

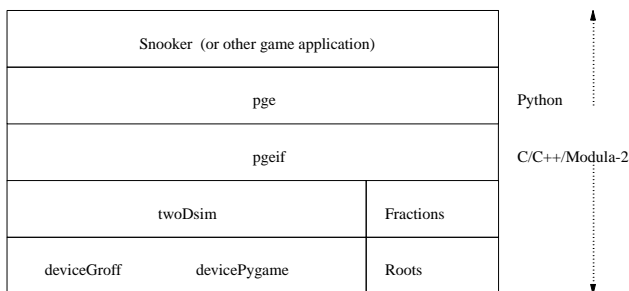
Internals of PGE (Python)

- 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

slide 3
gatus

Internals of PGE (Python)

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slide 4
gatus

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-2.0.1

## Source directory structure of the pge package

- the key directories are:
  - pge-2.0.1/c
    - C source code
  - pge-2.0.1/m2
    - Modula-2 source code
  - pge-2.0.1/i swig interface (PGE API definition)
  - pge-2.0.1/python
    - python code, (pge.py and Python tools, such as pgeplayback and max2code)

## Key configuration files

- pge-2.0.1/configure.ac
  - source code for the classic configure command
- pge-2.0.1/Makefile.am
  - source code for Makefile in the top directory of the build tree
- pge-2.0.1/c/Makefile.am
  - source code for c/Makefile in the build directory
- pge-2.0.1/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-2.0.1/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-2.0.1/examples/trapped/trapp
```

Revisiting pge-2.0.1/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-2.0.1/python/pge.py

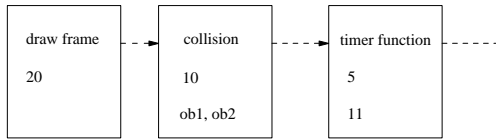
- in order for PGE to be integrated with Pygame we need to ensure that
 - a program does not block waiting for an input event
- otherwise the physics engine will be starved from updating itself in real time

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-2.0.1/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-2.0.1/configure.ac

- is the source file which builds the file `pge-2.0.1/configure`
- it is written in a language called `autoconf` which is compiled into a portable shell script
- `autoconf` allows you to specify dependencies 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-2.0.1-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])
  
```

- 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`

Example sections of pge-2.0.1-configure.ac