

Lab – PlanetWars Bots

Download the PlanetWars code from the learning material area of blackboard. Extract to your favourite work location. In this lab we will create a basic bot for the PlanetWars simulator. In a later spike you will extend on this work to create your own bots that exploit tactical analysis details.

To run the game, open a command window and change to the directory where the PlanetWars code is located. Provided Python and the PATH are set correctly, we run the main.py as follows.

```
➤ python main.py
```

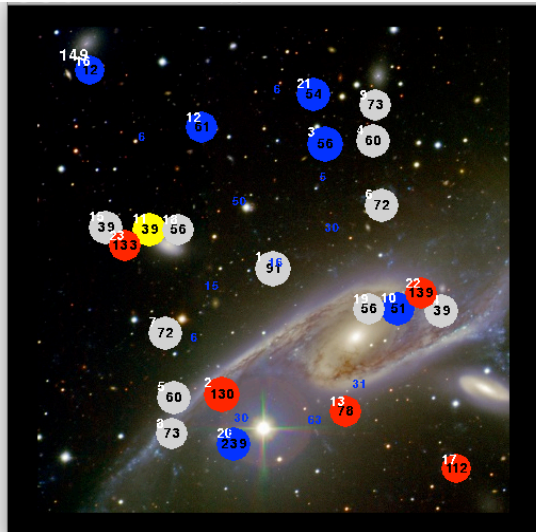


Fig 1: Game in progress showing full view

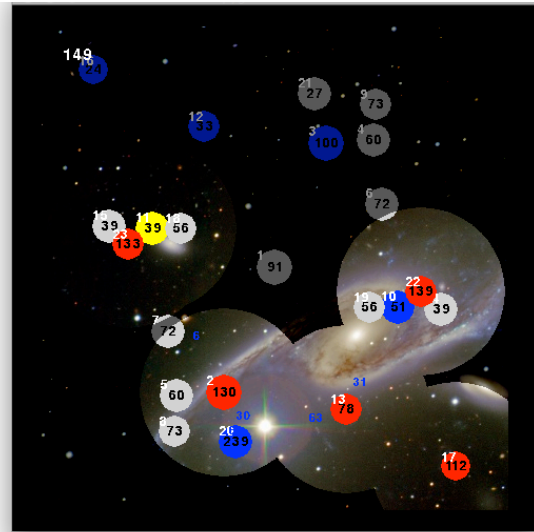


Fig 2: Red player's façade view of the game

Figures 1 and 2 show a game in progress with different views. The game starts “paused” and can either be “stepped” by pressing the “N” key or un-paused by pressing the “P” key. Frame-rate can be changed by pressing the “-” or “+” keys. There are various viewing options: “[” and “]” cycle through different player views, “A” gives the original all player view, and “L” cycles through different planet value types (id, num_ships, vision_age).

PlanetWars Architecture

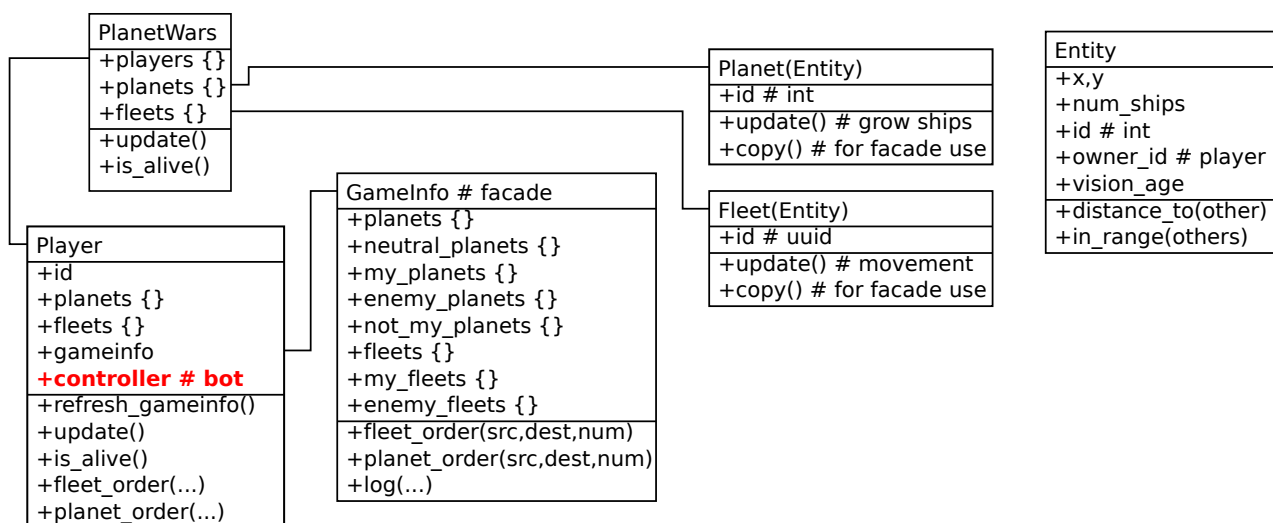


Fig 2. Simplified UML diagram of the PlanetWars architecture, showing major classes and composition. Note the bold red text indicating where bot code instance is used.

