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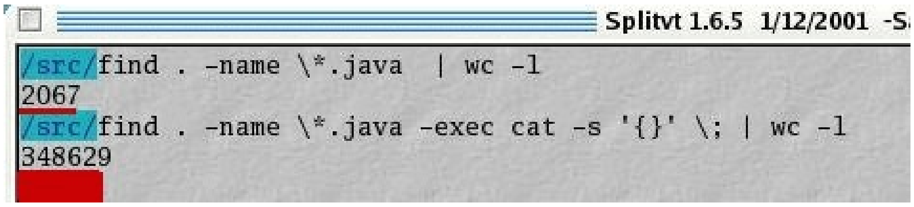
*About the author:*
Gerrit didn't like any computers at all until he tried C and Linux.

# Cruising with the snavigator



```
Splitvt 1.6.5  1/12/2001  -S
/src/find . -name \*.java  | wc -l
2067
/src/find . -name \*.java -exec cat -s '{}' \; | wc -l
348629
```

*Abstract*:

This article presents the snavigator, a powerful code analysis, cross–referencing and re–engineering tool which is indispensable for tackling the complexity of maintaining larger pieces of software and packages in an effective manner.

## Motivation

An old proverb says that a book should not be judged by its cover. A similar thing happens with open source code. However, open source does not equal open documentation, and the reading process becomes increasingly difficult the more and the longer the source files are. I recently had to program with a piece of software which had half a html page of documentation, in contrast to over 348,000 lines of Java open source code spread over more than 2060 files (see figure). In light of such dimensions, electronic orienteering, reverse engineering and analysis tools become indispensable, such as the Red Hat source code navigator presented in this article.
The tool automates many of the tasks one would normally do using (c)tags, grep, search and replace, but much more accurately and more conveniently, wrapped in an easy to use graphical interface. See screenshots below.

## Installing under debian

Under debian you can get the whole lot via the one–liner

```
apt-get install sourcenav sourcenav-doc
```

This at the same time takes care of the documentation as well. The source navigator then resides in `/usr/lib/sourcenav/`, you can call the main program via `/usr/lib/sourcenav/bin/snavigator` (see tip about symlinks below). Documentation can be found in `/usr/share/doc/sourcenav/html/`.

## Installation from source

The URL for the homepage of source navigator is http://sourcenav.sourceforge.net/, actual downloads are from here (sourceforge.net/project/showfiles.php?group_id=51180). Obtain the latest tarball `sourcenav-xx.xx.tar.gz`. While downloading, try to do something else meanwhile – the sources amount to 55 Megabytes. This does have a positive background, the whole package is largely self–sufficient. Although it makes wide use of other libraries such as Tcl/Tk, Tix and Berkeley DB, the correct versions of these packages are all included. To avoid clashes with other versions of `Tcl/Tk` etc on your system, it is a good idea to place the installation into a separate directory, e.g. `/opt/sourcenav`. The instructions further suggest using a separate *build directory*, this works as follows. After unzipping, in the directory which contains the unpacked sources issue the following commands:

```
mkdir snbuild; cd snbuild
../sourcenav-*/configure --prefix=/opt/sourcenav
make                                   ## takes a while ...
make install                           ## might have to become root first
```

The `--prefix` option is there to specify the installation directory. While configure runs, one already gets an idea about the many languages that snavigator can handle. It is also possible to add in further parsers for languages of your choice or making. Once the installation is finished via `make install`, the snavigator is ready to work and can be invoked as `/opt/sourcenav/bin/snavigator`. Instead of extending the PATH shell environment I suggest to use a *symlink*, e.g. to `/usr/local/bin`, instead.

```
ln -s /opt/sourcenav/bin/snavigator    /usr/local/bin
```

The main executable is a shell script which needs to know its directory. Thus it gets confused if called via a symlink. This can be remedied by changing the following lines in `/opt/sourcenav/bin/snavigator`; instead of

```
snbindir=`dirname $0
```

