

Tulip

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1 Short Description

This paper briefly presents some of the most important capabilities of a graph visualization software called Tulip¹. This software has been developed in order to experiment tools such as clustering, graph drawing and metrics coloring for the purpose of information visualization. The main Tulip's characteristics are: a graph model which allows clustering with data sharing, and a general property evaluation mechanism that makes the most part of the software reusable and easily extendable. This software has been written in C++ and uses the Tulip graph library, the OpenGL library and the QT library[5]. The current version is fully usable and enables to visualize graphs with about 500.000 elements on a personal computer.

2 Areas of Application

Tulip has been designed to enable manipulation and visualization of huge graphs. Thus, its areas of application are those where visual-analyse of such kind of data structures must be addressed. We are currently using it in some works about the visualization of metabolic pathways and for the visualization of the interactions between proteins. Some others direct applications are the visualization of: hyperlinks(WWW), file system structures or computer networks.

3 Layout Algorithms and Layout Features

The Tulip's layout engine makes it possible to connect dedicated algorithms to each properties of the displayed layout. For nodes and bends positions it exists about ten graph drawing algorithms. The most important of them are:

- A variant of the so-called Sugiyama algorithm. It manages general graphs with fixed elements size[2],
- A 3D general graph drawing algorithm,
- The tree walker algorithm[4],
- The 3D cone tree layout[1],
- An implementation of the famous force directed approach[3].

¹ Tulip, software is under GPL license and is available on the world wide web at the URL: <http://dept-info.labri.fr/~auber/projects/tulip>.

For the others properties(sizes, colors, shapes), Tulip also includes dedicated algorithms that enables to compute them automatically. Most of these algorithms are based on the combinatorial properties of graphs. They are used to highlight important elements of the graph in order to help the user in his research.

4 Architecture

The Tulip software has been written in C++ and is currently available for the Linux operating system. It uses the Qt library for its graphics user interface and the OpenGL library for the 3D displaying. The extensions are supported by the so-called plug-in mechanism which allows to receive dynamically new algorithms (selection, graph drawing, import, export, metric, etc ...).

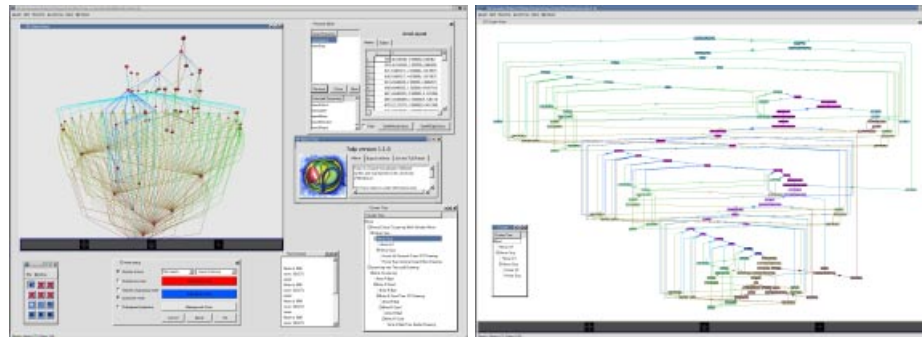
5 Interfaces

The Tulip software interface enables to manipulate the following parts of the visualized graph:

- Cluster and graph structure: The user can add or remove elements (nodes or edges) of a graph, or of a cluster, by a simple click on the visualization window. Furthermore, it can graphically select parts of a graph, or of a cluster, to create a new cluster.
- Cluster and graph properties: The layout property of a graph, or of a cluster, can be directly modified with the visualization window. Another window called “property editing” enables to modify the values of other properties and to add or to remove a property from a graph or a cluster.
- Clusters hierarchy : With the cluster-tree window, the user can add or remove clusters in the hierarchy and change their positions in it.

The interface also enables to navigate in the graph. The available operations are: rotations, zoom, and translations.

6 Screenshots



References

1. J.D.Mackinlay G.G.Robertson and SK.Card. Cone trees:animated 3d visualizations of hierarchical information. In *CHI'91*, pages 189–194. ACM Press, 1991.
2. S.Tagawa K.Sugiyama and M.Toba. Methods for visual understanding of hierarchical system structures. *IEEE Transactions on system, Man and Cybernetics.*, 11:109–125, 1981.
3. M.Kaufmann and D.Wagner. *Drawing Graphs*. LNCS 2025. Springer-Verlag, 2001.
4. Edward M. Reingold and John S. Tilford. Tidier drawings of trees. *IEEE Transactions on Software Engineering*, 7(2):223–228, March 1981.
5. Trolltech. Qt the crossplatform c++ gui framework. <http://www.trolltech.com/>.