# Tower Defense

About Hackathon & MiniProject2

- Take this game as the simple version of COC (Clash of Clans).

- We'll complete the project in stages.

- Hackathon: Fix the bugs and incompleteness

- MiniProject2: Add new features related to the game (E.g. create bullets that can slow down the armies.)

- We have provided questions for you to validate your understanding of the project and the concept of OOP.

Hackathon Demo
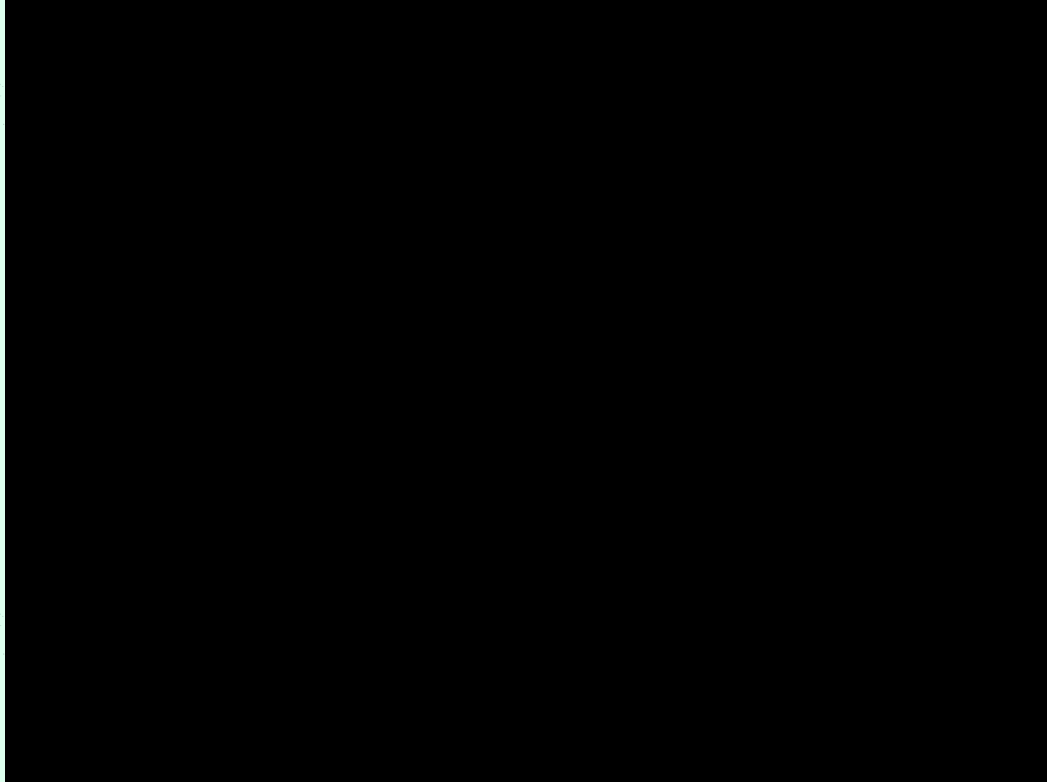
Outline

01 Allegro5 game development process

02 Template: StartScene

03 User Extension

04 Hackathon schedule

Outline

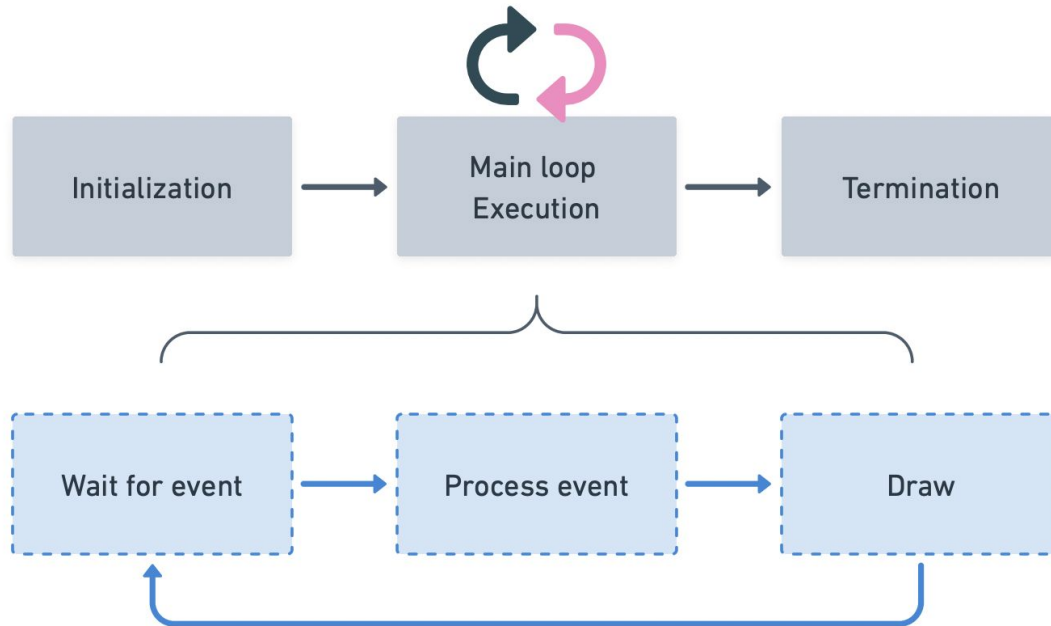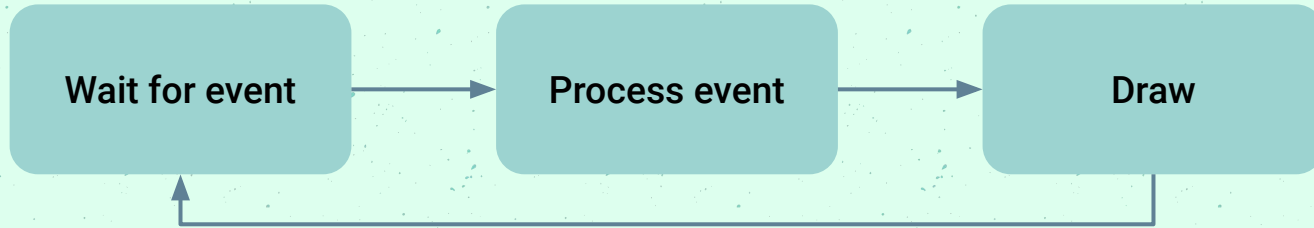**01** **Allegro5 game development process**