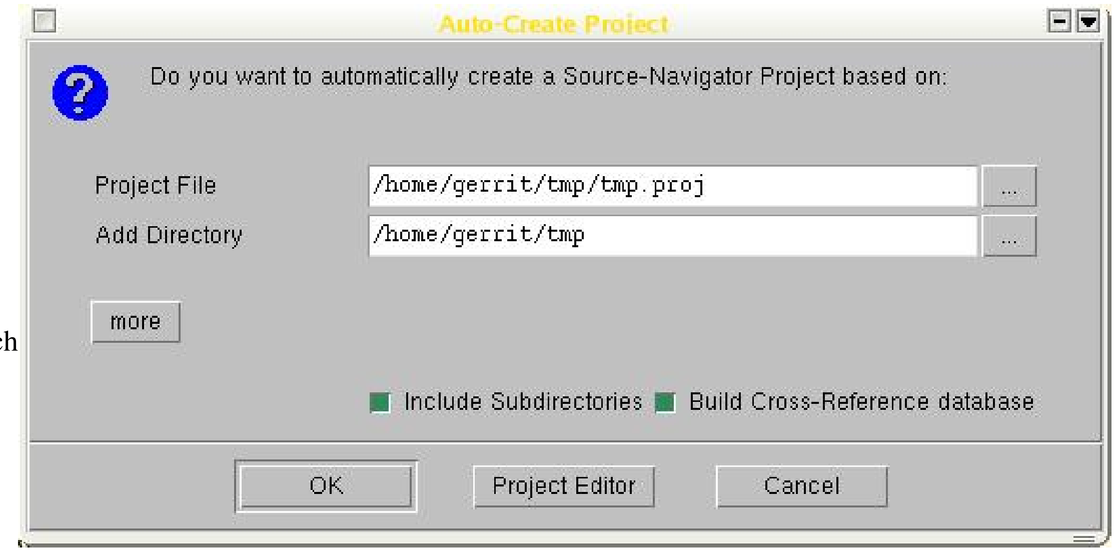
use

```
prog=`readlink -f $0`
snbindir=`dirname $prog`
```

The `-f` option to **readlink(1)** creates a canonical pathname representation, this means it even works if the file is accessed via a very long chain of nested symlinks.

## Using snavigator

The first time snavigator is invoked, it asks for directories containing source files, as the following screenshot shows. Languages which are supported include, but are not limited to, Java, C, C++, Tcl, Fortran,


Auto-Create Project

Do you want to automatically create a Source-Navigator Project based on:

