

Programming Proverbs

- 13 Do not recompute constants within a loop
- 14 Avoid implementation-dependent features
- Henry F. Ledgard, “Programming Proverbs: Principles of Good Programming with Numerous Examples to Improve Programming Style and Proficiency”, (Hayden Computer Programming Series), Hayden Book Company, 1st edition, ISBN-13: 978-0810455221, December 1975.

Know your tools

- “a bad workman blames his tools”,
Cambridge Idioms Dictionary
- we will examine:
 - emacs, etags, grep, diff, patch, gcc, gm2, cvs, gdb, git

emacs customisation (\$HOME/.emacs) for ioquake

- ```
;; F5 loads in the .gdbinit file ready for debugging ioqu.
(defun my-find-file-debug ()
 "load a file"
 (interactive)
 (find-file (concat (getenv "HOME") "/Sandpit/ioquake-la
(global-set-key [f5] 'my-find-file-debug)

;; F12 compiles ioquake
(setq compile-command "make")
(defun my-compile ()
 "run the compile command after moving to the correct di.
 (interactive)
 (find-file (concat (getenv "HOME") "/Sandpit/ioquake-la
 (compile compile-command))

;; compile ioquake by pressing
(global-set-key [f12] 'my-compile)

;; F8 moves to the next error in the source file.
(global-set-key [f8] 'next-error)
```

## emacs

- in conclusion you *need* to use an editor which is capable of running gdb, etags and grep.
- there are other candidates codeblocks, kdevelop and elipse.
- however emacs is the most mature and also it can be used for many other activities (other than programming).

## etags

- the etags program is used to create a tag table file, in a format understood by emacs
- it understands the syntax for the following languages:
  - C, Objective C, C++, Java, Fortran, Ada, Cobol, Erlang, LaTeX, Emacs Lisp/Common Lisp, makefiles, Pascal, Perl, Postscript, Python, Prolog, Scheme and most assembler

## Obtaining the modified ioquake tarball

- you will need this to undertake the following tutorial and also the coursework
- open up a terminal and type:

```
$ cd $HOME
$ mkdir -p Sandpit
$ cd Sandpit
$ wget http://floppsie.comp.glam.ac.uk/download/c/ioquake
$ tar xzf ioquake-latest.tar.gz
```

## Running etags

- open up a terminal and change directory to the ioquake-latest directory
- ```
$ cd $HOME/Sandpit/ioquake-latest
$ cd ioquake3
$ etags */*.[ch] */*/*.[ch]
```
- the last command requests etag scan each C .c and .h file in all directories one level below the current
- etags builds an index for every type, function, variable declaration
 - it also builds indices for #define's

Using etags

- now start emacs and press <F5>
- now load in a new file: ^x^f code/server/sv_game.c
- cursor down to the declaration of the function SV_GameSystemCalls
- now continue further and find the call to function SV_CheckRPC
 - place the cursor on top of this function
 - now press <Esc> . <enter>
 - emacs will request you enter the TAGS file, you can delete the last path entry. So the path will match the location where you invoked the etags program
 - ie the path must match ~/Sandpit/ioquake-latest/ioquake3
 - now emacs will now take you to the declaration of SV_CheckRPC

Using etags

- now split the screen into two and continue to follow the function calls
- `updatePy -> testFor -> execFunction`
- now use `etags` to find the function `putPacket`

grep

- or how to find where functions are called
- read the manual page for `grep`
 - this can be done from within `emacs` via `M-x man <enter> grep <enter>`
- return back to the buffer `sv_game.c`
- now type: `M-x grep <enter> putPacket`
`../**/*. [ch] <enter>`
- now you can use the `<F8>` key to move to the next occurrence of `putBuffer`

grep

- the previous `grep` command was instructed to find all occurrences of `putPacket` in all `C .c` and `.h` files and output these findings in an `emacs` compatible format

diff and patch

- read the manual pages for `diff` and `patch`
- see if you can do this from within `emacs`

diff and patch

- now switch to the `sv_game.c` buffer and split the screen into two
- move to the top of the `sv_game.c` and mark this position `<ctrl><space>`
- now move to the end of the buffer and copy the whole file into the yank buffer `<esc>w`
- move to the other window `^xo` and open up a new file `^x^f sv_game.c-test`

diff and patch

- now yank the internal buffer into this file `^y`
- now make a single line change (maybe just add your name in a comment)
 - anywhere in the file
- save the file `^xs`

diff and patch

- now make `emacs` run the bash shell via `M-x shell` `<enter>`
- and type:
- ```
$ diff sv_game.c sv_game.c-test
```
- note the output

