

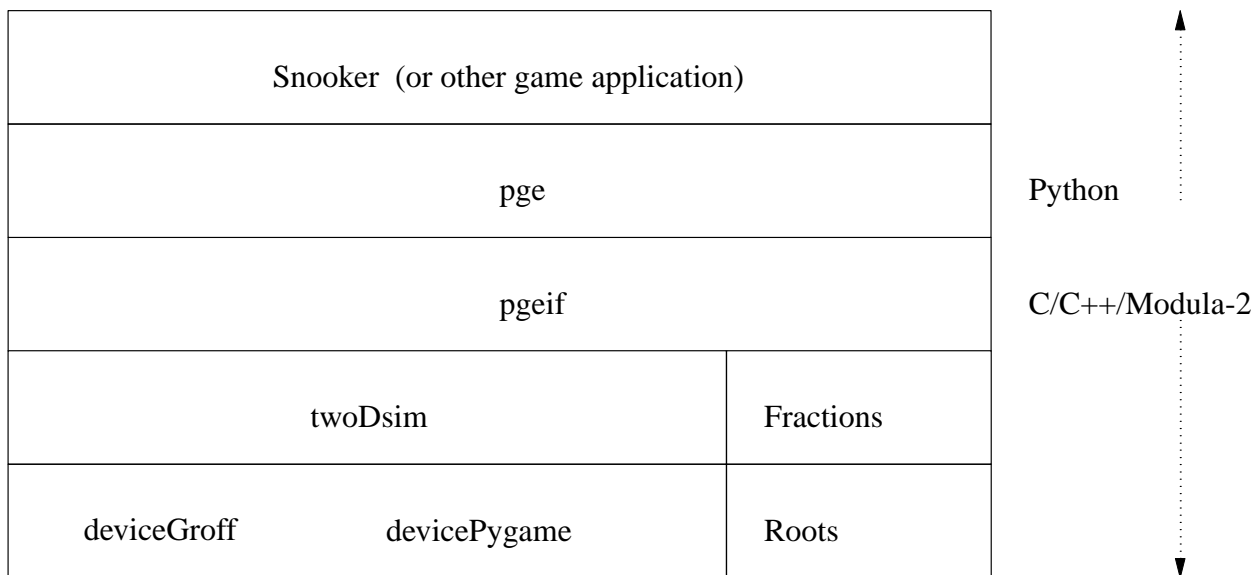
# Programming Proverbs

- 15. “Avoid tricks.”
- 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.

## Internals of PGE (Python)

- during this lecture we will start to look at the internals of PGE
- we will concentrate on the Python module `python/pge.py`
- we can see that this sits near the top of the various software levels of our game

# Internals of PGE (Python)



## pge.py

- in the last lecture we saw how foreground and background objects are maintained in `python/pge.py`
- we also saw how objects were created and are checked at runtime for type consistency
- in this lecture we will examine how integrates with Pygame

## Obtaining the source to pge

- open up and command line terminal and type:

```
$ mkdir -p $HOME/Sandpit  
$ cd $HOME/Sandpit  
$ apt-get source --allow-unauthenticated pge
```

- the files for the pge package will be available in pge-2.0.0

## Source directory structure of the pge package

- the key directories are:
- `pge-2.0.0/c`
  - C source code
- `pge-2.0.0/m2`
  - Modula-2 source code
- `pge-2.0.0/i` swig interface (PGE API definition)
- `pge-2.0.0/python`
  - python code, (`pge.py` and Python tools, such as `pgeplayback` and `max2code`)

## Key configuration files

- `pge-2.0.0/configure.ac`
  - source code for the classic `configure` command
  
- `pge-2.0.0/Makefile.am`
  - source code for `Makefile` in the top directory of the build tree
  
- `pge-2.0.0/c/Makefile.am`
  - source code for `c/Makefile` in the build directory
  
- `pge-2.0.0/m2/Makefile.am`
  - source code for `m2/Makefile` in the build directory