PlanetWars Files

```
main.py          # run this — the game loop
planet_wars.py   # PlanetWars class
entities.py      # Entity, Planet, Fleet classes
players.py       # GameInfo, Player
bots/            # Bot controllers
    Blanko.py
    OneMove.py
    Rando.py
    ...
maps/*.txt       # Planet map files
logs/*.log       # Battle logs
```

Controller Bot's

In Figure 3 you can see that each player has a “controller” bot instance. A bot is a simple Python class (it does not need to inherit from anything) with a single “update” method.

To create a bot you simply need to create a Python file in the bots folder, which contains a single class with the update method. The bot's class name much match **exactly** the Python file name. Take care - CaSe MaTTeRs!

Each game “step” of a PlanetWars game instance happens in its `update()` method, which in turn calls each players `update()`, which then refresh their `GameInfo` façade object and pass it to their bot controller via the update method. The `GameInfo` instance also has two function which are used to issue “orders” (which the game may or may-not do depending on game rules).

```
class MyNewBot(object):
    def update(self, gameinfo):
        # ... decide on src and dest ...
        gameinfo.planet_rder(src, dest, num_ships) # launch fleet from planet
        gameinfo.fleet_order(src, dest, num_ships) # launch fleet from fleet
```

The `GameInfo` instance is given to the bot controller as a “façade” object. It contains a copy of all the current information the player can have about the game space, limited by a “fog of war”.

Task 1: Familiarisation

Run the simulation and become familiar with the operation and output. The default bots are `Blanko` and `OneMove`. `Blanko` is a “blank” bot (with lots of comments to help new bot creators) that has, as the name implies, a “blank” update method. The `OneMove` bot has a very simple way of selecting a source planet, a target planet and then launching a fleet.

Task 2: Making A Random Bot

We will be creating a new “random” based bot. Create a new Python file called `Rando.py` and save it in the bots directory. Paste the following skeleton code into the file to start with.

```
from random import choice

class Rando(object):

    def update(self, gameinfo):
        pass
```

Test it! Edit `main.py` so that one of the players now uses your “Rando” bot. (If you want to, use `print` to check that your bot is being called, or to print out some of the information you being given with the `GameInfo` object. The `random` import of `choice` is for later.

In this bot, we will only launch one fleet at a time. It's simple, but it works, and it's actually how many (new) human players approach similar games.

So, add the following code to check if we have any currently moving fleets.

```
# only send one fleet at a time
if gameinfo.my_fleets:
    return
```

Time to attack! The basic design is this:

1. Make sure we have a planet we can launch a fleet from. (Do you know why is this?)
2. Make sure there is at least one planet to attack! (Again, make sure you know why this is.)
3. Select a random source planet from the planets we have (my_planets).
4. Select a random target planet from the planets that are not in our control (not_my_planets).
5. Launch a fleet if the source planet has more than 10 ships.
6. Only launch 75% of the ships available from the source planet.

Here's one way to do all that:

```
# check if we should attack
if gameinfo.my_planets and gameinfo.not_my_planets:
    # select random target and destination
    dest = choice(list(gameinfo.not_my_planets.values()))
    src = choice(list(gameinfo.my_planets.values()))
    # launch new fleet if there's enough ships
    if src.num_ships > 10:
        gameinfo.planet_order(src, dest, int(src.num_ships * 0.75) )
```

Task 3: Finding the Best and Worst

In order to take this further you will want to sort through available planets or fleets: this is the heart of any tactical analysis. You can use a for loop and check each of the planet (or fleets) in a list and check it's values for the strongest or weakest.

However there are two nice features in Python that make this type of "search" a concise one line of code. They are the min/max functions, and lambdas. (If you are not familiar with the ideas, it may not seem "simpler" at first, but with experience it is considered clearer.)

```
src = max(gameinfo.my_planets.values(), key=lambda p: p.num_ships)
```

Don't get it? Ask your peers or staff – it's worth knowing! ☺

```
# Find a target planet with the minimum number of ships.
dest = min(gameinfo.not_my_planets.values(), key=lambda p: p.num_ships)

# OR, (alternatively), use an inverse proportional maximum search...
dest = max(gameinfo.not_my_planets.values(),
            key=lambda p: 1.0 / (1 + p.num_ships))
```

Now what? Try it, vary it! Create a new bot, add this and use it.

Extensions

Where to from here? Spikes! Perform tactical analysis (using what you know about how to get the "best" and "worst" planets) and then exploit it. *Battle it out! Add a defence mode ... avoid long fleet travel ... scout ... look for weakness ...*

Save your work for use later!