Project File: /home/gerrit/tmp/tmp.proj

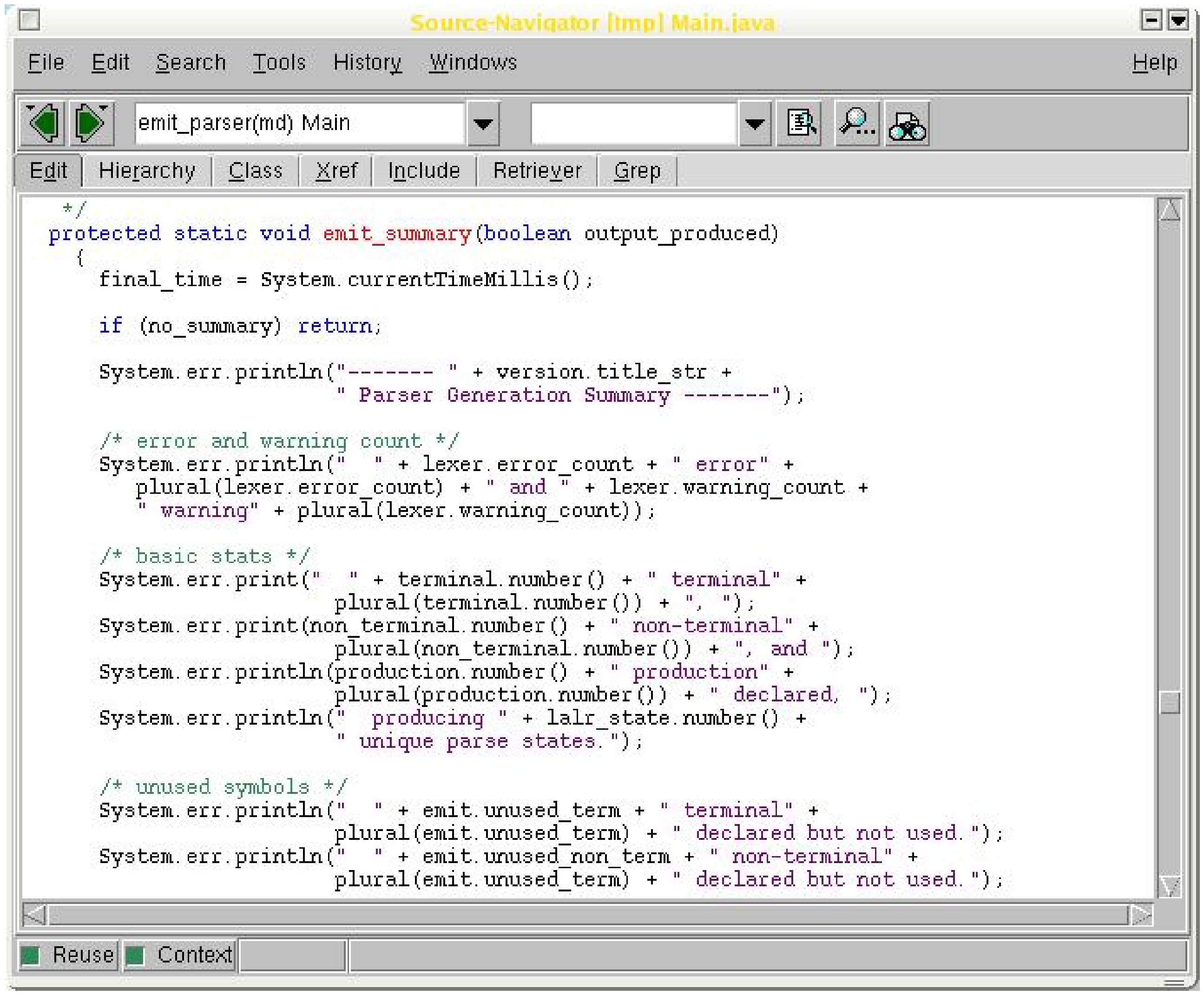
Add Directory: /home/gerrit/tmp

🟩 Include Subdirectories 🟩 Build Cross-Reference database

COBOL, and assembly programs. Once given the details of source code locations, it independently builds a project database which includes referencing information, class hierarchies, file inter–dependencies ... and much more. Depending on the size of your project, it takes a short while to build. Once done, the database can be queried and additional information be asked about the code. The following just highlights some of the features, to give you an idea. An illustrated *user guide*, as well as a reference manual, is included in the `html` directory of the installation.