## Building pge from source

- you can choose either Modula-2 or C

```
$ cd $HOME/Sandpit  
$ mkdir -p build-pge  
$ cd build-pge  
$ ../pge-2.0.0/configure --enable-langc  
$ make
```

- in this case the pge package is built from > 90% of C source files



## Testing your build

- one simple test is to run the trapped example

```
$ cd $HOME/Sandpit/build-pge  
$ PYTHONPATH=. python ../pge-2.0.0/examples/trapped/trapped.py
```

## Revisiting `pge-2.0.0/python/pge.py`

- a potential problem surfaces during the development of pge and its integration with Pygame
- Pygame controls the input sources: keyboard, mouse, joystick
  - and output devices, screen, audio etc
- internally Pygame uses an event queue on which all input events (keypress, mouse button press) are posted
- events are meant to be read by the Pygame user application code

## Revisiting pge-2.0.0/python/pge.py

- in order for PGE to be integrated with Pygame we need to ensure that
  - a program does not block waiting for an input event
- otherwise the physics engine will be starved from updating itself in real time

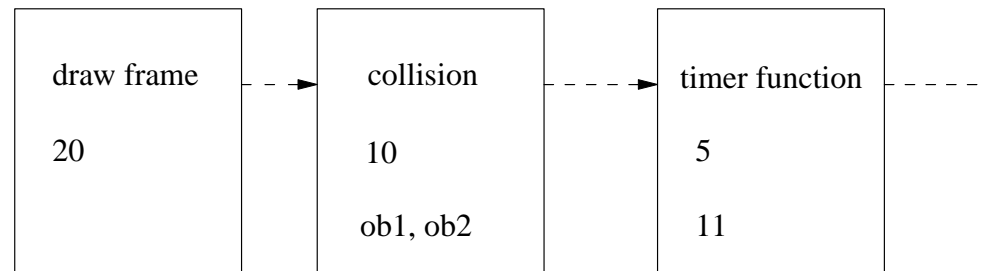
## The PGE event queue

- internally pge also maintains an event queue (different from the Pygame event queue!)
  
- the pge event queue is a time ordered list of future events
  - each event predicting what will happen in the future
  - it might be a draw frame event
  - or a collision event
  - or a timer activation event
  
- `pge-2.0.0/python/pge.py` coordinates the pge event queue and also the Pygame event queue (input source)

# The PGE event queue



Relative event Q



- notice the different kinds of events
  - relative time ordered
- although there might be another collision event at, say, time  $(20+10+1)$  31 there is no point predicting it as the event at time 30 might change the world

## pge-2.0.0/configure.ac

- is the source file which builds the file `pge-2.0.0/configure`
- it is written in a language called `autoconf` which is compiled into a portable shell script
- `autoconf` allows you to specify dependancies such as the build machine must have certain tools: `awk`, `cpp`, `c++` and `make`
  - and the build machine must also have the `-lpth` library
- it also allows you to add extra configuration arguments
  - ie pge can be built using C sources, or built from Modula-2
  - and one can enable maintainer mode (dont do this unless you know what you are doing!)

## Example sections of pge-2.0.0-configure.ac

```
AS_MKDIR_P(c)
AS_MKDIR_P(m2)
AS_MKDIR_P(python)

LT_INIT
...
AC_ARG_ENABLE([maintainer],
[ --enable-maintainer      Turn on maintainer],
[case "${enableval}" in
  yes) maintainer=true ;;
  no) maintainer=false ;;
  *) AC_MSG_ERROR([bad value ${enableval} for --enable-maintainer]) ;;
esac],[maintainer=false])
AM_CONDITIONAL([MAINTAINER], [test x$maintainer = xtrue])
...

AC_HAVE_LIBRARY(-lpth)
AC_SUBST([langm2])
AC_SUBST([langc])
AC_SUBST([maintainer])
```

## Example sections of pge-2.0.0-configure.ac

- we can see that `autoconf` allows us to use a library of routines  
`AS_MKDIR_P`
- and also we can create our own code to drive an option in rule  
`AC_ARG_ENABLE`