**diff and patch**

- `diff`'s are a useful method of transferring textual changes and posting changes to co-developers
- nearly all free software/open source projects operate on this principle
  - this has had a major impact on keeping these free software/open source projects highly portable
- give the flexibility of `diff` and `patch` it is often possible to apply textual patches to later releases of the same project
  - not always, and sometimes a few *hunks* require fixing

## diff and patch

- in the early days of free software projects were maintained by creating patches and diffs by hand
- fortunately now there are tools which perform most of this automatically
  - and coordinate all the source files in a project
- these are content management systems such as:
  - cvs, git, svn

## diff and patch

- [svn or subversion](http://subversion.tigris.org/) `<http://subversion.tigris.org/>`
- [git](http://git-scm.com/) `<http://git-scm.com/>`
- [cvs](http://www.nongnu.org/cvs/) `<http://www.nongnu.org/cvs/>`
- we will be concentrating on `git` as it is used by the `ioquake3` project

## git

- open up a terminal and type in the following:
- ```
$ mkdir -p $HOME/Sandpit/ioquake3-git
$ cd $HOME/Sandpit/ioquake3-git
$ git clone git://github.com/ioquake/ioq3.git
```
- these commands create a new directory `$HOME/Sandpit/ioquake3-git` and change your current working directory to this location
- finally it checks out the latest copy of the development version of `ioquake3`

git

- now type:
- ```
$ cd ioquake3
$ make
```
- this builds the latest `ioquake3`
- you should be able to run this by typing:
- ```
$ ./build/debug-linux-x86_64/ioquake3.x86_64
```



- run it, load up the level `pom_bots` and play against alien or legoman
- take note at the smoke and blood when using the grenade launcher and the rocket launcher



- now open up another terminal and type:

```
$ cd $HOME/Sandpit/ioquake-latest/ioquake3
$ ./compilequake
$ ./build/debug-linux-x86_64/ioquake3.x86_64
```

- run it, load up the level `pom_bots` and play against alien or legoman
- take note at the smoke and blood when using the grenade launcher and the rocket launcher



- open up another terminal and type:
- ```
$ cd $HOME/Sandpit/ioquake-latest/ioquake3
$ svn diff
```
- this will yield the code changes which were made in order that the blood, smoke, gibbs and Python bot work

## Tutorial work

- see if you can create a patch set from the modified `ioquake3` which can be applied to the `ioquake3-svn` tree
- hint you need to capture the `diff`'s and use `patch` to apply them
  - however you also need to make copies of some new files which are not in the `svn` tree
- the new files can be found by typing:

```
$ cd $HOME/Sandpit/ioquake-latest/ioquake3
$ svn status
```

## Tutorial

- read through the code:
 

```
$HOME/Sandpit/ioquake-latest/python-
bot/bot-
legoman/botfiles/bots/legoman.py
$HOME/Sandpit/ioquake-latest/python-
bot/bot-
legoman/botfiles/bots/botlib.py
$HOME/Sandpit/ioquake-
latest/ioquake3/code/botlib/be_ai_py.[ch]
$HOME/Sandpit/ioquake-
latest/ioquake3/code/botlib/be_ai_char.c
```

 also read the directed reading at the end of lecture 0

## gdb

- GNU debugger
  - online documentation is available [here](http://sourceware.org/gdb/current/onlinedocs/gdb) (<http://sourceware.org/gdb/current/onlinedocs/gdb>).
- read the
  - summary
  - sample session
  - GDB commands and
  - stopping and continuing

## Debugging ioquake3

- you will need two computers, side by side
- on the left computer log in, open a terminal and change directory to ioquake-latest
- ```
$ cd $HOME/Sandpit/ioquake-latest/ioquake3
```
- and start the debugging version of ioquake3 under the debugger

Debugging ioquake3

- ```
$./debugquake
```
- at this point the debugger (GDB) is split into two
  - the server is manipulating ioquake3
- the GDB client will be controlled by you

## Debugging ioquake3

- on the right computer login and start emacs
  - maximise it to its rightful size, full screen
  - press F5

## Debugging ioquake3

- the first line requires modifying, change `localhost` for the FQDN of the computer running `ioquake3` under the debugger
- you should be given a GDB prompt
  - now type
- ```
(gdb) cont
```
- and debug the `ioquake3` as you would debug an ordinary binary
 - there are a few differences
 - never type `run`
 - and always finish the debugging session by typing `quit`