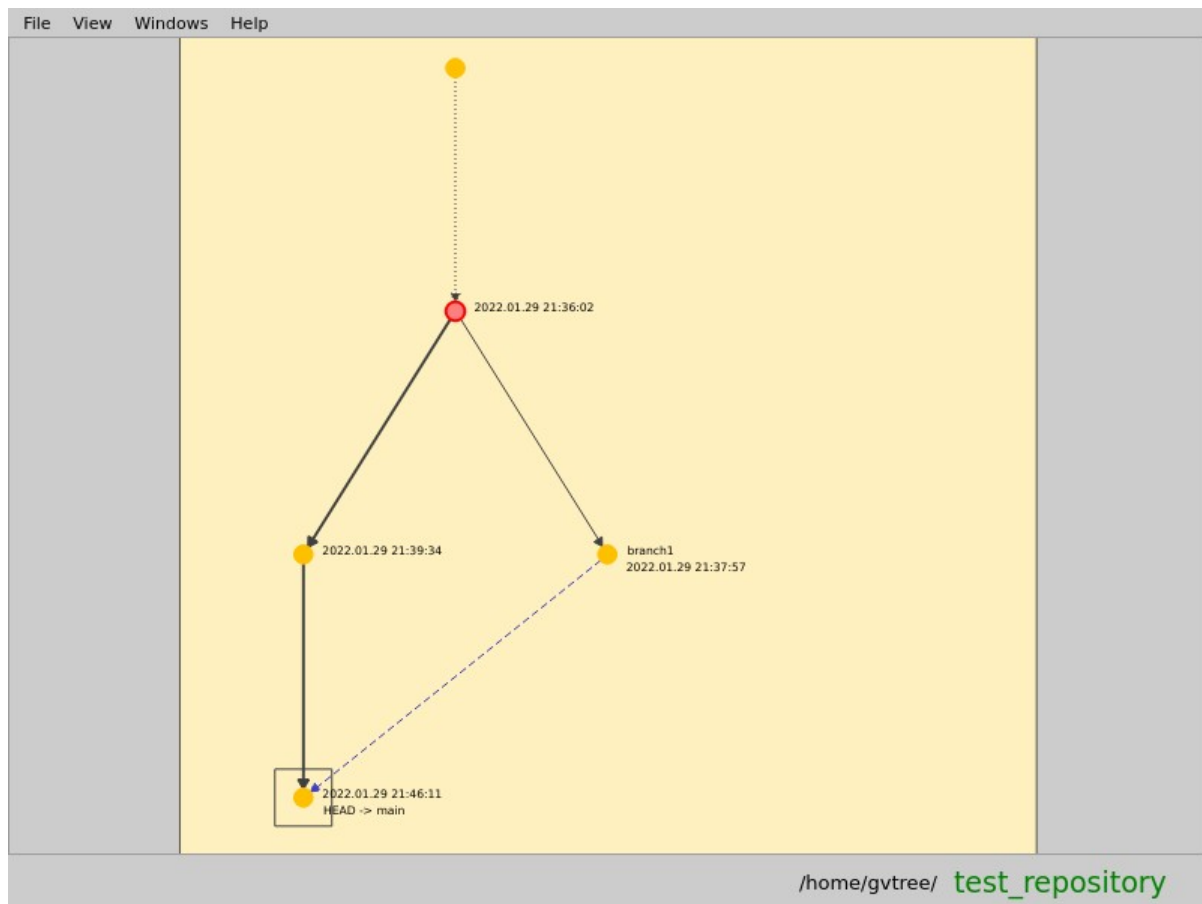


Figure 35: LMB version selection

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

- Compare to selected
  - Compare to previous
  - Compare to local HEAD
  - Compare to branch baseline
  - 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.

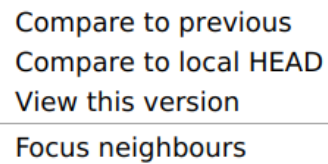
To change the selected version, **LMB** to a different version node.

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:



A context menu for a graph edge. It contains three items: 'Compare to previous', 'Compare to local HEAD', and 'View this version'. A horizontal line separates these three items from a fourth item, 'Focus neighbours'.

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

*Figure 37: Context menu of a graph edge*

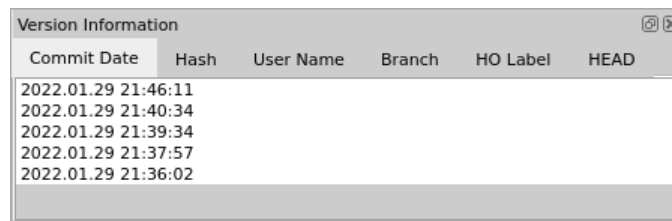
With Compare adjacent versions the two versions connected by the edge are compared.

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 currently selected and 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.

