The interactive Graph Visualization System *daVinci* V1.3

UNIVERSITÄT BREMEN

Michael Fröhlich, Mattias Werner

daVinci is an universal, generic visualization system of high quality for directed graphs. Nowadays, the importance of a visualization of graph structures is obvious. Directed graphs are very common in modern computer applications: module dependencies in a software project, file systems on storage devices, dataflows in a program, the structure of a computer network, time dependencies in a project management system, the tree of chapters in a structured document and so on. The graphical representation of these partly huge and complex objects offers the foundation for getting an overview, looking down on details, exploring interesting areas and finally obtaining the understanding of the structure. Sometimes one can find specific visualization tools for a concrete application, but these tools are often integrated into the program that handles the graph; they are not designed for a general use. Moreover, a viewer has often only a limited influence on the way the graph is represented.

daVinci is an interactive visualization system which tries to overcome these deficits. The basic philosophy of *daVinci* is to be independent from an application and to offer the definition of the visualization. In *daVinci* a user is able to load a graph in a readable term representation from a file. Layout qualities like edge crossing minimization or bend elimination are considered for a graph layout. Furthermore an interface for the connection with a graph administrating application is available. With this interface, an application program is able to send graphs to the visualization system as well as define application specific menus and simple user dialogues. A connected application is informed about events like user selection of graph nodes and edges, selection of application generated menus or the result of user dialogues. By using *daVinci* this way like an abstract user interface, an application program can offer the user the opportunity to work on the graphical view of a graph. A graph editor, available in the distribution of *daVinci*, demonstrates the advantages of the application interface.

The visualization of a graph is not static in *daVinci*. The user can manipulate the layout interactively to obtain a better view. The most important features of the current release *daVinci* V1.3 are:

- Application interface for the connection with a graph administrating program.
- Acyclic and cyclic graphs are supported as well as multiple edges and self-refering edges.
- Automatic graph layout considering aesthetics like edge crossing minimization, edge bend minimization, etc.
- Fine-tuning of a graph layout by dragging nodes and edges.
- High quality scaling down to 1% with preservation of the full functionality in a scaled visualization.
- Interactive abstractions like fading out of uninteresting subgraphs or edges.
- PostScript™ interface.
- Graph attributes for influencing the visualization of nodes and edges individually: colors, patterns, shapes, fonts, etc.
- Global font size can be set interactively from 6pt up to 34pt.