02 Template: StartScene

03 User Extension

04 Hackathon schedule

Main Process

Loop execution

```
┌──────────────────┐     ┌──────────────────┐     ┌──────────────────┐
│  Wait for event  │ ──> │  Process event   │ ──> │      Draw        │
└──────────────────┘     └──────────────────┘     └──────────────────┘
        ▲                                                    │
        └────────────────────────────────────────────────────┘
```
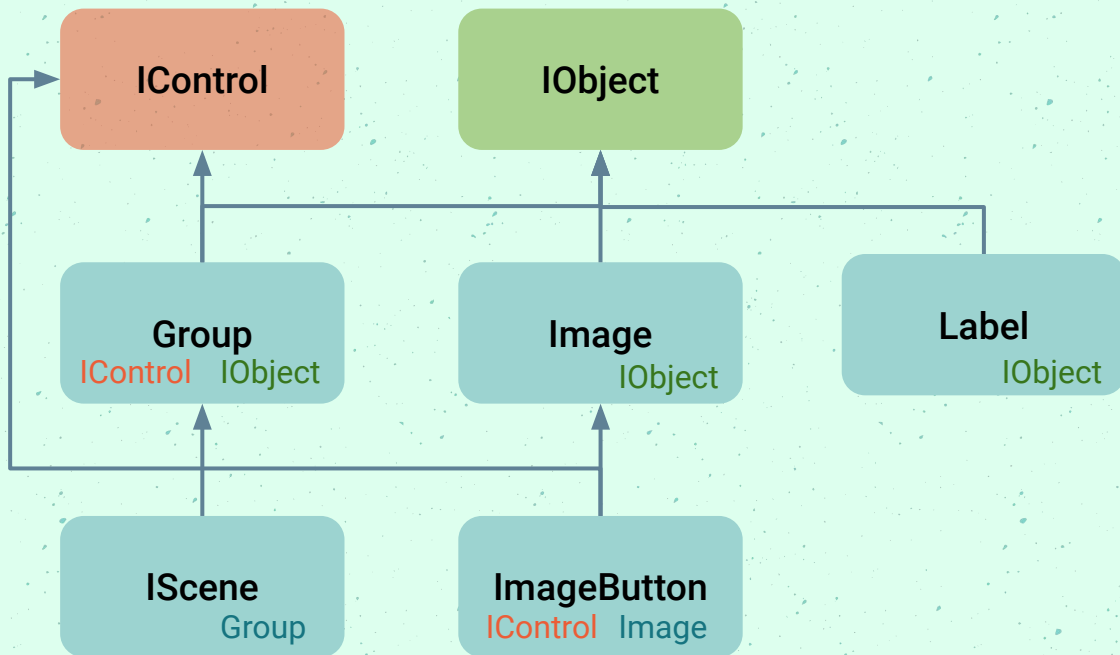
It mainly consists of two parts:

1. Events -> Keyboard, mouse, timer ... etc.
2. Draw - > Objects painting

Core Structure

IControl

IObject

GameEngine

Group
IControl IObject

Image
IObject

Label
IObject

Resources

IScene
Group

ImageButton
IControl Image

Collider

Outline

Template: StartScene

01 GameEngine, Resources, Collider

02 Label

03 ImageButton

04 IScene

05 Scene Extension

Template: StartScene

01 GameEngine, Resources, Collider
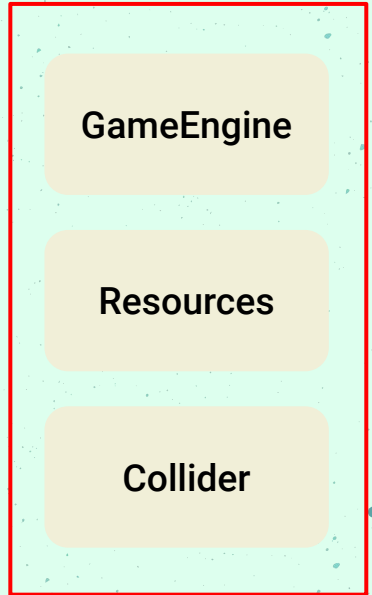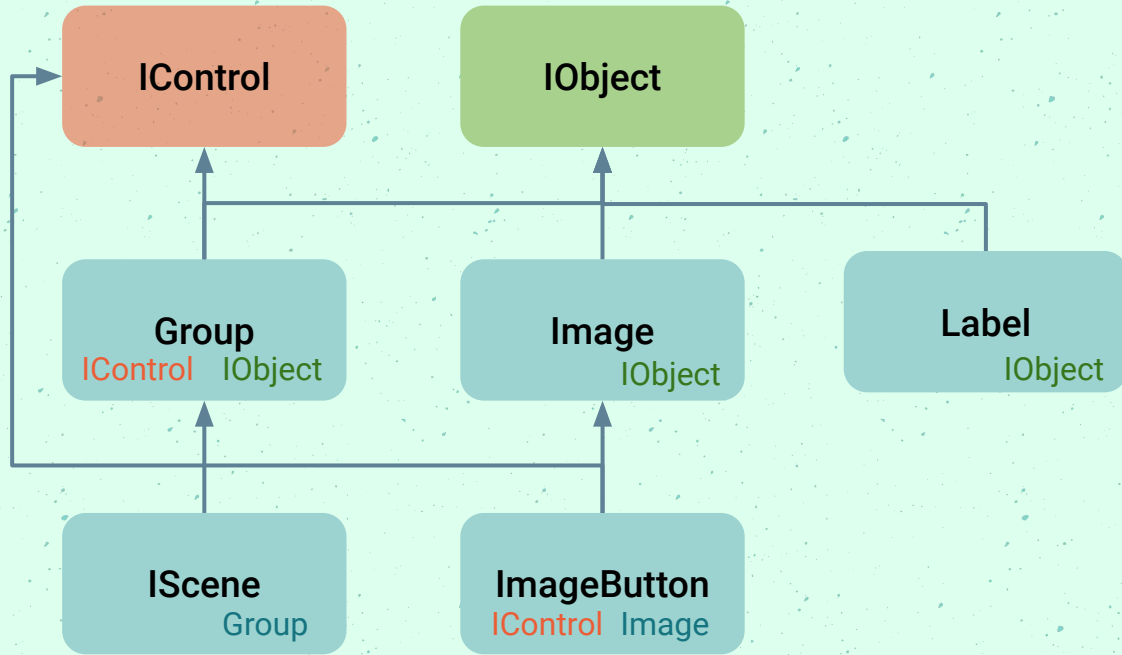
02 Label

