



I2P(II) Project 2: Tower Defense

Deadline: 6/6 11:59^{am}

Slides from TA 許陸崑

Edited by Po-Chih Kuo

Before we start

- You should have finished installing Allegro5 and set up your IDE on your own computer last semester in I2P course.
- If you did not take the course, see the Tutorial and videos.
(<https://github.com/j3soon/Allegro5Template>)
- Our template requires Allegro5 and C++11 and you should compile and run the template successfully beforehand.

About MiniProject2

- A tower defense game as *Plants vs. Zombies*.
- You'll get an incomplete package with bugs.
- Hackathon(Stage 1): Fix the bugs and incompleteness.
- MiniProject2 (Stage2): Add new features to the game (e.g. the turret can be destroyed).
- Please fully understand this package, because you will be asked questions during demo (6/6).



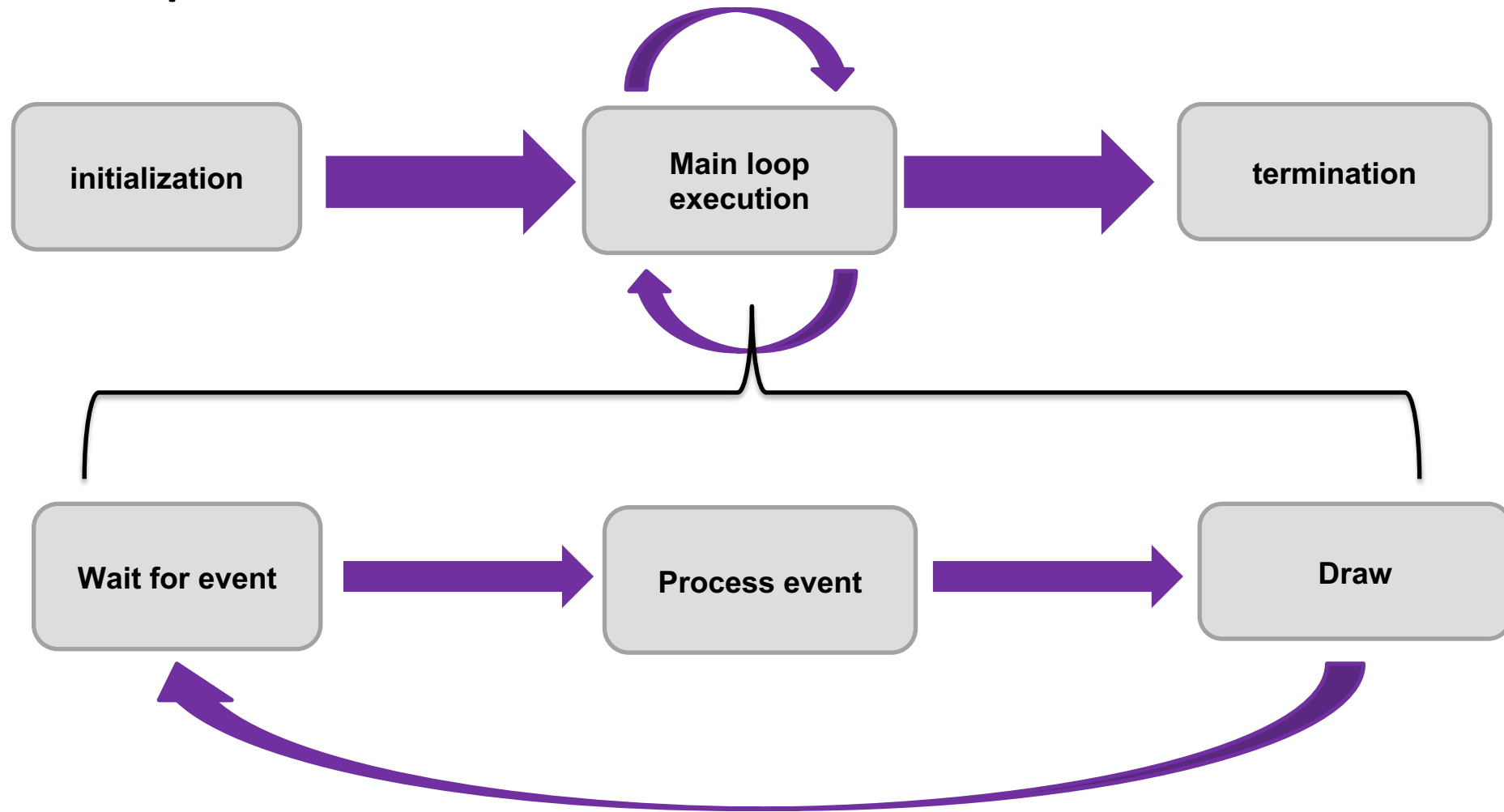
Outline

- Allegro5 game development process
- Core
 - Condition-StartScene
 - Condition-StartScene-label
 - Condition-StartScene-ImageButton
 - Condition-StartScene-lscene
 - Condition-Scene-Extension
- Game code

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Main process:



Core process:



It mainly consists of two parts.

1. Event → keyboard , mouse , timer...etc
2. Draw → object painting

Simple Code

```
int main()
{
    int error=0;

    error=game_init();
    if(error!=0)return error;

    error=game_run();
    if(error!=0)return error;

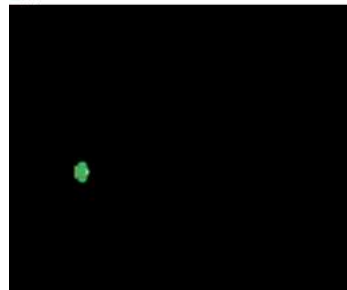
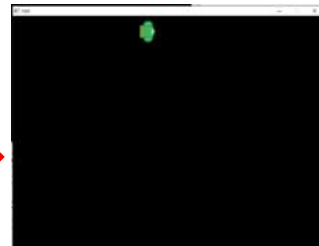
    error=game_destory();
    if(error!=0)return error;

    return 0;
}
```

```
int game_msg(){

    al_wait_for_event(queue,&my_event);
    switch (my_event.keyboard.keycode) {
        case ALLEGRO_KEY_DOWN:
            direction = 0;
            break;
        case ALLEGRO_KEY_UP:
            direction = 1;
            break;
        case ALLEGRO_KEY_LEFT:
            direction = 2;
            break;
        case ALLEGRO_KEY_RIGHT:
            direction = 3;
            break;
        default:
            break;
    }
    return 0;
}
```

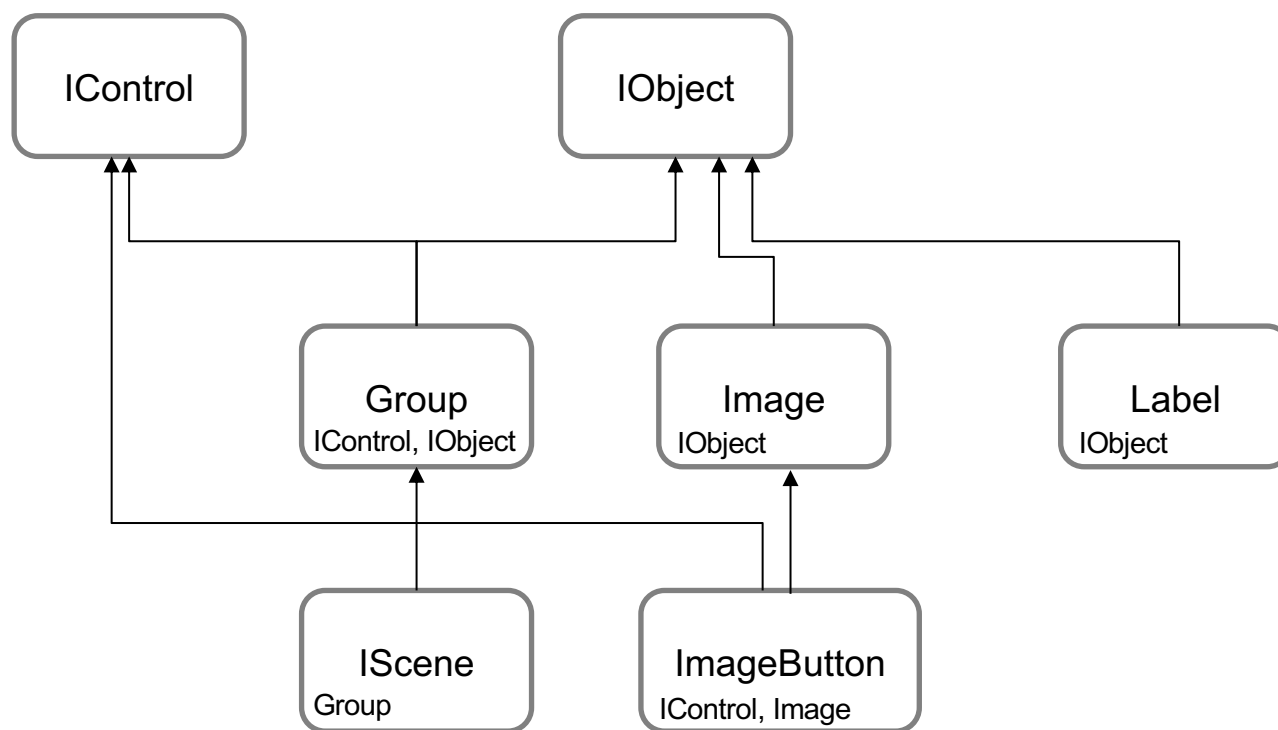
```
int game_render(){
    //用指定的颜色填充屏幕
    al_clear_to_color(al_map_rgb(0,0,0));
    al_draw_tinted_scaled_rotated_bitmap(bmp, al_map_rgba(255, 255, 255, 255), 32, 32,
                                         x, y, 1,1, 0, 0);
    al_flip_display();
    return 0;
}
```



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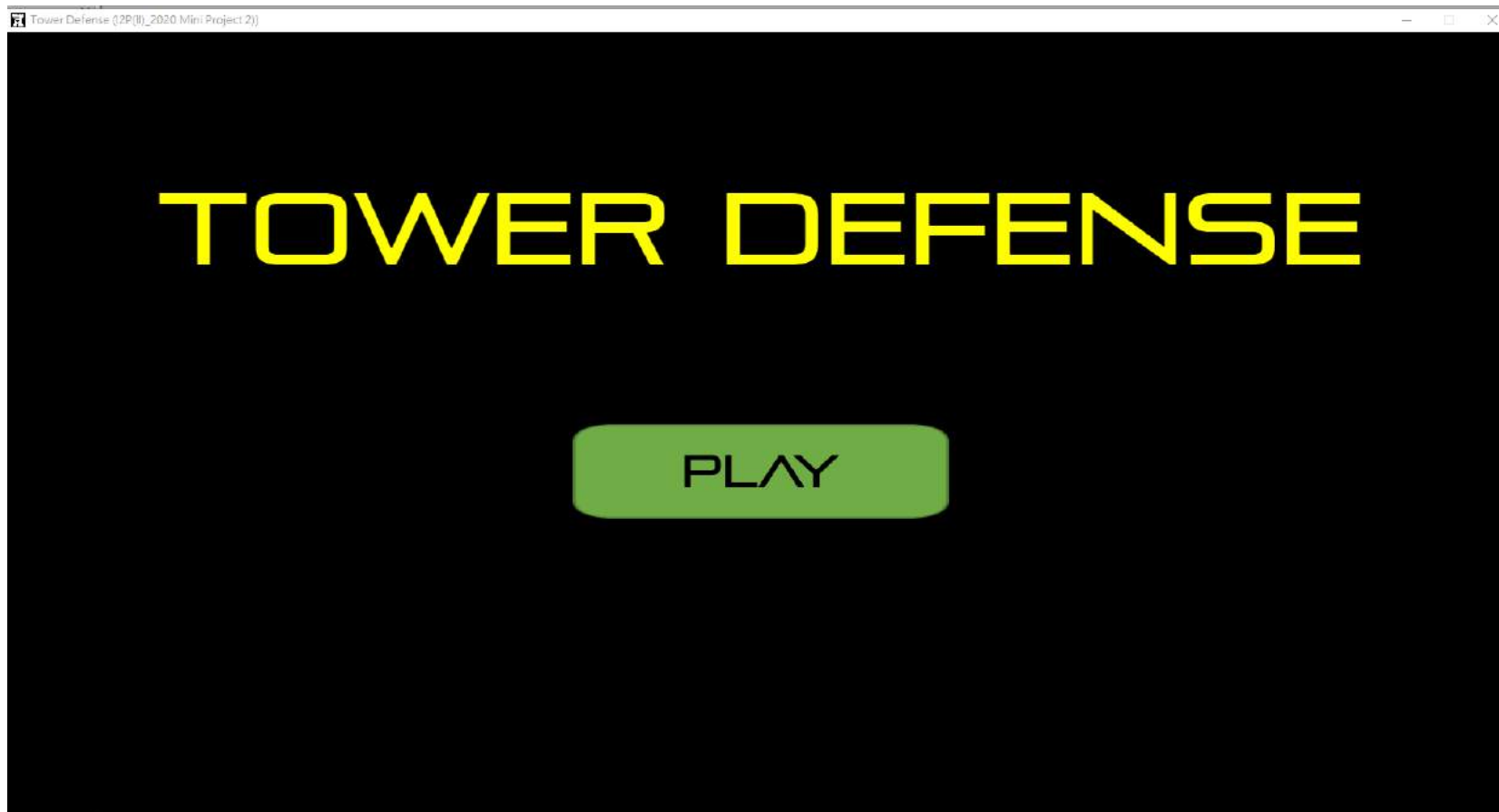
Core