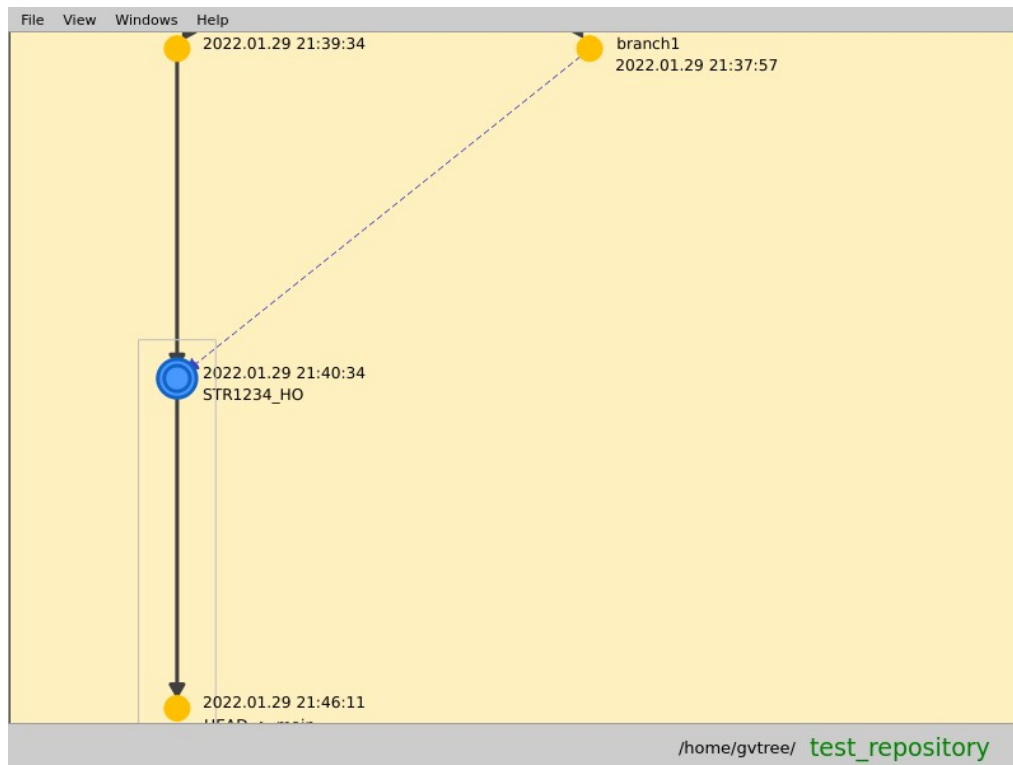


Figure 40: Search by Version Information widget.

## Step 9 Search dialog

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

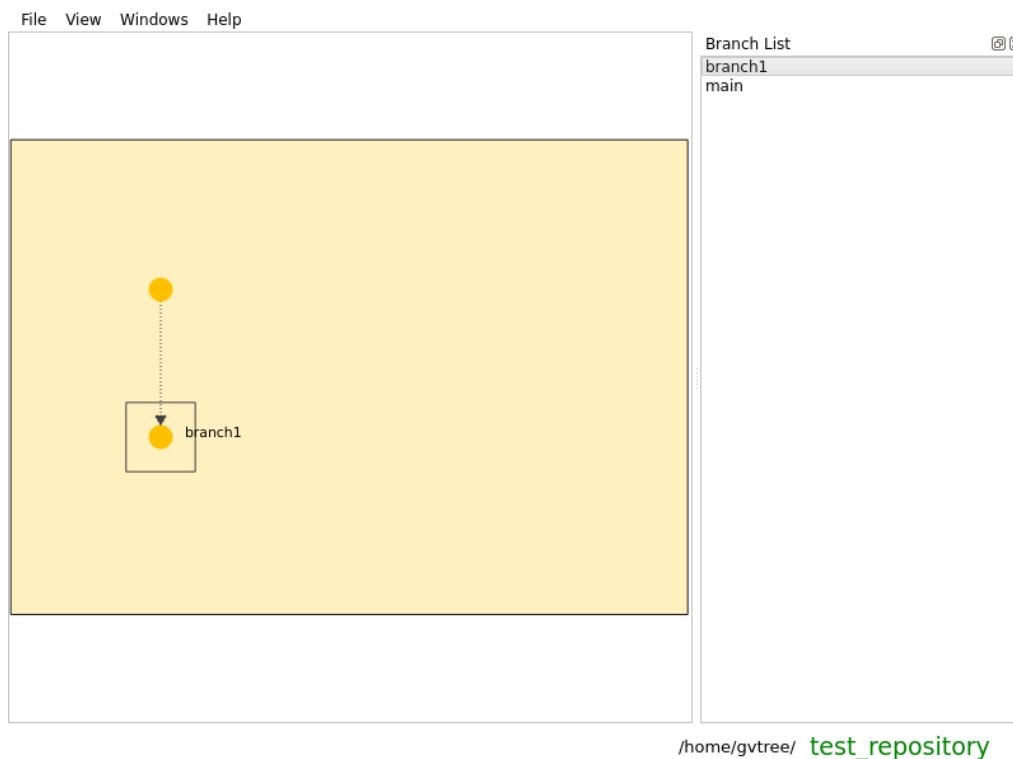
Now open the Search dock widget.

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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**17. Interpretation of Sections 15 and 16.**

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