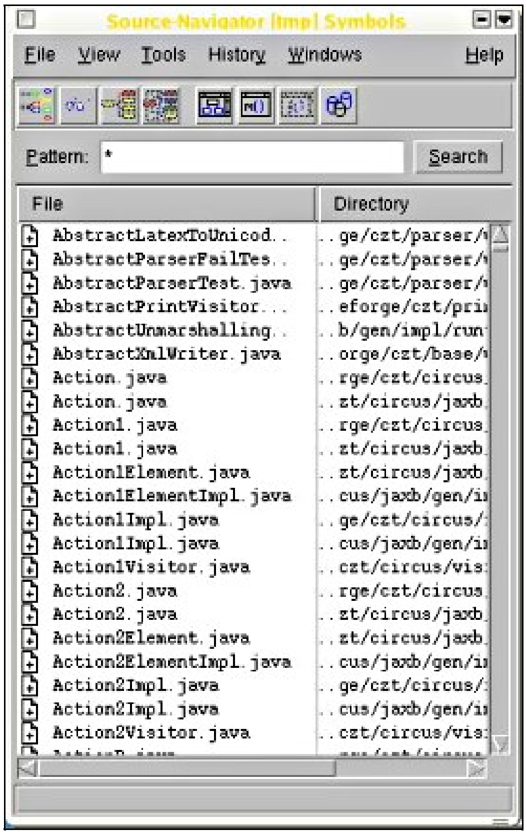
## Project management

Part of the suite is an *editor* with syntax highlighting, this can also be used for pretty–printing files. The following screenshot depicts the main editor window. It is almost like a development environment, comes with such things as a debugging facility, project build commands, version control and the like.


Source-Navigator [tmp] Main.java
File Edit Search Tools History Windows Help
emit_parser(md) Main
Edit Hierarchy Class Xref Include Retriever Grep
Reuse Context

```
  */
protected static void emit_summary(boolean output_produced)
  {
    final_time = System.currentTimeMillis();

    if (no_summary) return;

    System.err.println("------- " + version.title_str +
                       " Parser Generation Summary -------");

    /* error and warning count */
    System.err.println("  " + lexer.error_count + " error" +
       plural(lexer.error_count) + " and " + lexer.warning_count +
       " warning" + plural(lexer.warning_count));

    /* basic stats */
    System.err.print("  " + terminal.number() + " terminal" +
                       plural(terminal.number()) + ", ");
    System.err.print(non_terminal.number() + " non-terminal" +
                       plural(non_terminal.number()) + ", and ");
    System.err.println(production.number() + " production" +
                       plural(production.number()) + " declared, ");
    System.err.println("  producing " + lalr_state.number() +
                       " unique parse states.");

    /* unused symbols */
    System.err.println("  " + emit.unused_term + " terminal" +
                       plural(emit.unused_term) + " declared but not used.");
    System.err.println("  " + emit.unused_non_term + " non-terminal" +
                       plural(emit.unused_term) + " declared but not used.");
```

In particular, the big green arrows on the menu work just as in a web browser. The project editor allows one to control the database information, e.g. if a file has just been updated; to add or delete files from the list and other management tasks. All files are treated as one big project. So if changes are committed to, you can update the database information via *Refresh Project* or *Reparse Project*.
When in the editor window, highlight something, e.g. the name of a function such that the highlighted region appears in yellow. Then right–click with the mouse – there is a choice to find either (a) the *declaration* of what you just have highlighted (e.g. a header file) or (b) the *implementation* of the highlighted symbol (e.g. a `.cpp` file), plus a few more useful options.

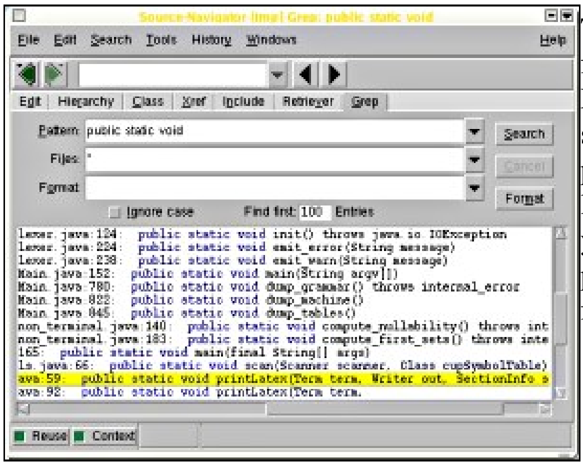

Source-Navigator [tmp] Symbols
File View Tools History Windows Help
Pattern: *
Search