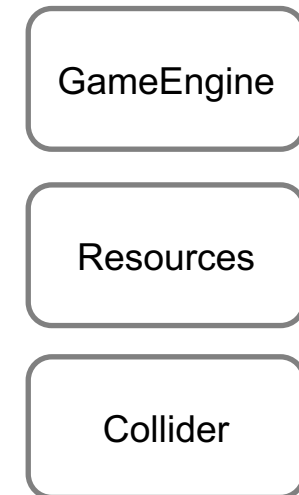
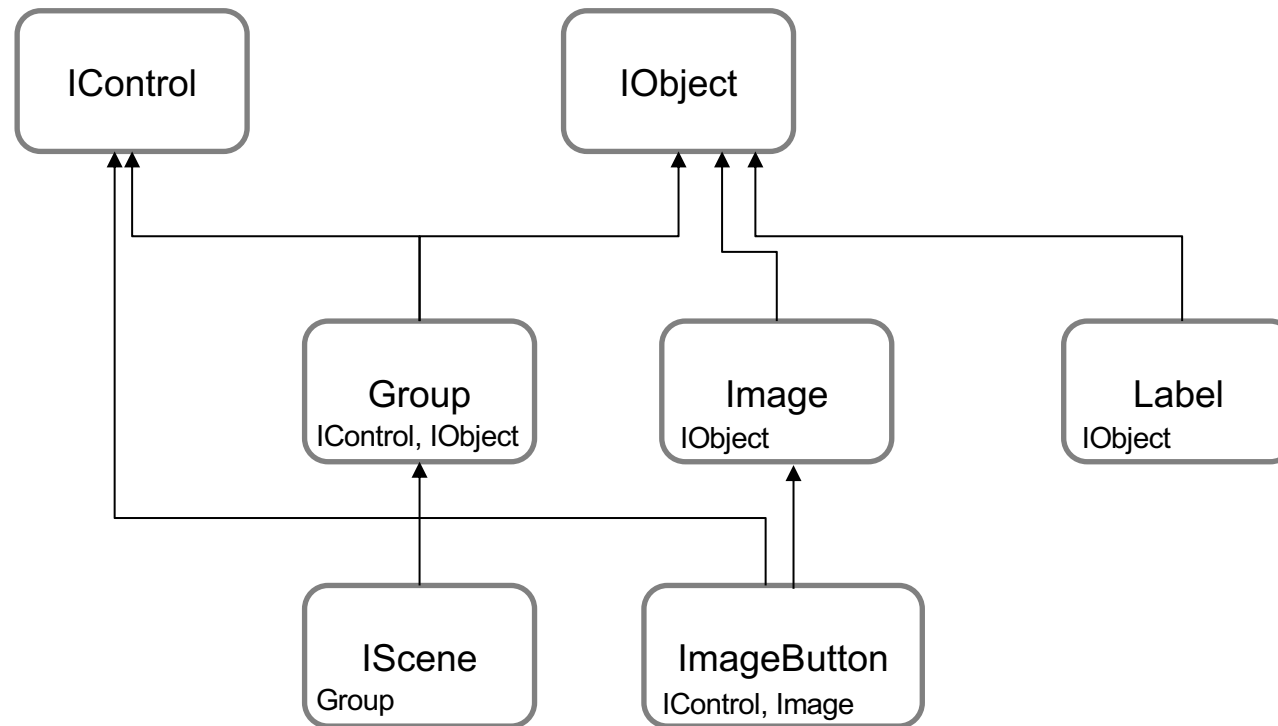


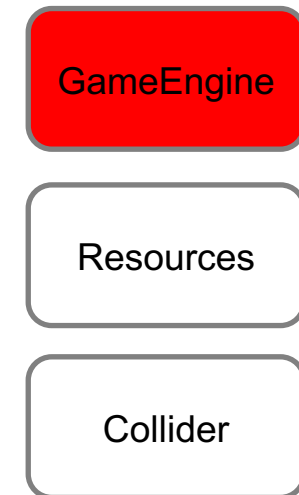
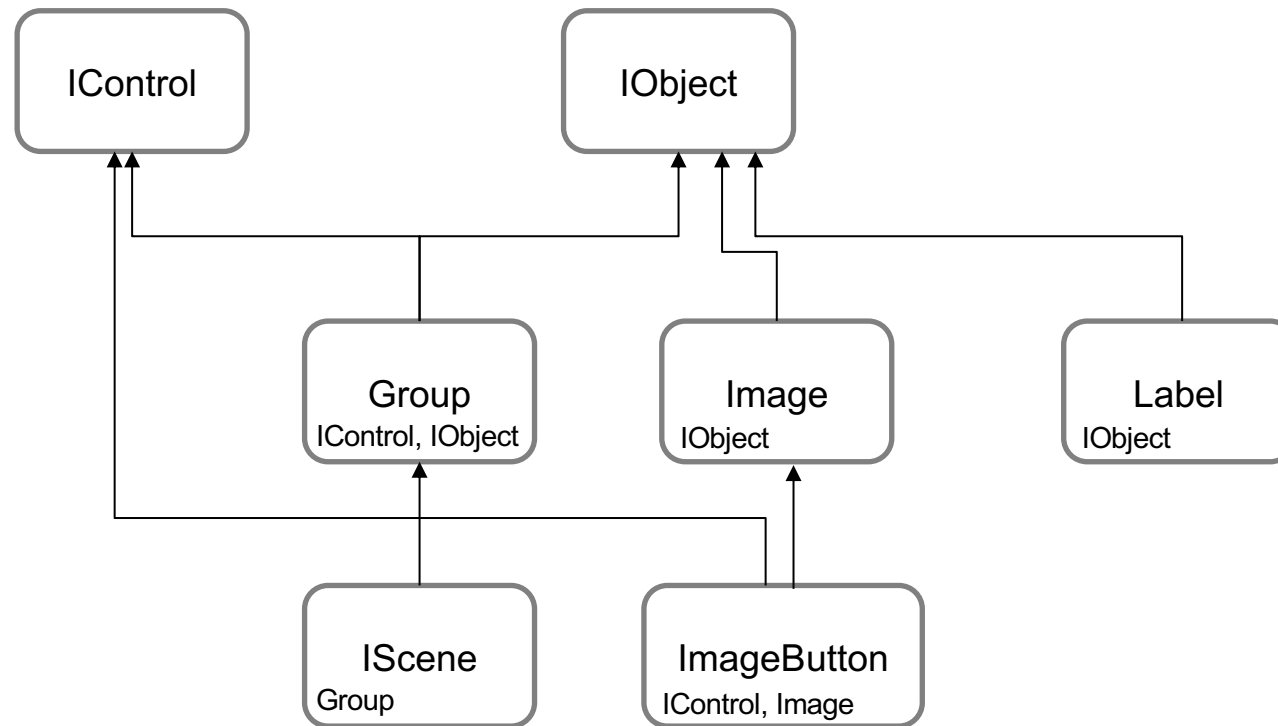
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Condition -StartScene