03 ImageButton

04 IScene

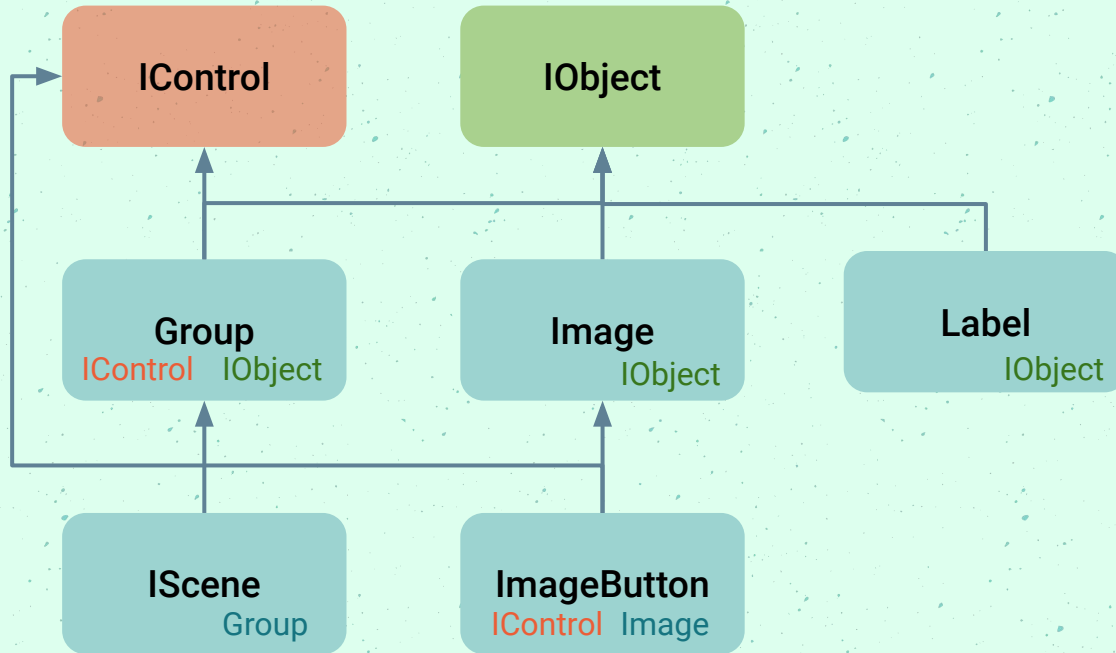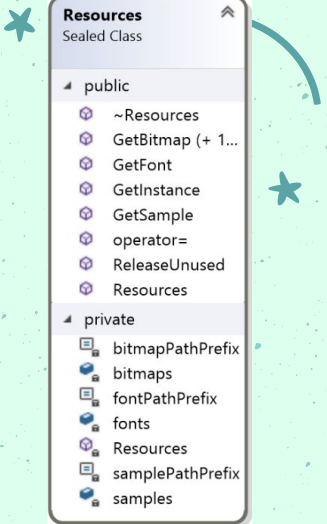**05** Scene Extension