| File | Directory |
|---|---|
| AbstractLatexToUnicod.. | ..ge/czt/parser/ |
| AbstractParserFailTes.. | ..ge/czt/parser/ |
| AbstractParserTest.java | ..ge/czt/parser/ |
| AbstractPrintVisitor... | ..eforge/czt/pri |
| AbstractUnmarshalling.. | ..b/gen/impl/run |
| AbstractXmlWriter.java | ..orge/czt/base/ |
| Action.java | ..rge/czt/circus |
| Action.java | ..zt/circus/jaxb |
| Action1.java | ..rge/czt/circus |
| Action1.java | ..zt/circus/jaxb |
| Action1Element.java | ..zt/circus/jaxb |
| Action1ElementImpl.java | ..cus/jaxb/gen/i |
| Action1Impl.java | ..ge/czt/circus/ |
| Action1Impl.java | ..cus/jaxb/gen/i |
| Action1Visitor.java | ..czt/circus/vis |
| Action2.java | ..rge/czt/circus |
| Action2.java | ..zt/circus/jaxb |
| Action2Element.java | ..zt/circus/jaxb |
| Action2ElementImpl.java | ..cus/jaxb/gen/i |
| Action2Impl.java | ..ge/czt/circus/ |
| Action2Impl.java | ..cus/jaxb/gen/i |
| Action2Visitor.java | ..czt/circus/vis |

## Symbol browser

This is the first window that opens up after populating the project database. Usually it contains filenames, but it can also display class methods, function symbols and the like. When a filename is clicked upon, the editor will be opened with that file.

## The grep window


Source-Navigator [tmp] Grep: public static void
File Edit Search Tools History Windows Help
Edit Hierarchy Class Xref Include Retriever Grep
Search
Cancel
Format
Reuse
Context

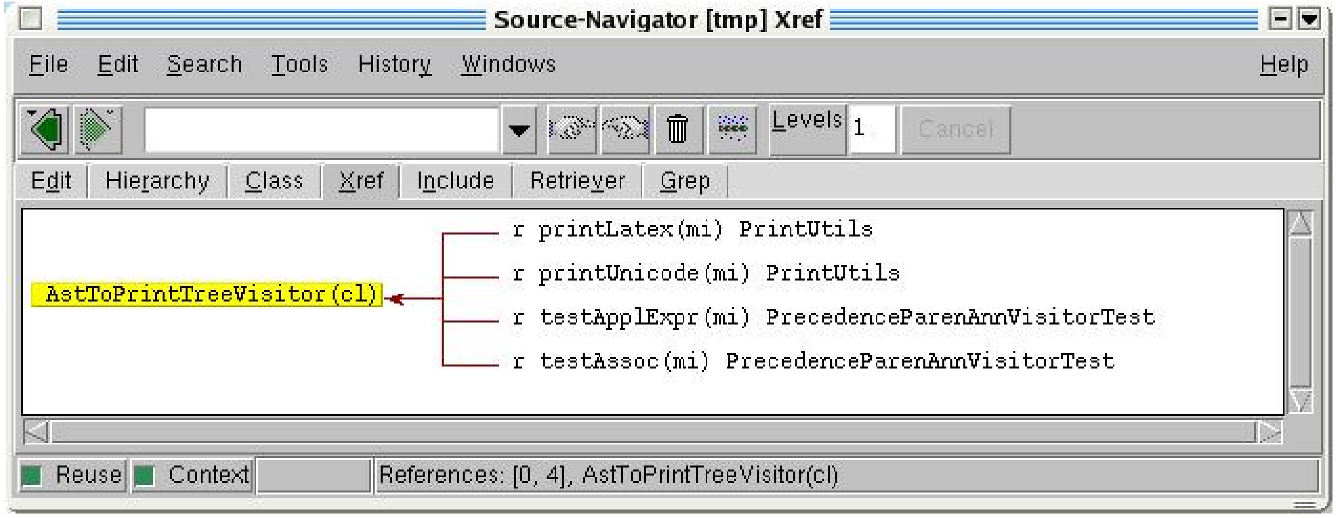
Pattern: public static void
Files: *
Format:
Ignore case Find first: 100 Entries

```
lexer.java:124:  public static void init() throws java.io.IOException
lexer.java:224:  public static void emit_error(String message)
lexer.java:238:  public static void emit_warn(String message)
Main.java:152:  public static void main(String argv[])
Main.java:780:  public static void dump_grammar() throws internal_error
Main.java:822:  public static void dump_machine()
Main.java:845:  public static void dump_tables()
non_terminal.java:140:  public static void compute_nullability() throws int
non_terminal.java:183:  public static void compute_first_sets() throws inte
165:  public static void main(final String[] args)
ls.java:66:  public static void scan(Scanner scanner, Class cupSymbolTable)
ava:59:  public static void printLatex(Term term, Writer out, SectionInfo s
ava:92:  public static void printLatex(Term term,
```