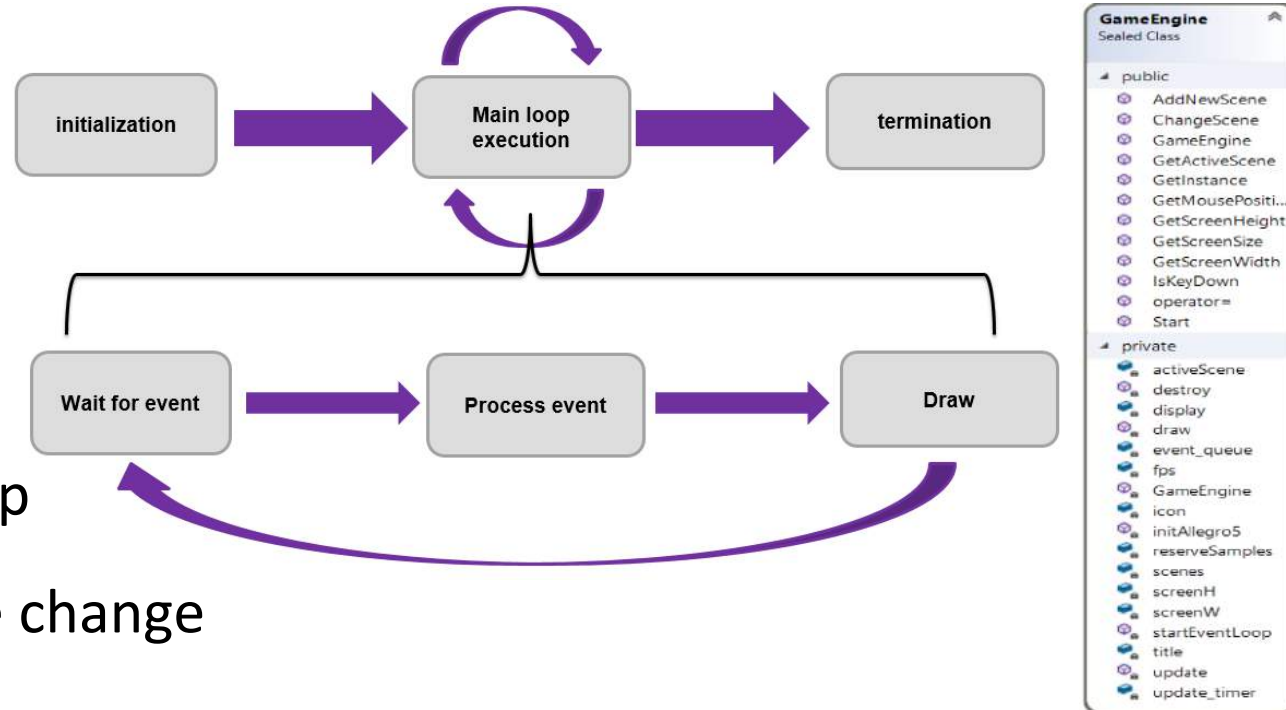




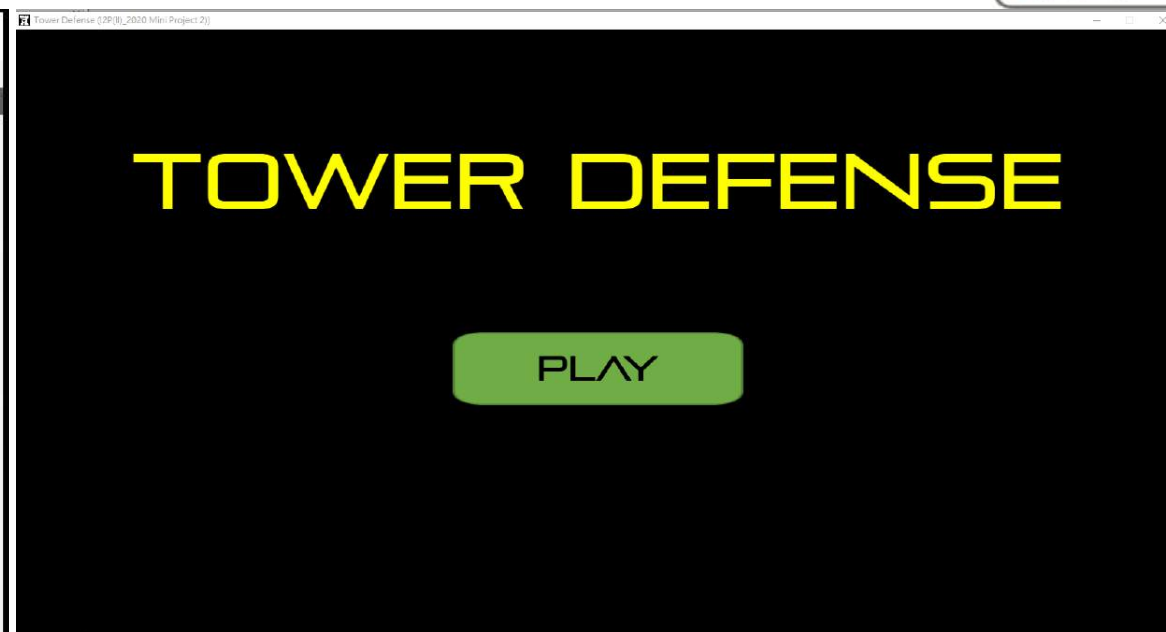


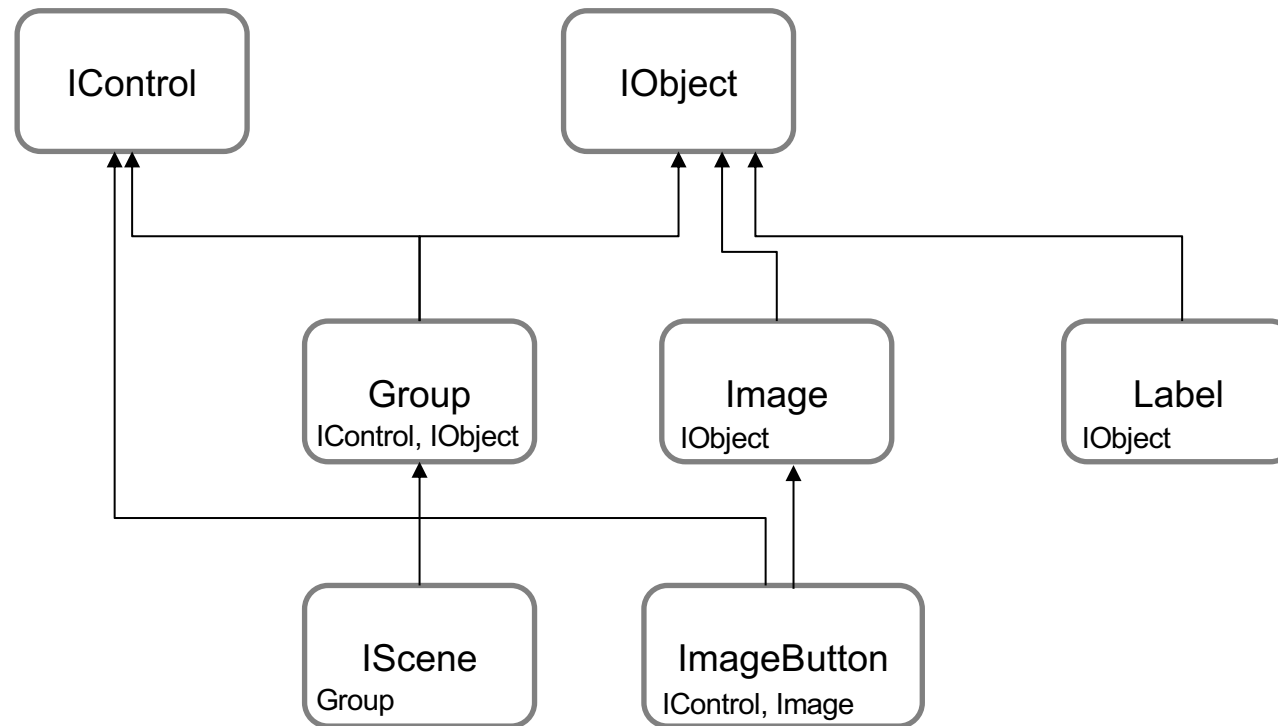
GameEngine

- Abstracts the entire message loop
- Manage current scene and scene change



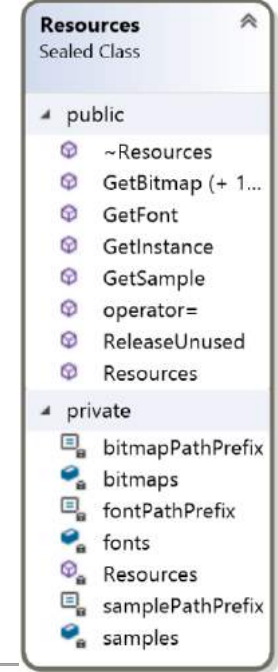
```
C:\Users\user\Desktop\c++專案助教\mini project 2\TowerDefense\Debug\TowerDefense.exe
[INFO] Game Initializing...
[INFO] Loaded Resource<image>: resources/images/icon.png
[INFO] Loaded window icon from: icon.png
[INFO] There are total 8 supported mouse buttons
[INFO] Allegro5 initialized
[INFO] Game begin
[INFO] Loaded Resource<image>: resources/images/start_scene/out.png scaled to 400x100
[INFO] Loaded Resource<image>: resources/images/start_scene/out.png
[INFO] Loaded Resource<image>: resources/images/start_scene/in.png
[INFO] Loaded Resource<font>: resources/fonts/pirulen.ttf with size 48
[INFO] Loaded Resource<font>: resources/fonts/pirulen.ttf with size 108
[INFO] Game initialized
[INFO] Game start event loop
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] draw
```





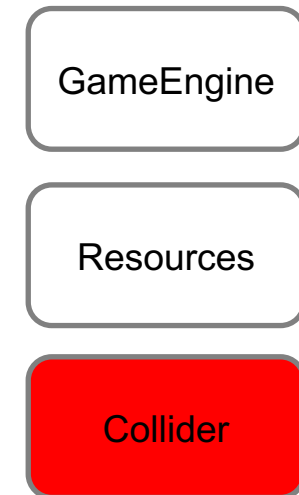
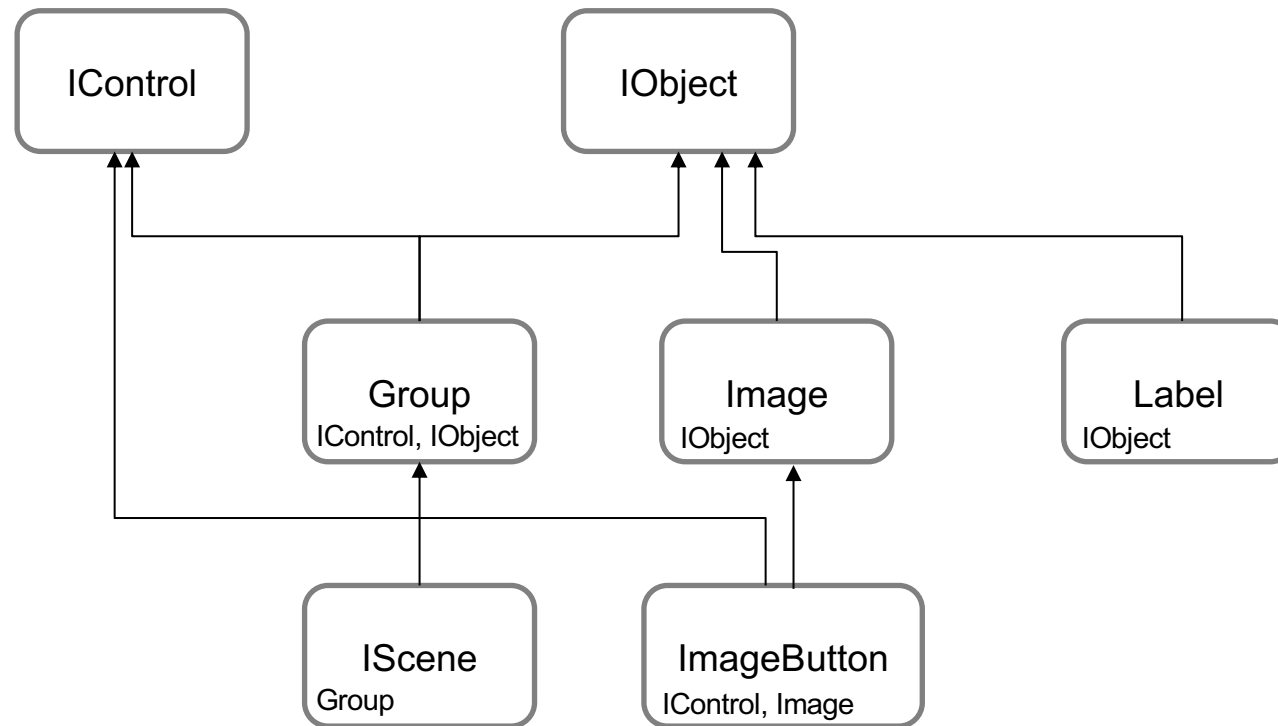
Resources

- Abstracts all resources loading and destroy.
- Resources can be retrieved from this class directly



