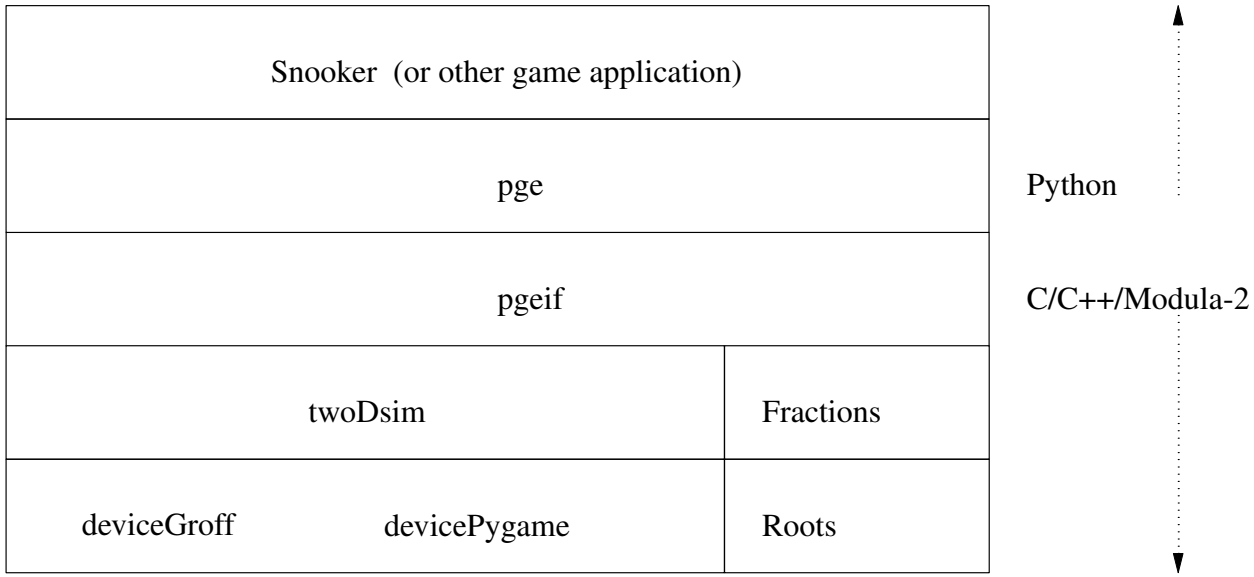
# John Romero Programming Proverbs

- John Romero, “The Early Days of Id Software - John Romero @ WeAreDevelopers Conference 2017”

# Internals of PGE (Python)

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

# Internals of PGE (Python)



# What does pge.py provide?

- for full details see the section PGE Python API ⟨`http://floppsie.comp.glam.ac.uk/Southwales/gaius/pge/homepage.html`⟩ in the online documentation

- it provides the ability for users to create the following objects
  - colour
  - circle
  - polygon
  - text

# What does pge.py provide?

- circle, polygon and text objects appear on the screen at a position
  - they are also given a level

- only objects at level 0 are handled by the physics engine
  - objects declared at any level < 0 are in the background
  - objects declared at any level > 0 are in the foreground

- all objects are drawn in level order

# What does pge.py provide?

- `pge.py` front ends the object creation
- it creates a Python object for the `circle`, `polygon`, `colour` and `text` objects
  - the `pge.py` object contains a `type` field which is set to one of: `colour_t`, `box_t`, `circle_t`, `fb_box_t`, `fb_circle_t` or `fb_text_t`
- it then checks the parameters to methods in `pge.py` to ensure that users to not try and create a polygon of colour circle!