This does what the name says, it provides a convenient gui for grepping through all involved source code files. Matching entries are highlighted and hyper–linked, the source code can thus be browsed as if it were a bunch of web pages. As the screenshot shows, the respective file and location can be selected and by simply clicking that entry you have the editor opened at the right position. (This particular search term gives positive results in many Java files :)

## Xref window

Here we have a cross–reference list of all the symbols, in particular one can see which methods read (r), write (w), ... on which data and see the relationships among symbols, depicted in a hierarchical manner. The entries are clickable.

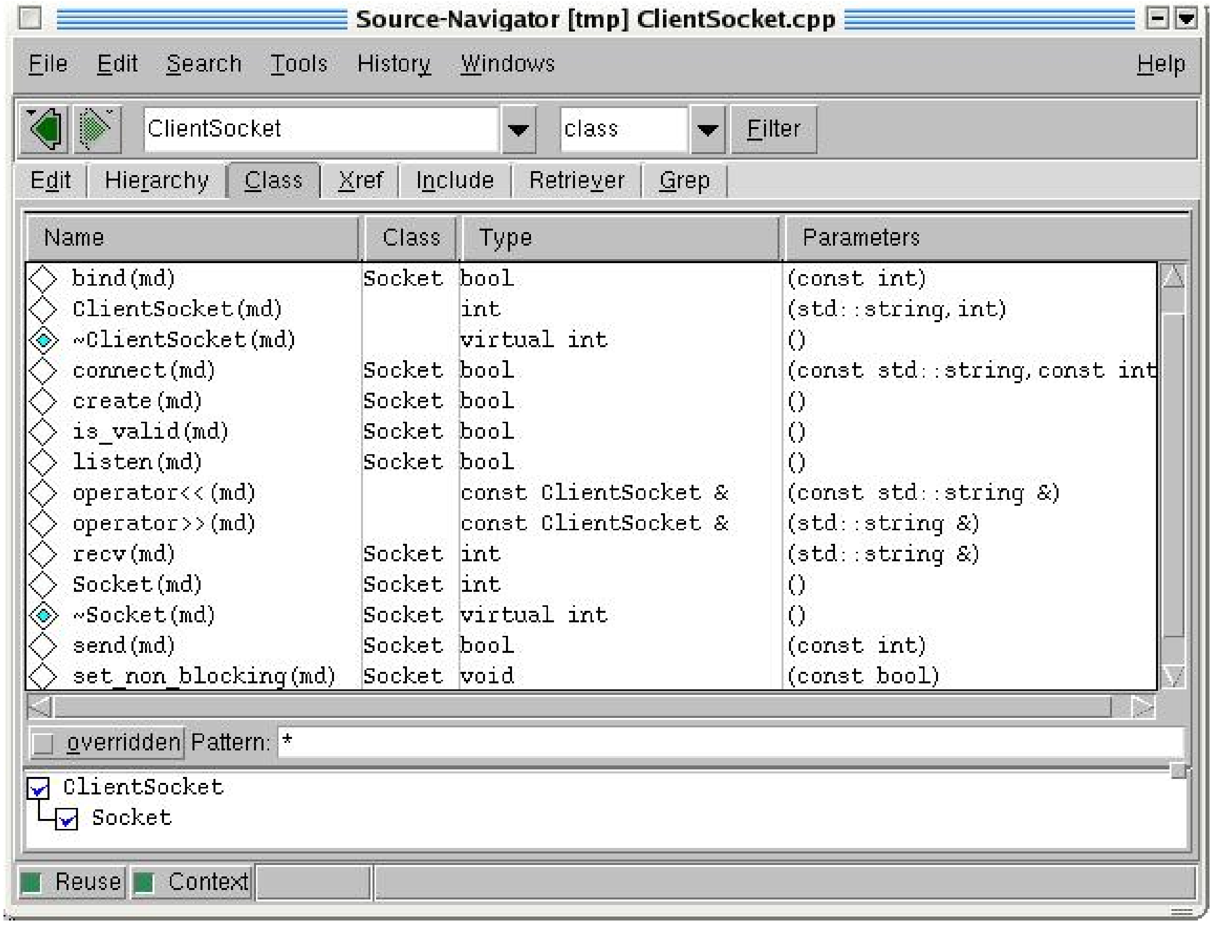

Source-Navigator [tmp] Xref
File Edit Search Tools History Windows Help
Levels 1 Cancel
Edit Hierarchy Class Xref Include Retriever Grep
Reuse Context

```
AstToPrintTreeVisitor(cl)  r printLatex(mi) PrintUtils
                           r printUnicode(mi) PrintUtils
                           r testApplExpr(mi) PrecedenceParenAnnVisitorTest
                           r testAssoc(mi) PrecedenceParenAnnVisitorTest
```

References: [0, 4], AstToPrintTreeVisitor(cl)

## Class window

This interface aggregates all useful information one wishes to know about classes in an object–oriented language. In particular, super– and subclasses are shown, as well as attribute and method names along with their parameters. For a change, the window below shows a C++ `ClientSocket` class which inherits from `Socket` and has quite a few methods. Again, by clicking any of the entries you can open an editor window at the appropriate position.


Source-Navigator [tmp] ClientSocket.cpp
File Edit Search Tools History Windows Help
ClientSocket
class
Filter
Edit Hierarchy Class Xref Include Retriever Grep
Reuse Context

| Name | Class | Type | Parameters |
|---|---|---|---|
| bind(md) | Socket | bool | (const int) |