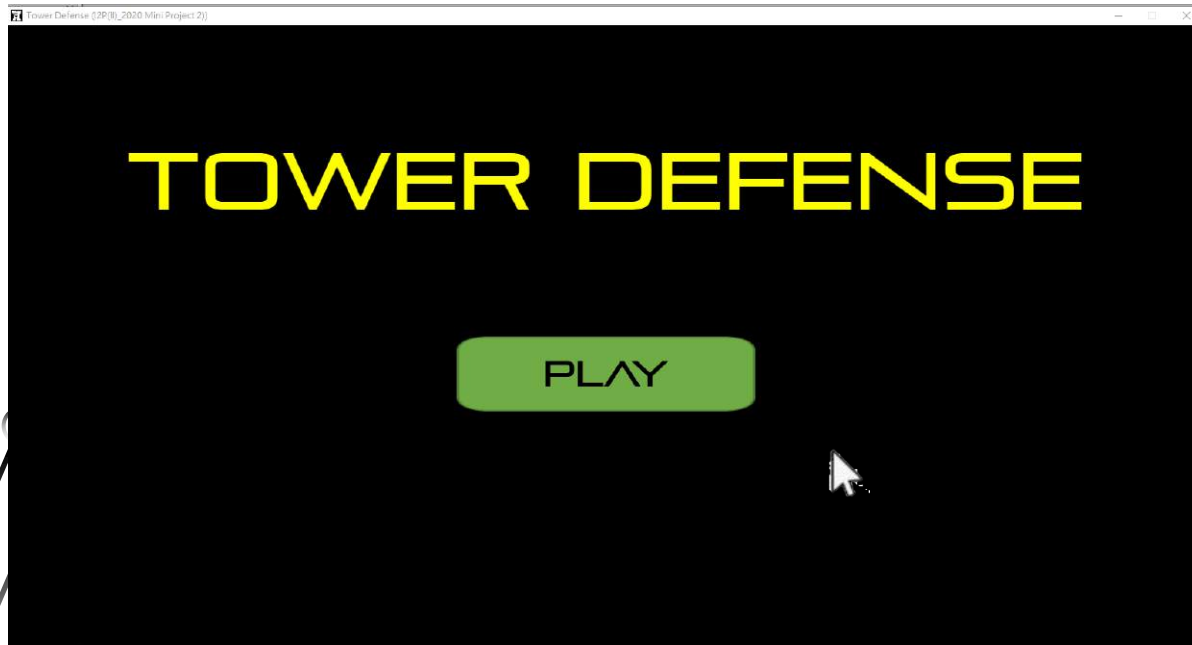
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[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] Timer event
[INFO] draw
[INFO] This must
```





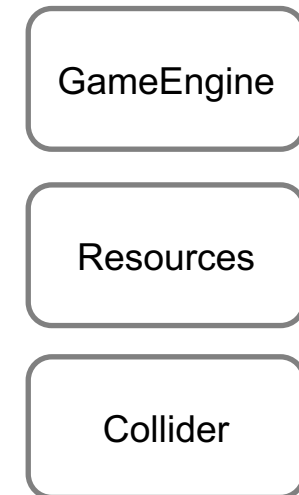
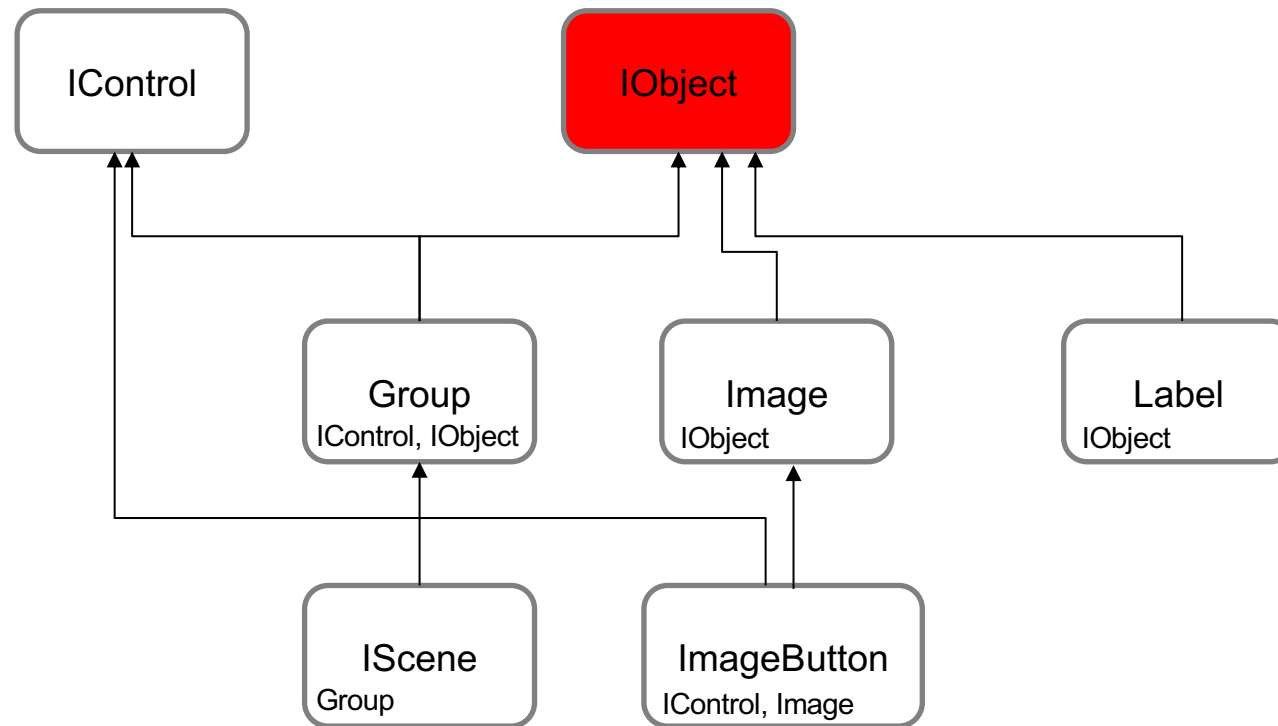
Collider(struct)

- calculating physical collision, overlap, point in region.



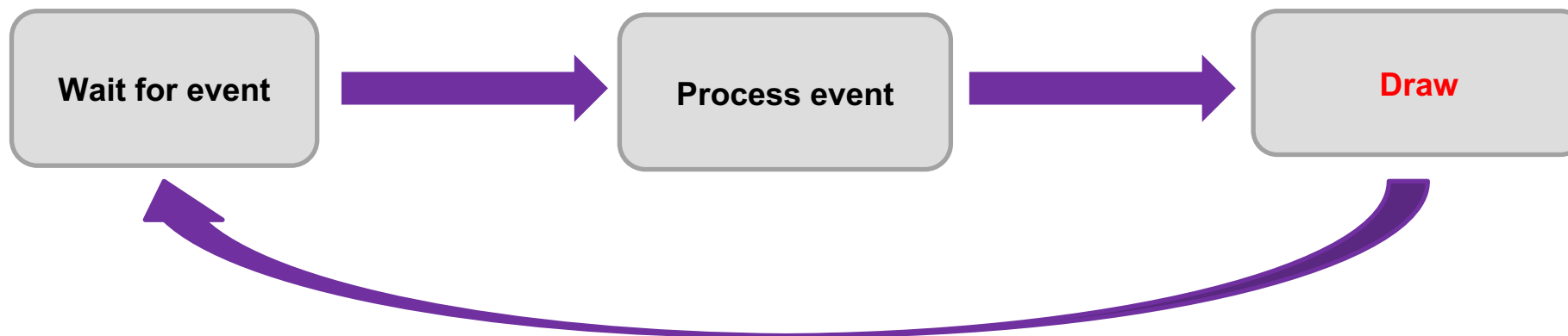
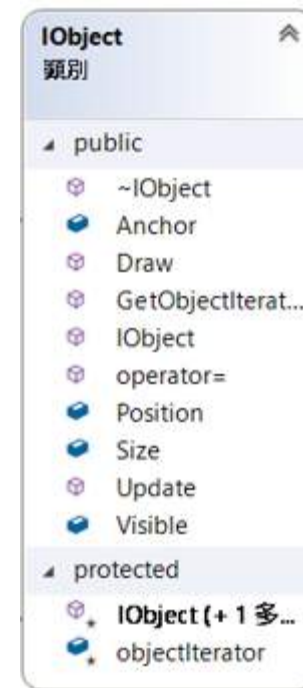
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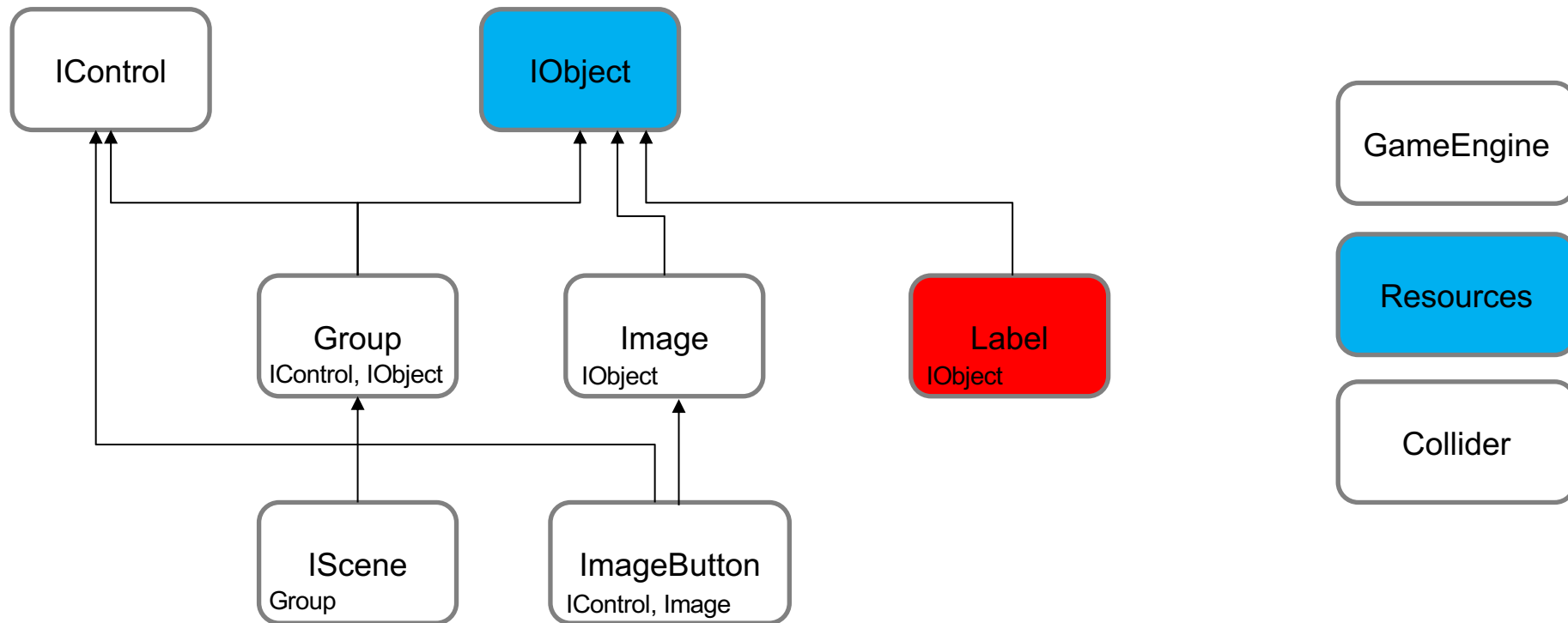