# What does pge.py provide?

```
#
#  text - place text string, s, at position [x, y] in colour, c.
#         The size will be in font size and placed in the
#         foreground or background depending upon level.
#         You are not allowed to place text in level zero.
#

def text (x, y, s, c, size, level):
    global device, screen
    c._param_colour ("fourth parameter to text is expected to be a colour")
    if level == 0:
        _errorf ("not allowed to place in level 0")
    else:
        ob = object (fb_text_t, \
                  [x, y, s, size, c._get_pgeif_colour ()], c, level)
        _add (ob, level)
    return ob
```

# What does pge.py provide?

- `pge.py` will check to see that users do not try and assign velocity or acceleration to fixed objects

- and ensure that the object still exists

# What does pge.py provide?

```
#
#  velocity - Pre-condition:  an circle or polygon object
#             which is not fixed and exists at level 0.
#             Post-condition:  assign the velocity (vx, vy)
#             to this object.
#
def velocity (self, vx, vy):
    self._check_type ([box_t, circle_t], "assign a velocity to a")
    self._check_not_fixed ("assign a velocity")
    self._check_not_deleted ("a velocity")
    self.o = self._check_same (pgeif.velocity (self.o, vx, vy))
    return self
```

# Managing foreground/background and the physics engine

- `pge.py` coordinates the foreground, background and physics engine
- a foreground and background circle is never seen by the physics engine
- it is managed locally in `pge.py` and Pygame
- foreground/background objects have the `type` field set to: `fb_circle_t`, `fb_box_t` or `fb_text_t`

# Managing foreground/background and the physics engine

```
#
#  circle - place a circle at coordinate (x, y)
#           The circle has a radius, r, and is filled with colour, c.
#           If the level == 0 it is placed into the physics engine.
#           A level < 0 is placed into the background.
#           A level > 0 is placed into the foreground.

def circle (x, y, r, c, level = 0):
    c._param_colour ("fourth parameter to box is expected to be a colour")
    if level == 0:
        id = pgeif.circle (x, y, r, c._get_pgeif_colour ())
        ob = object (circle_t, id, c, level)
        _register (id, ob)
    else:
        ob = object (fb_circle_t, [x, y, r, c._get_pgeif_colour ()], c, level)
        _add (ob, level)
    return ob
```

# Automatic PGE API documentation

- notice the naming convention, most of the internal methods have an underscore prefixed to them

- this allows for the internal methods to be excluded from documentation when it is automatically built
  - by `pge/tools/py2html.py`
  - this utility generates the API documentation from the comments prior to the method definition
  - it creates a subsection for each method
  - and a function index into the documentation

# Managing foreground/background and the physics engine

```
#
#  circle - place a circle at coordinate (x, y)
#           The circle has a radius, r, and is filled with colour, c.
#           If the level == 0 it is placed into the physics engine.
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def circle (x, y, r, c, level = 0):
    c._param_colour ("fourth parameter to box is expected to be a colour")
    if level == 0:
        id = pgeif.circle (x, y, r, c._get_pgeif_colour ())
        ob = object (circle_t, id, c, level)
        _register (id, ob)
    else:
        ob = object (fb_circle_t, [x, y, r, c._get_pgeif_colour ()], c, level)
        _add (ob, level)
    return ob
```

# Managing foreground/background and the physics engine

- notice the calls to `_register` and `_add`
- the function `_add` adds the object to the appropriate background/foreground level

# Managing foreground/background and the physics engine

```
#
#  _add - adds an object at foreground/background, level.
#         A level value of > 0 will be placed into the foreground.
#         A level value of < 0 will be placed into the background.

def _add (ob, level):
    global foreground, background, levels

    if level > 0:
        if not (level in foreground):
            foreground += [level]
            foreground.sort ()
    else:
        if not (level in background):
            background += [level]
            background.sort ()
    if levels.has_key (level):
        levels[level] += [ob]
    else:
        levels[level] = [ob]
```

# Managing foreground/background and the physics engine

- here there are three main data structures
- `foreground` and `background` are lists which contain integer values of active levels
  - the integers are sorted in order
- the dictionary `levels` which uses an integer key to lookup a list of objects

# _draw_foreground

```
#
#  _draw_foreground - draws all the foreground objects in order.
#

def _draw_foreground ():
    if foreground != []:
        for l in foreground:
            for o in levels[l]:
                o._draw ()
```

# Conclusion

- during this lecture we have started to look at the internals of PGE by concentrating on the Python module `pge.py`
- we have seen how basic objects are created and how parameters are checked and how foreground/background of objects are maintained