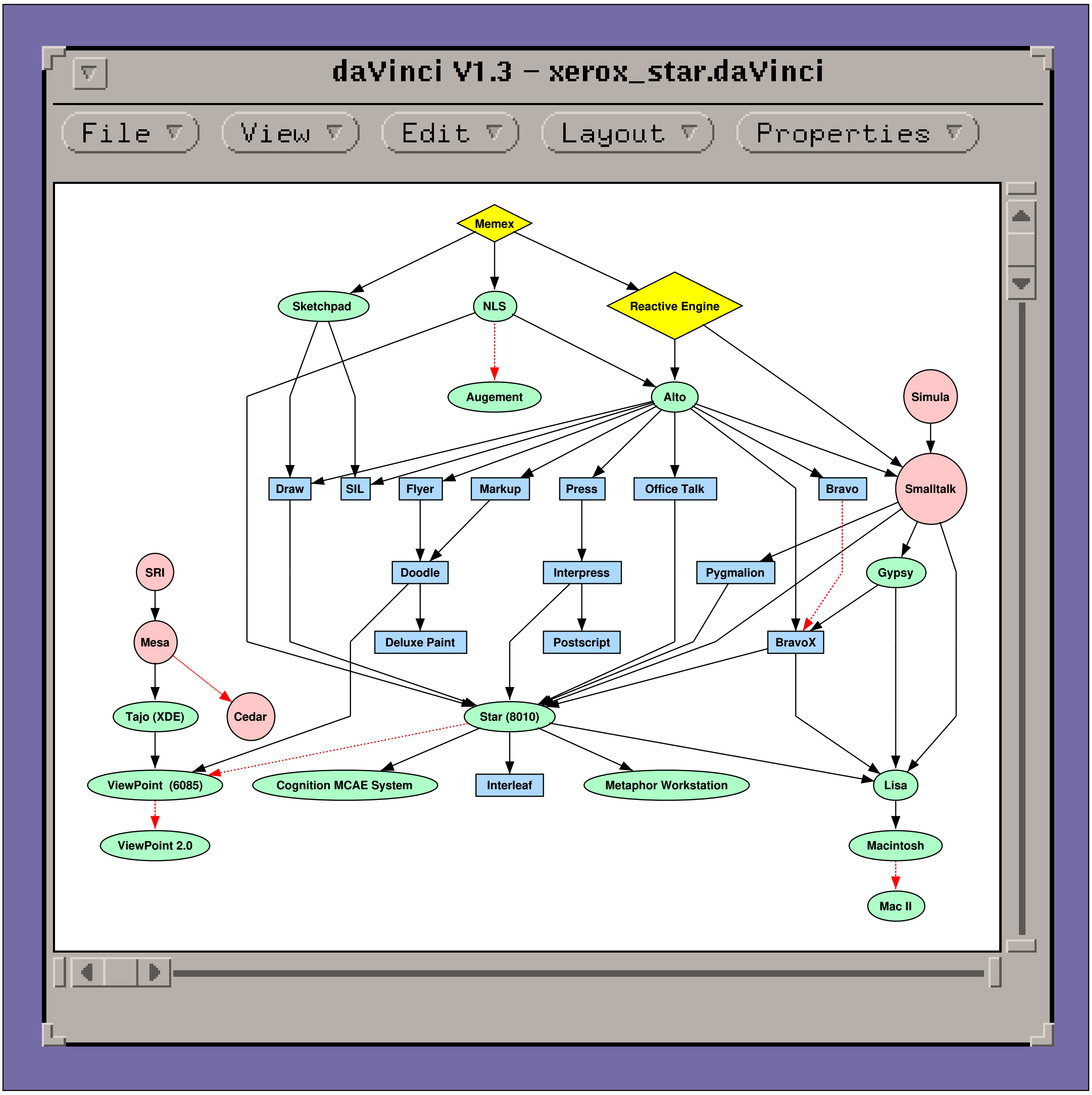
The interactive graph visualization system *daVinci* was developed at the Institute for Formal Methods in Software-Engineering of the University of Bremen, Germany. The system has been implemented since the end of 1992 by Michael Fröhlich and Mattias Werner. *daVinci* is written in the pure functional language *ASpecT*, developed at the University of Bremen also. The OPEN LOOK™ conform X-Window™ user interface of *daVinci* is implemented in *C* using the window toolkit *XView*.

Until now *daVinci* was distributed to more than 600 users all over the world like MIT, ETH Zürich, the Universities of Alberta, Bordeaux, Delft, San Diego, Nancy, Oregon, Purdue, Toronto, Washington as well as Adobe, AT&T, BASF, Chevron, DEC, Dupont, Ericsson, Kodak, Motorola, NASA, Nokia, Panasonic, Siemens, Sony, Sun Microsystems, Texas Instruments, Toshiba, Xerox and many more.

daVinci is available free of charge for non-profit use by anonymous ftp from ftp.Uni-Bremen.DE (Internet: 134.102.228.9) in the directory /pub/graphics/daVinci. Any commercial exploitation of this software is prohibitted without the explicit authorization of the authors.

daVinci V1.3 is available for Sun SPARCstations with Solaris 1 (known as SunOS 4.x) or Solaris 2 and for Intel PC's with Linux. In principle the system can be ported to each UNIX platform which is supported by the public available OPEN LOOK toolkit *XView*, e.g. Apple Macintosh (A/UX), DECstation (Ultrix), HP 9000/7xx (HP-UX), IBM RS6000 (AIX) or SGI (Irix).

If you are using *daVinci*, please send us your opinion about this software. We are very interested in applications of *daVinci* as well as critics or suggestions about new features. You can contact the *daVinci* project by e-mail to daVinci@Informatik.Uni-Bremen.DE. A mailing list is also available.



Visualization of a graph in *daVinci*