IObject

- The base class of everything that can be drawn
- Main definition of **Draw** and **Update**

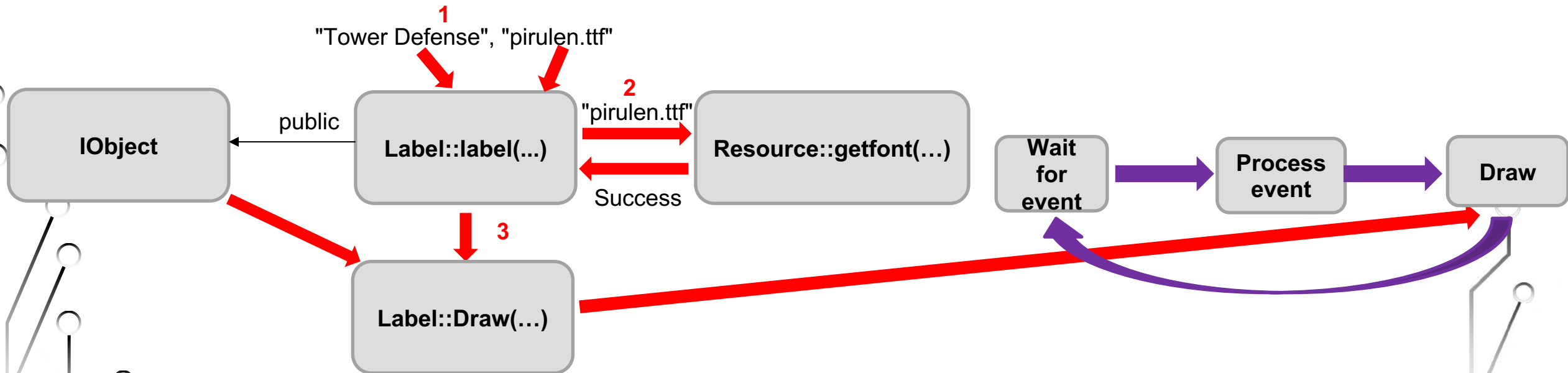
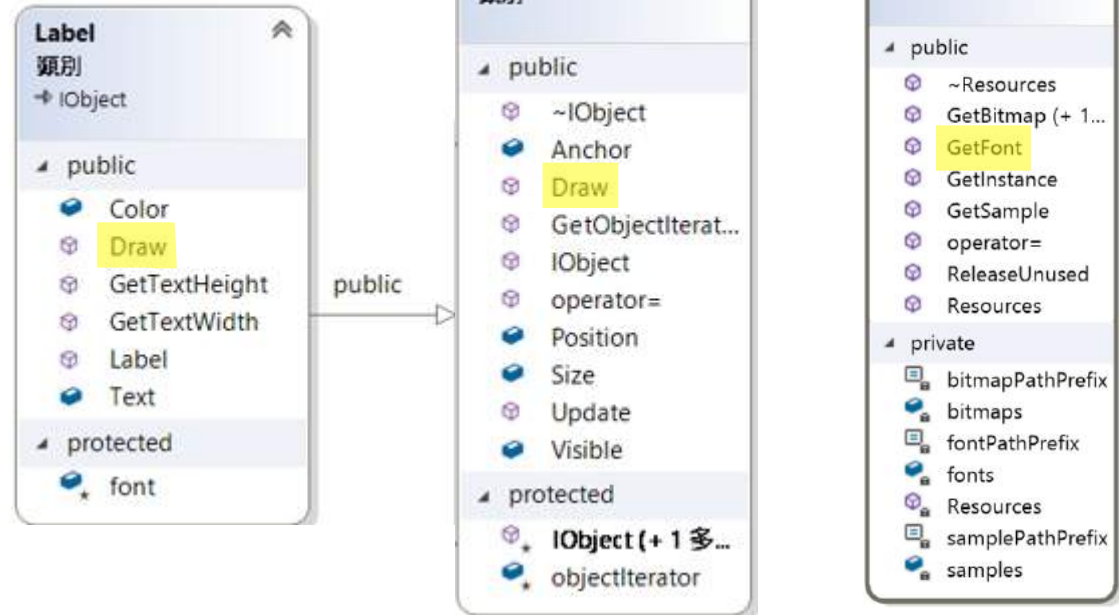


Condition –StartScene-label

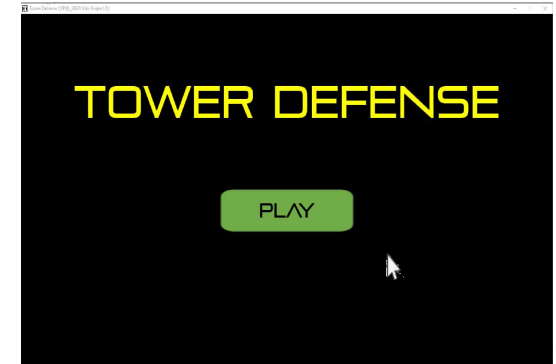


Label

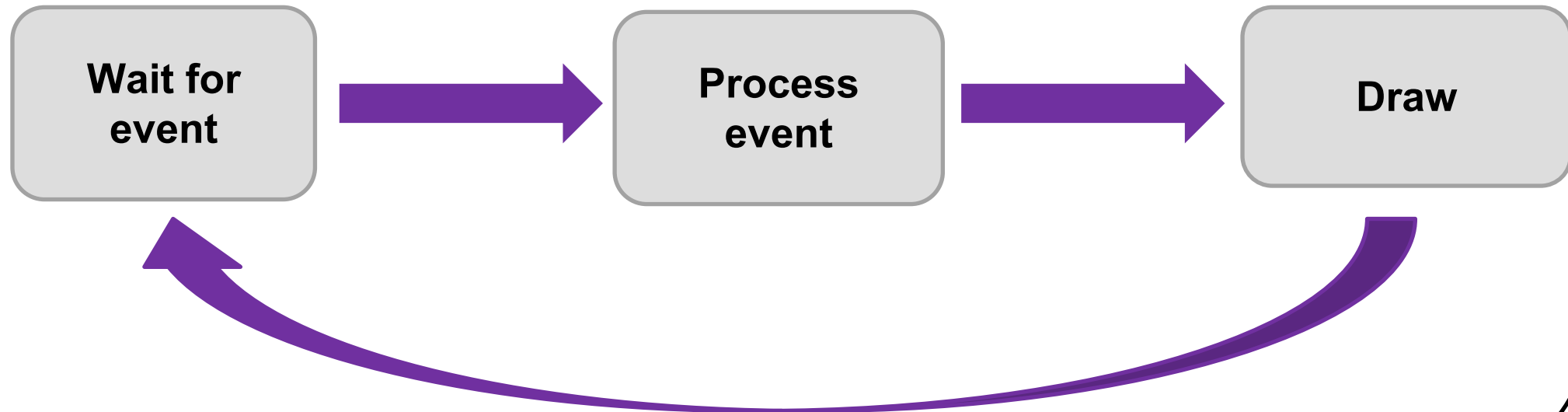
- public Engine::IObject
- A simple static text object.



GameEngine

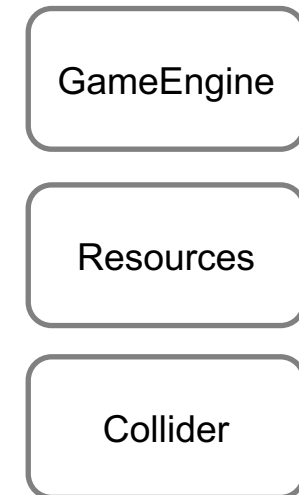
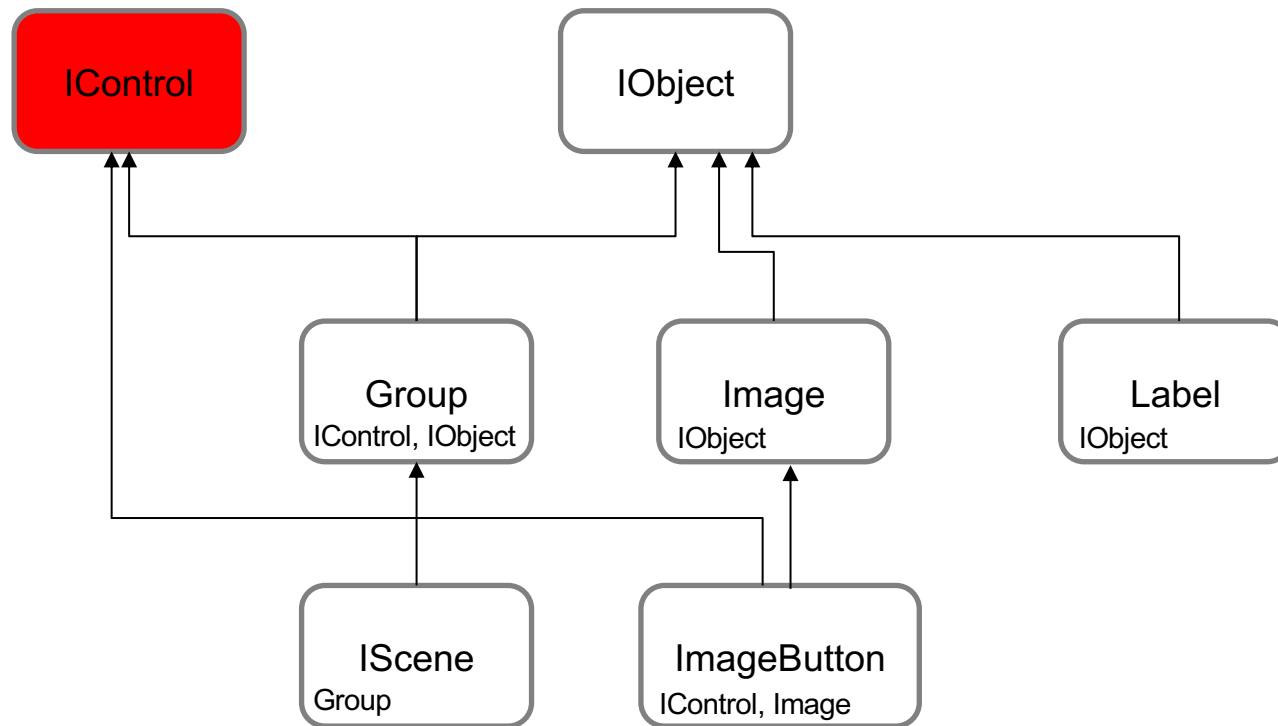


Label(Tower defense)



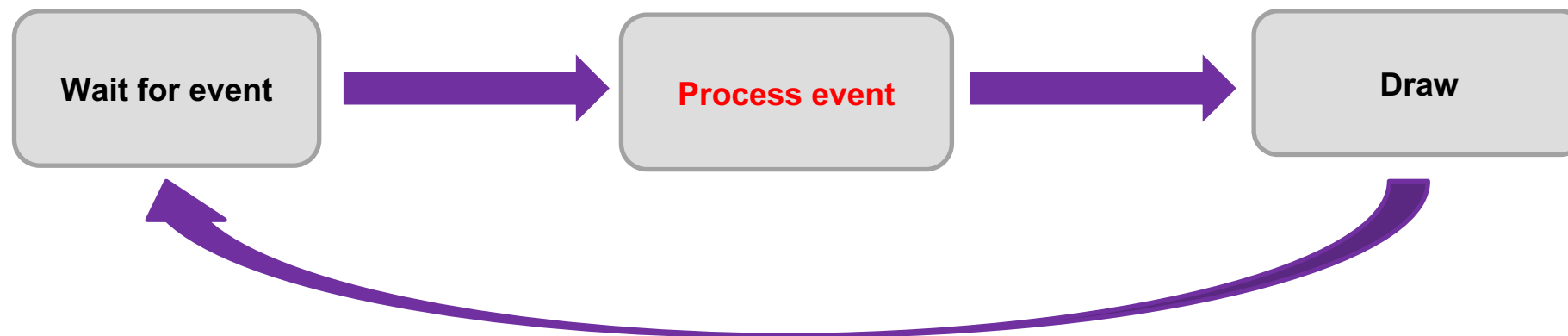