| ClientSocket(md) | | int | (std::string, int) |
| ~ClientSocket(md) | | virtual int | () |
| connect(md) | Socket | bool | (const std::string, const int |
| create(md) | Socket | bool | () |
| is_valid(md) | Socket | bool | () |
| listen(md) | Socket | bool | () |
| operator<<(md) | | const ClientSocket & | (const std::string &) |
| operator>>(md) | | const ClientSocket & | (std::string &) |
| recv(md) | Socket | int | (std::string &) |
| Socket(md) | Socket | int | () |
| ~Socket(md) | Socket | virtual int | () |
| send(md) | Socket | bool | (const int) |
| set_non_blocking(md) | Socket | void | (const bool) |

overridden Pattern: *

```
☑ ClientSocket
 └☑ Socket
```

## Other alternatives

`cscope` is an interactive, console−screen based C source code browser (it can do `C++`, too). It has some of the functionality of snavigator, a screenshot is here. In fact, it is much older and has been used in many and very big projects. Its homepage is http://cscope.sourceforge.net/. But you need not even go there − it is built into **vim** and can be used in much the way (g)vim is used in combination with `tags`. Simply type in

```
:help cscope
```

in your vim session to check the available options. There are a few derivatives of `cscope`. Freescope is a `cscope` clone which has some added functionality such as symbol completion. There is now also a KDE GUI frontend to cscope called `kscope`, it can be found on http://kscope.sourceforge.net/.

## Conclusions

For anyone involved in at least partly re−engineering or integrating source code, snavigator is a very useful and powerful tool. I once had an older Qt application which unfortunately did not work with the current version of the Qt library. By looking at the error messages and cruising a little with the snavigator, I had soon found out that only the parameter list of one function needed to be changed. Using the click−and−locate functionality, it was possible to bring the entire software package up to date in just a few minutes.