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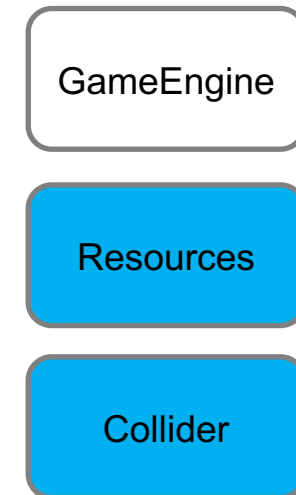
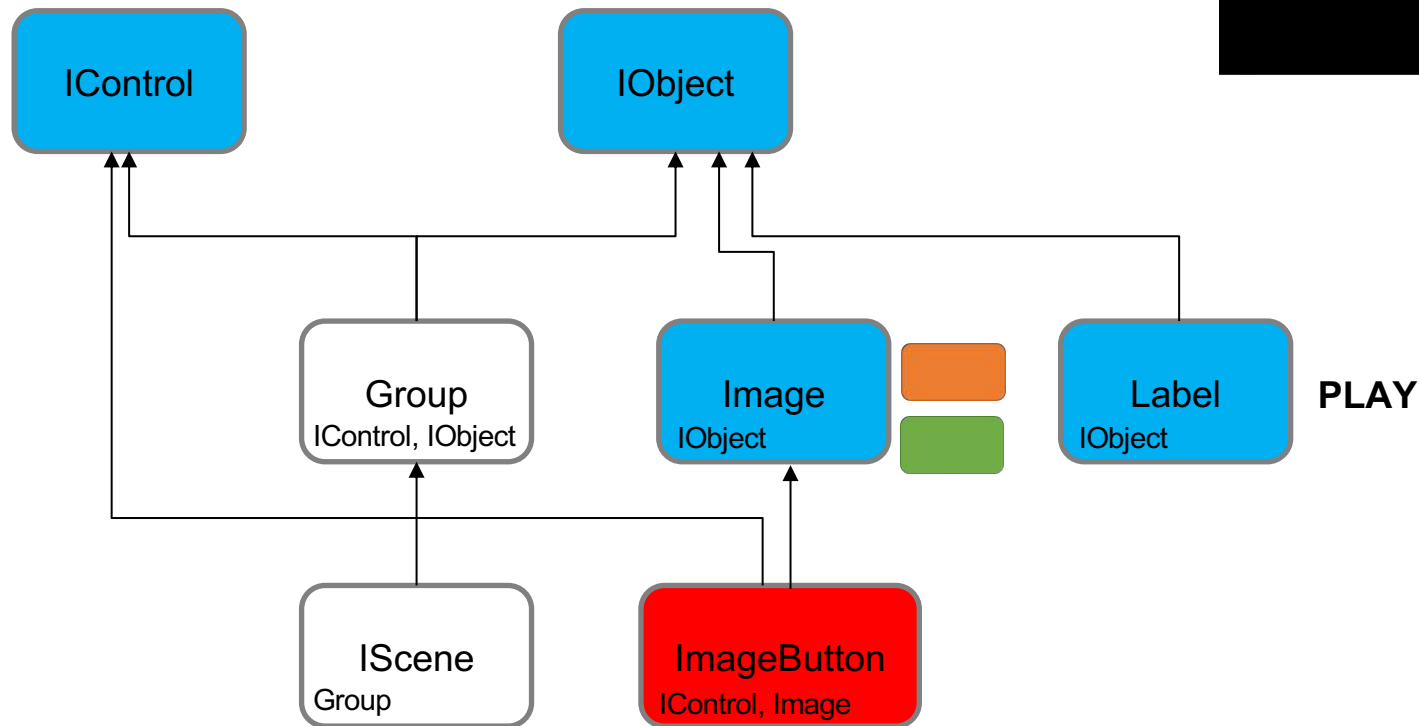


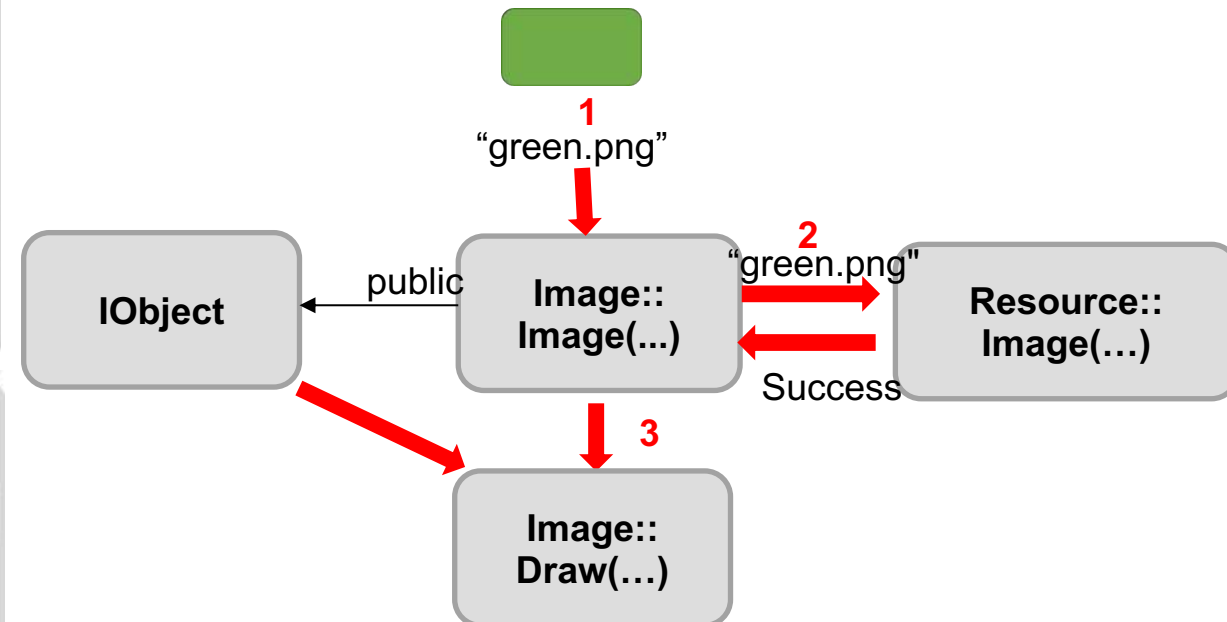
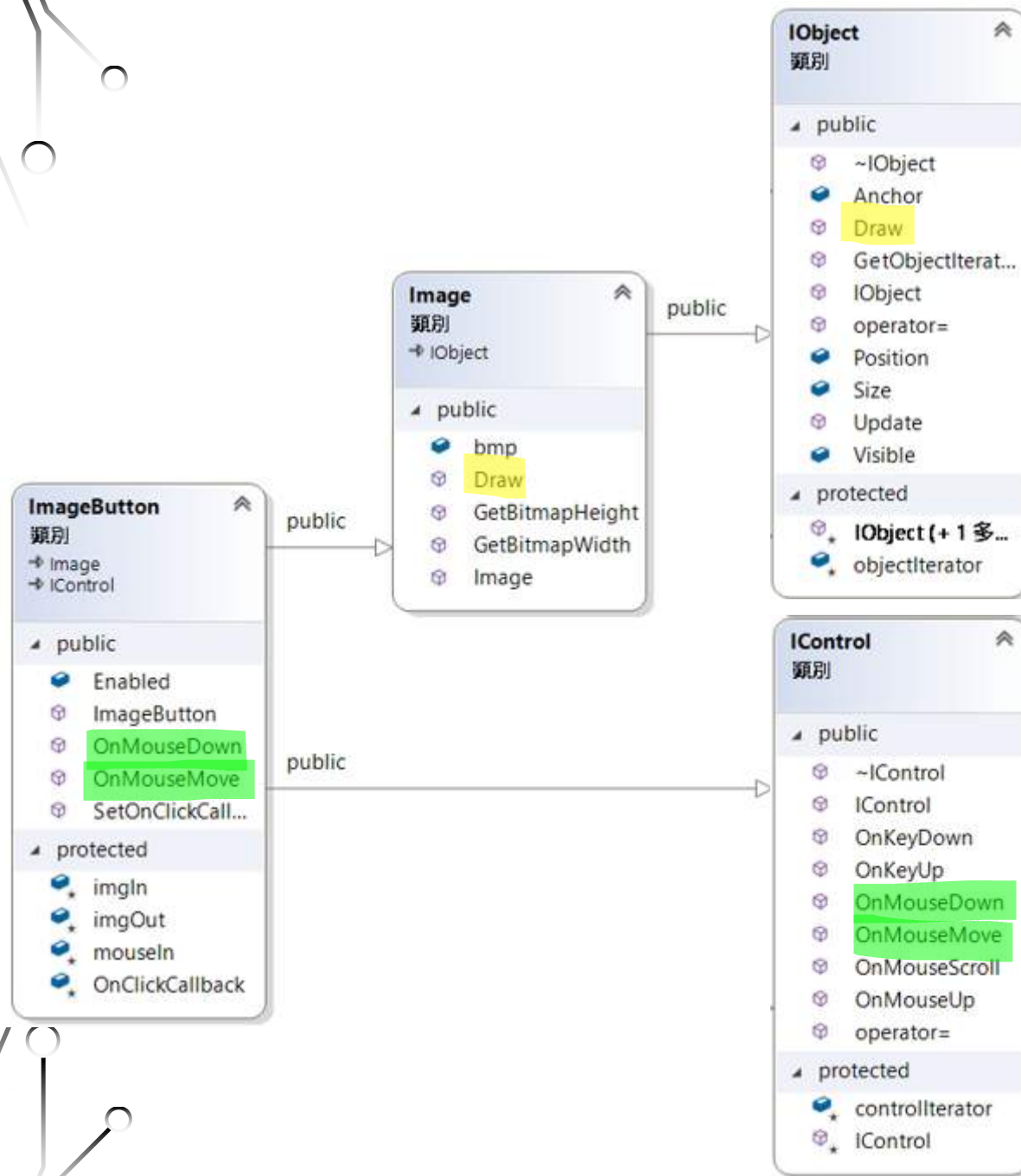
IControl

- The base class of everything that can receive events



Condition –StartScene-ImageButton





GameEngine

Wait for
event



Process
event



Draw



Label(Tower defense)
Label(PLAY)
Image(green.png)



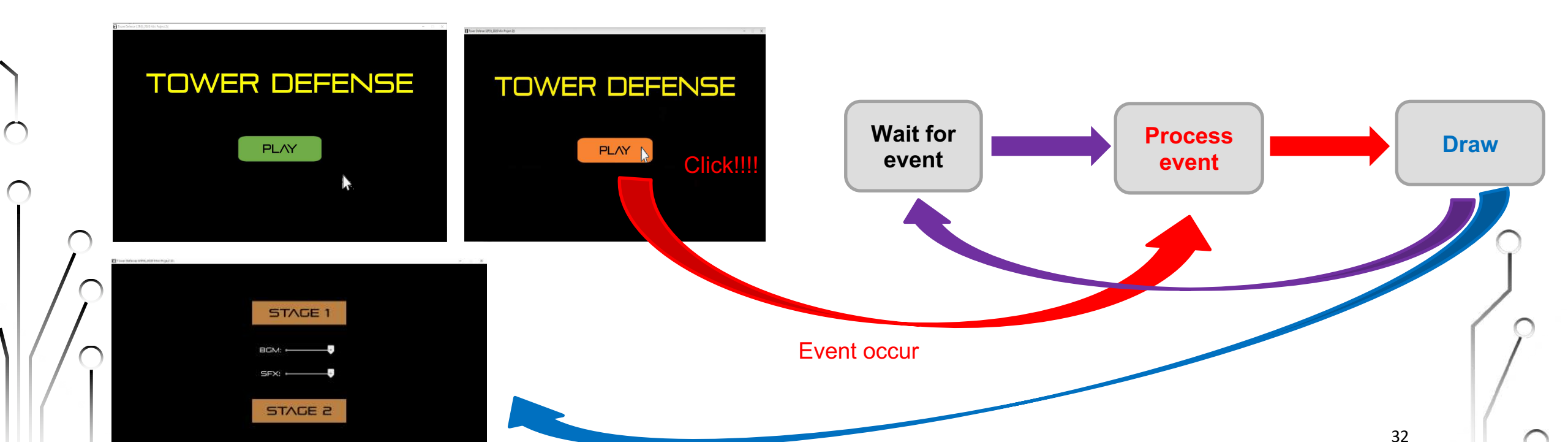
ImageButton

- public Engine::IControl , Image

```
sequenceDiagram
    participant GreenBox
    participant ImageButton as ImageButton::ImageButton(...)
    participant Resource as Resource::Image(...)
    participant IControl as IControl

    GreenBox->>ImageButton: 1 "green.png"
    ImageButton->>Resource: 2 "green.png"
    Resource-->>ImageButton: Success
    ImageButton->>IControl: 3
    IControl-->>ImageButton: public
```

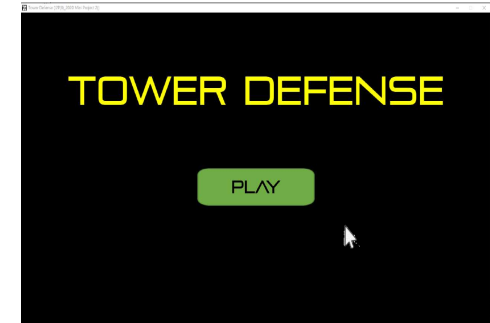
- A clickable button, changes image when mouse move.
- Imagebutton::
OnMouseDown(...)



GameEngine



OnMouseMove
(change img)
OnMouseDown
(change scene)



Label(Tower defense)
Label(PLAY)
Image(green.png)

Wait for
event



Process
event

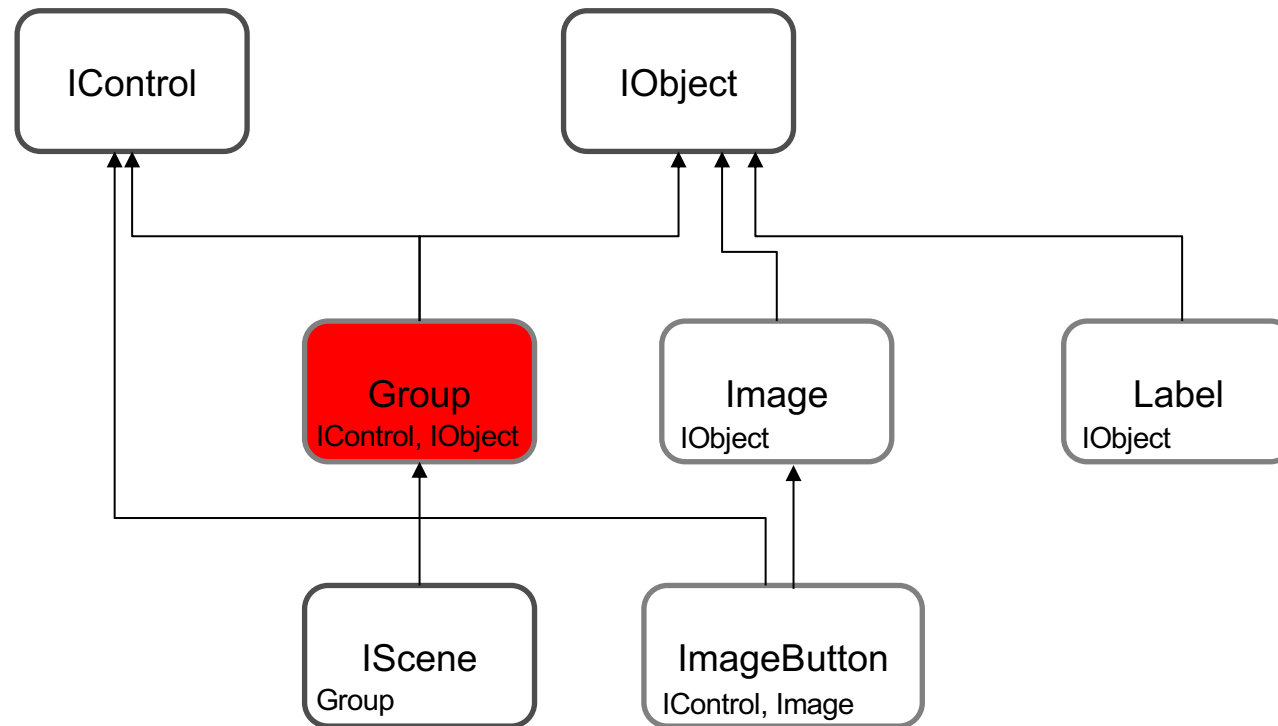


Draw



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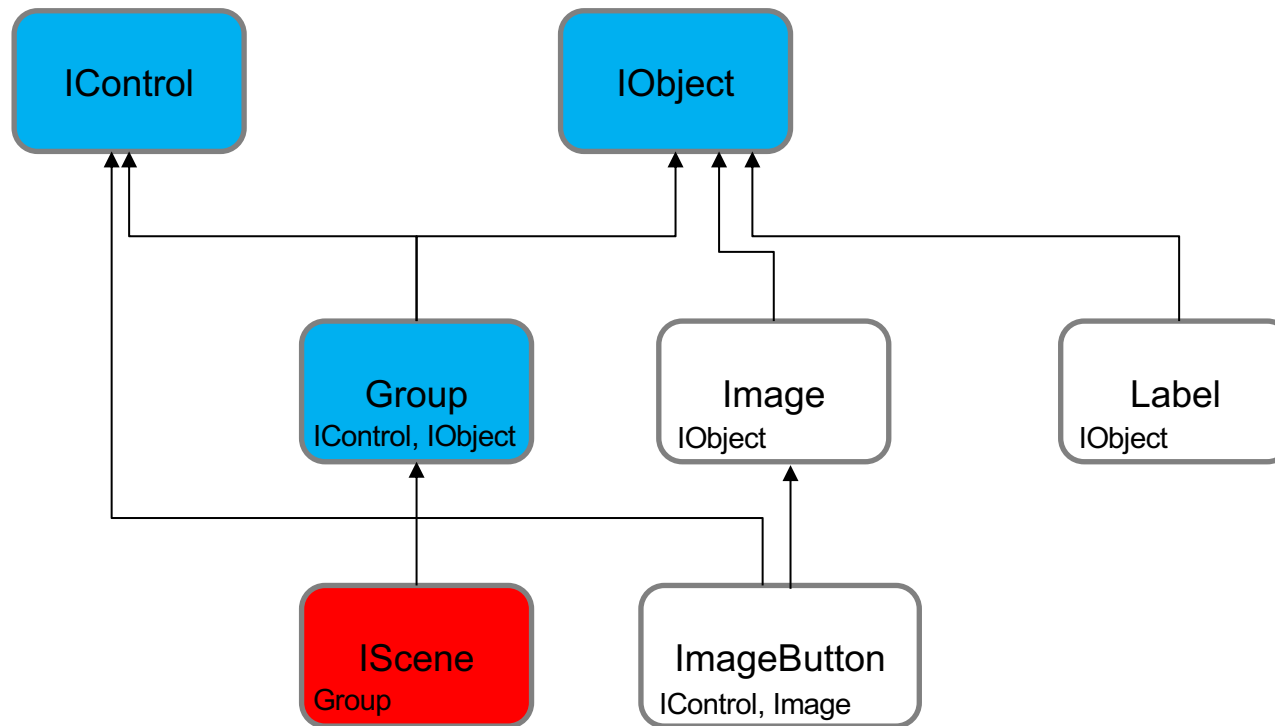


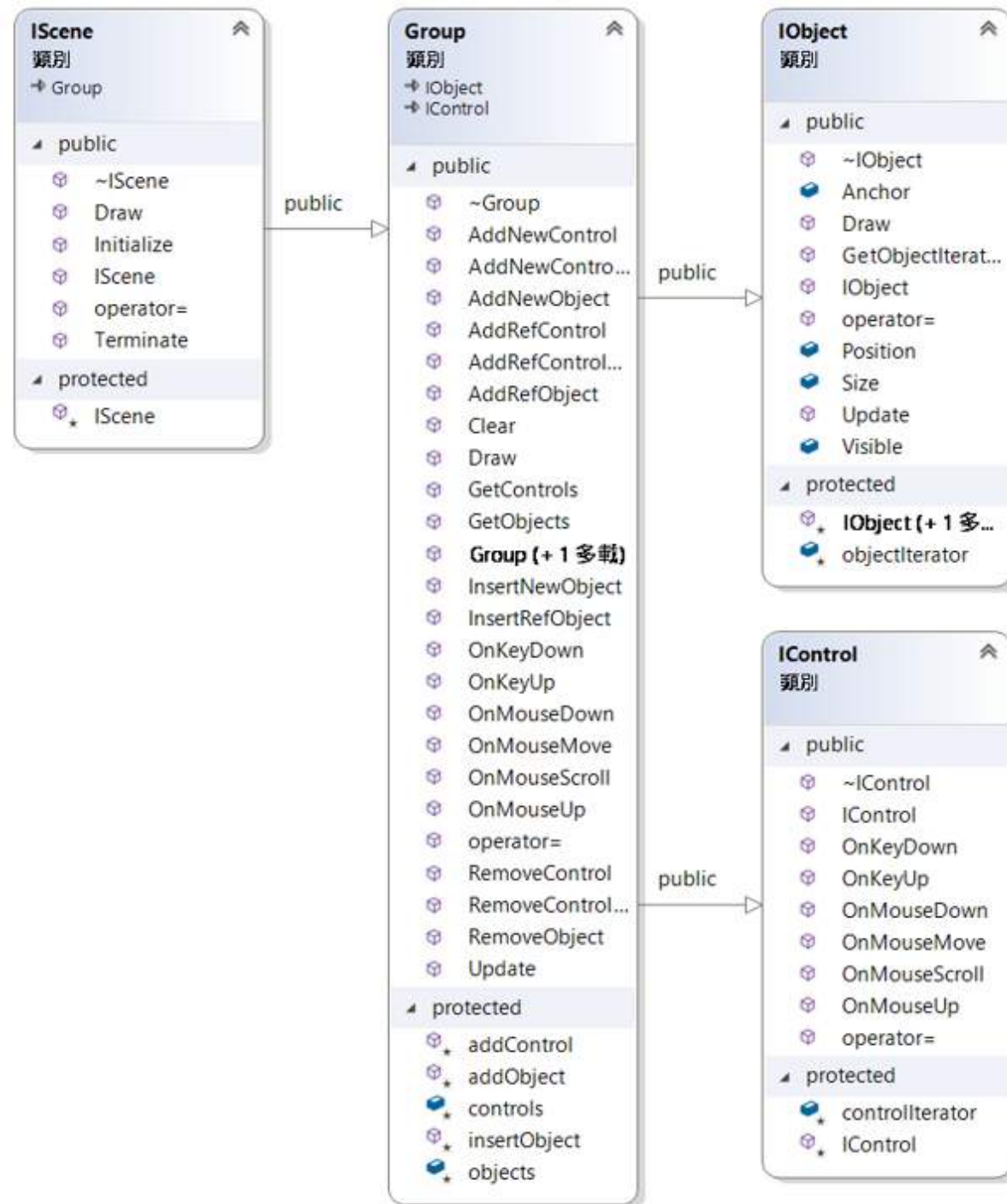


Group

- Draw and update everything for you.
- Make all objects of IObject and IControl into a individual list to manage.

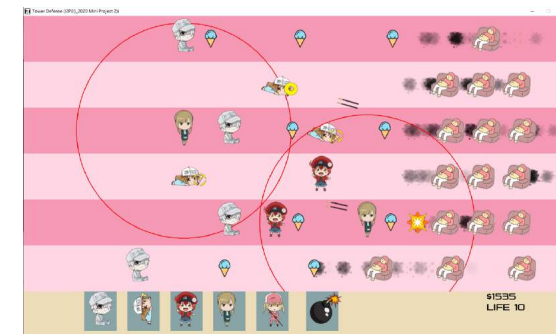
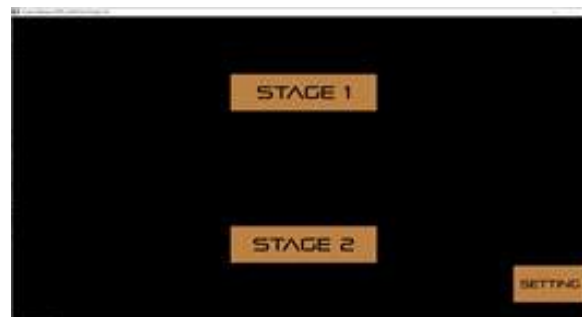
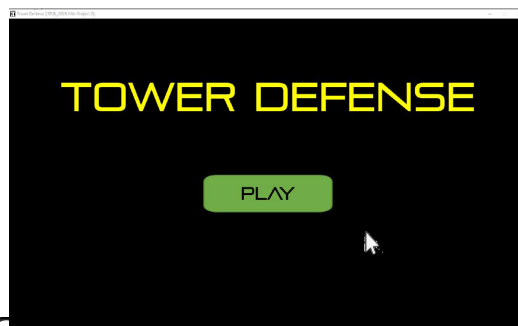
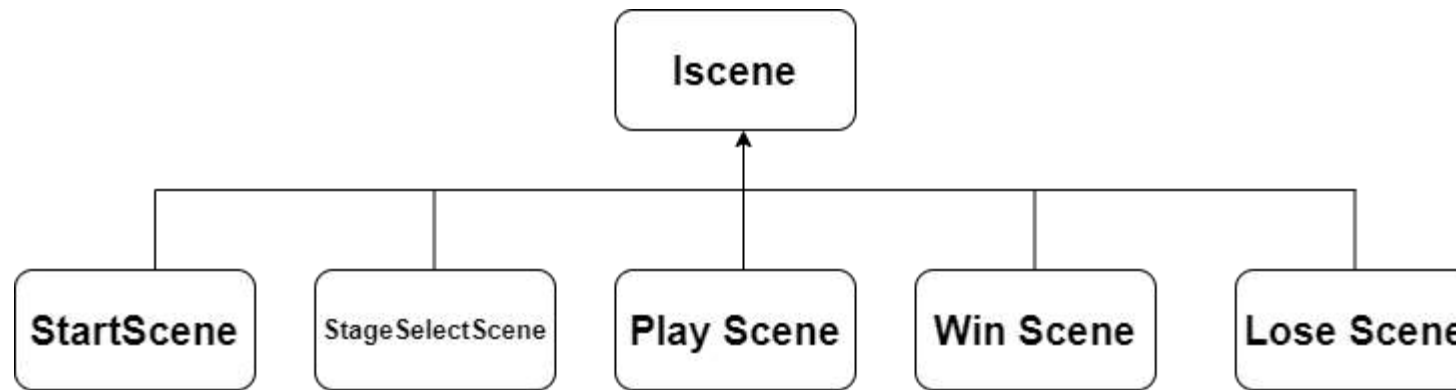
Condition –StartScene-IScene





IScene

- Encapsulates a scene, must be inherited and customized.

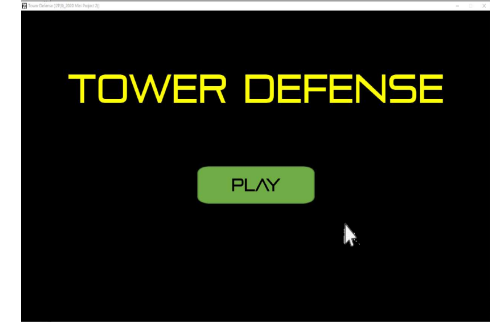


GameEngine



OnMouseMove
(change img)
OnMouseDown
(change scene)

Scene.process(event)



Label(Tower defense)
Label(PLAY)
Image(green.png)
Scene.draw()

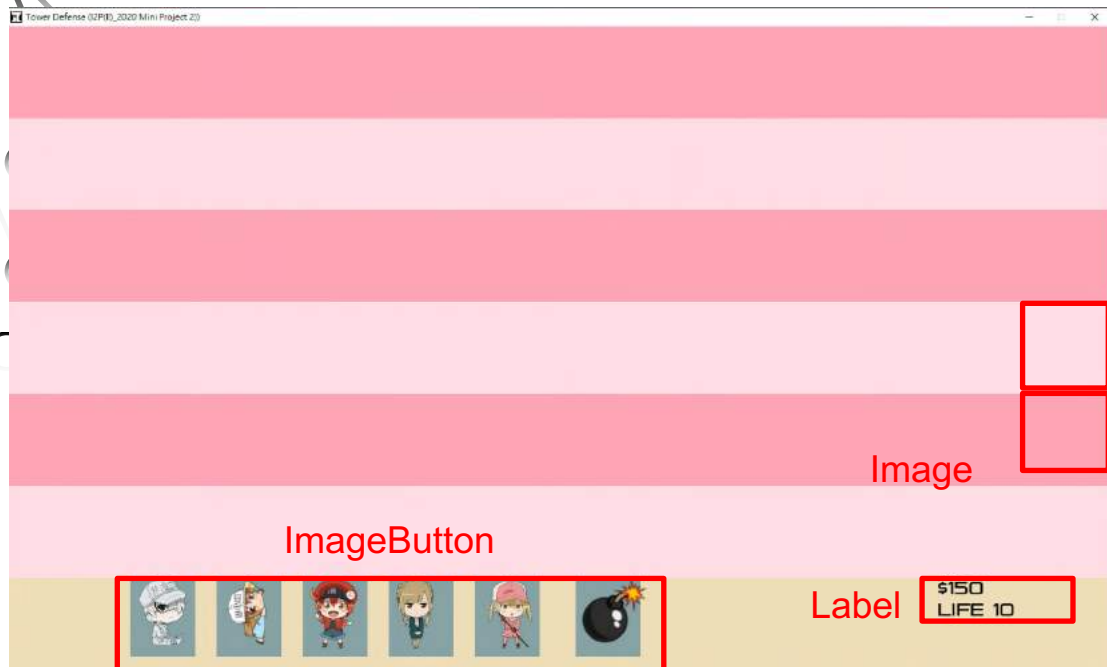
Wait for
event

Process
event

Draw

Outline

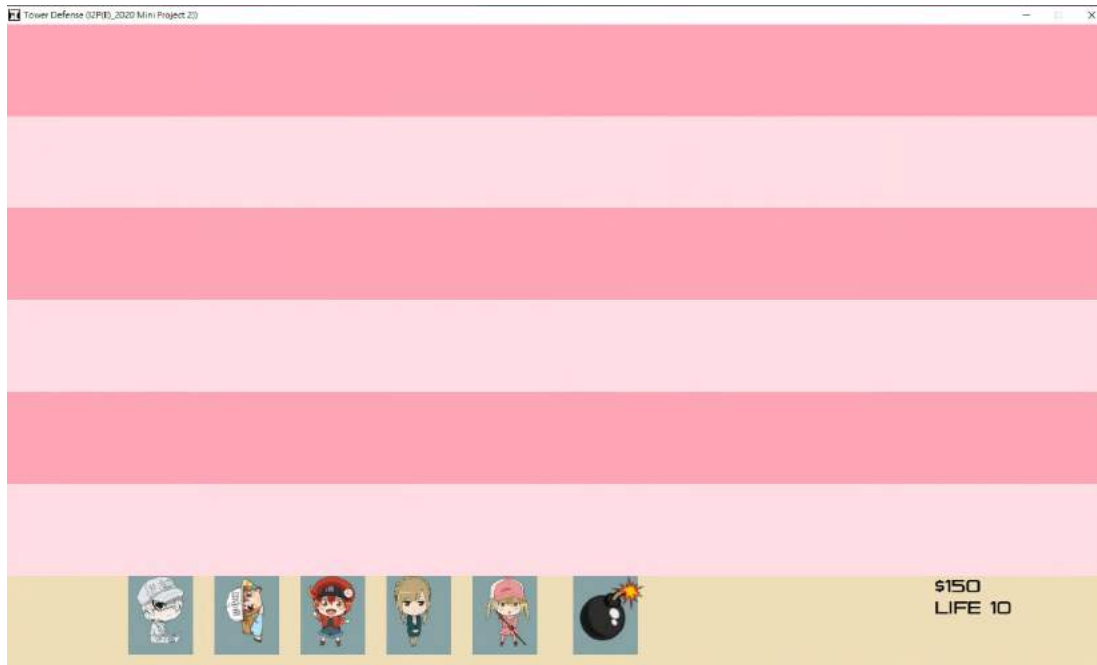
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Map file format





```
1111111111111111
0000000000000000
1111111111111111
0000000000000000
1111111111111111
0000000000000000
```

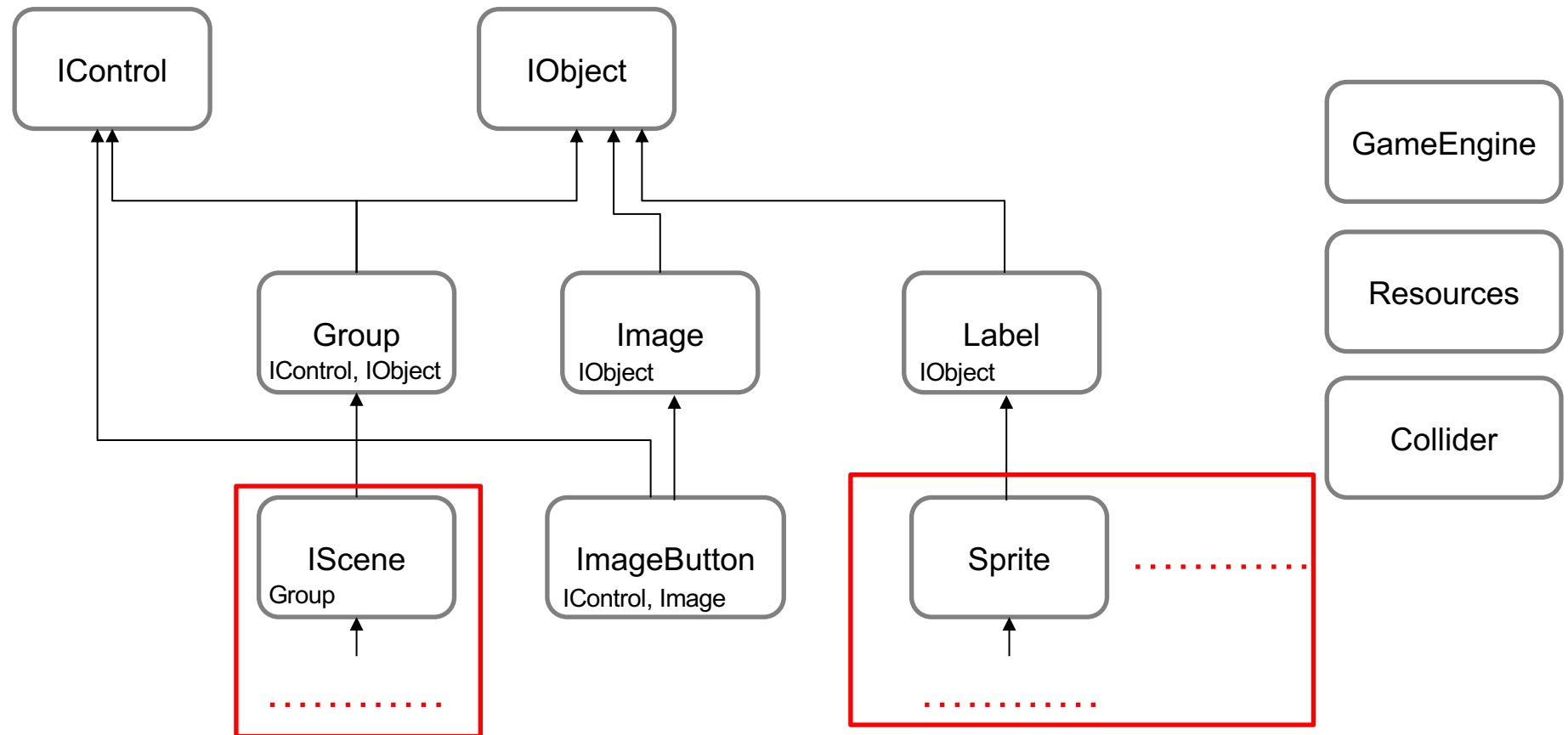
resources/map1.txt

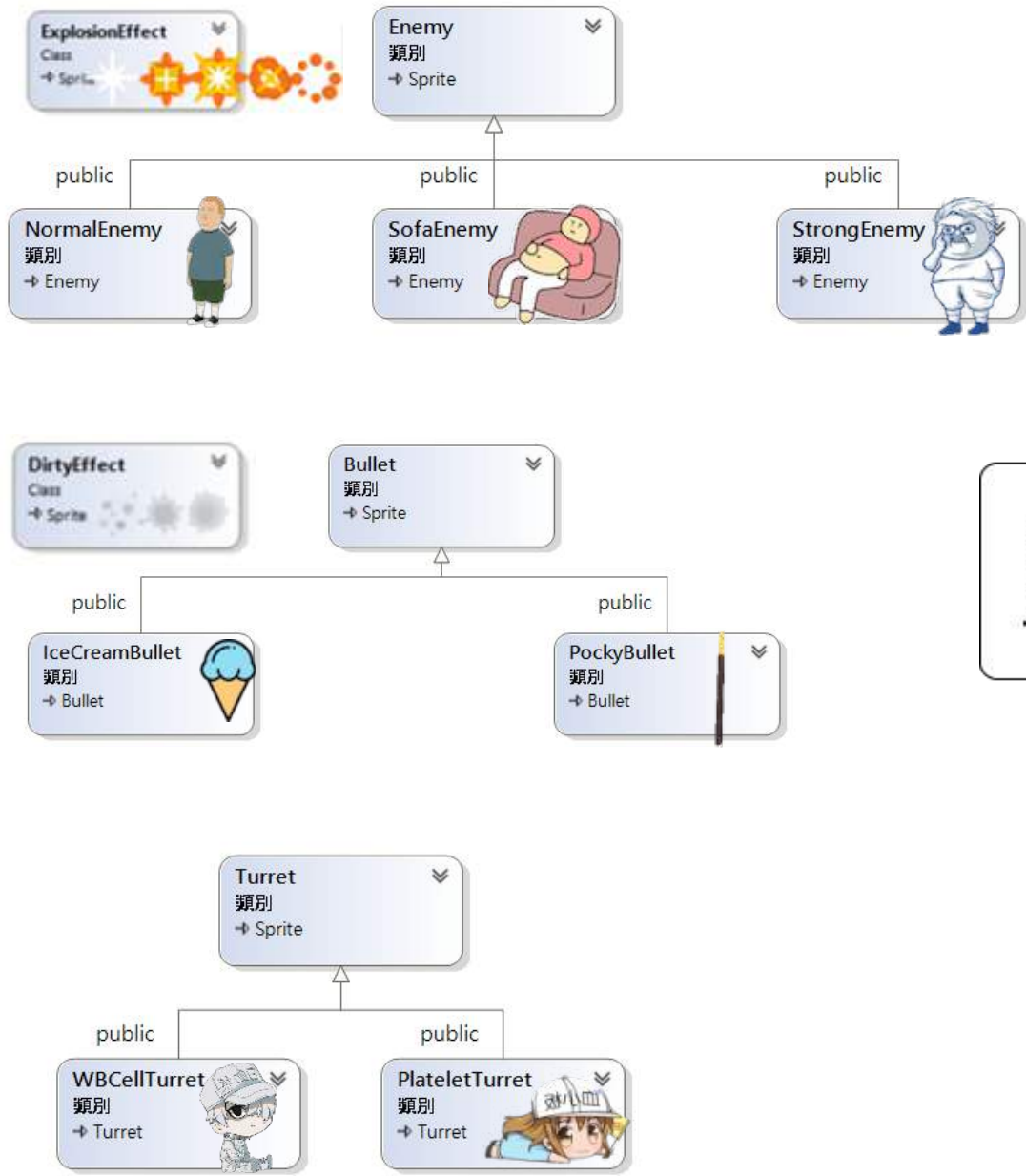
Enemy file format

- Enemytype TimeDelay LaneNum Repeat

1	1	3	5	➡	
0	2	4	1		
1	1	2	5		
0	2	5	1		
1	0.5	1	10		
0	6	5	1		
2	1	4	1	➡	
0	2	2	1		

You should edit this file
after adding new enemy.
resources/enemy1.txt





IsScene

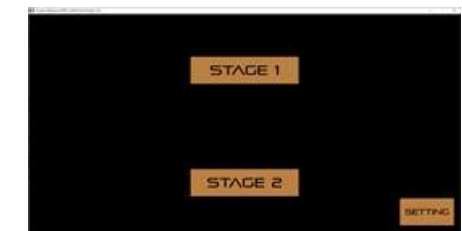
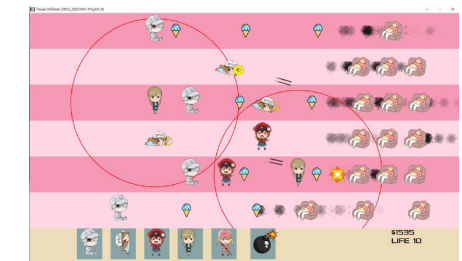
Lose Scene

Win Scene

Play Scene

StageSelectScene

StartScene



- Have fun!