StartScene

TOWER DEFENSE

PLAY

GameEngine

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


```
[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] draw
[INFO] Timer
```

TOWER DEFENSE

PLAY

GameEngine
Sealed Class

public
  AddNewScene
  ChangeScene
  GameEngine
  GetActiveScene
  GetInstance
  GetMousePositi...
  GetScreenHeight
  GetScreenSize
  GetScreenWidth
  IsKeyDown
  operator=
  Start

private
  activeScene
  destroy
  display
  draw
  event_queue
  fps
  GameEngine
  icon
  initAllegro5
  reserveSamples
  scenes
  screenH
  screenW
  startEventLoop
  title
  update
  update_timer

Resources

- **Abstract all resources loading and destroy**
- **Resources can be retrieved from this class directly**

Resources
Sealed Class

▲ public
- ~Resources
- GetBitmap (+ 1...
- GetFont
- GetInstance
- GetSample
- operator=
- ReleaseUnused
- Resources

▲ private
- bitmapPathPrefix
- bitmaps
- fontPathPrefix
- fonts
- Resources
- samplePathPrefix
- samples

```
[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
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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] Timer event
```

TOWER DEFENSE

PLAY

Collider (struct)

- Calculating physical collision, overlap, point in region.

Collider
Sealed 結構

⯅ public
- Collider
- IsCircleOverlap
- IsPointInBitmap
- IsPointInRect
- IsRectOverlap

Template: StartScene

01 GameEngine, Resources, Collider

02 Label

03 ImageButton

04 IScene
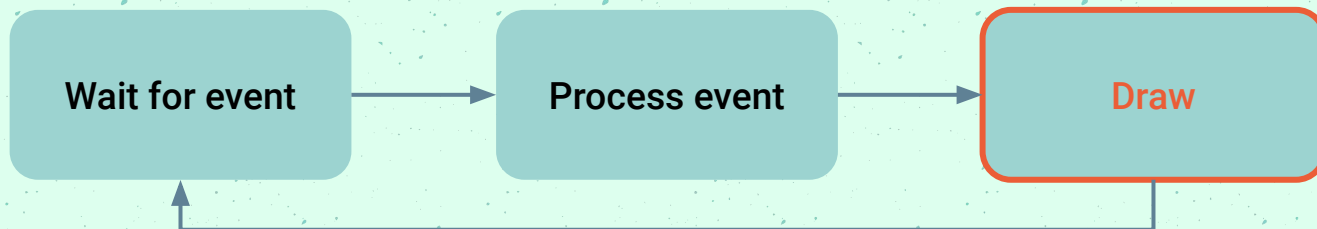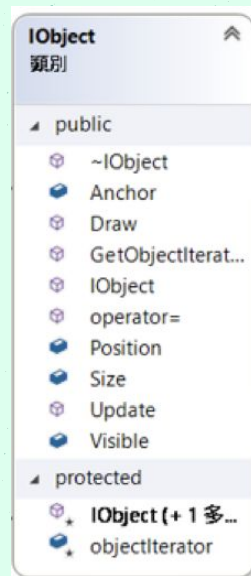
05 Scene Extension

StartScene Label

TOWER DEFENSE

PLAY

IControl

IObject

GameEngine

Group
IControl   IObject

Image
IObject

Label
IObject

Resources

Collider

IScene
Group

ImageButton
IControl   Image
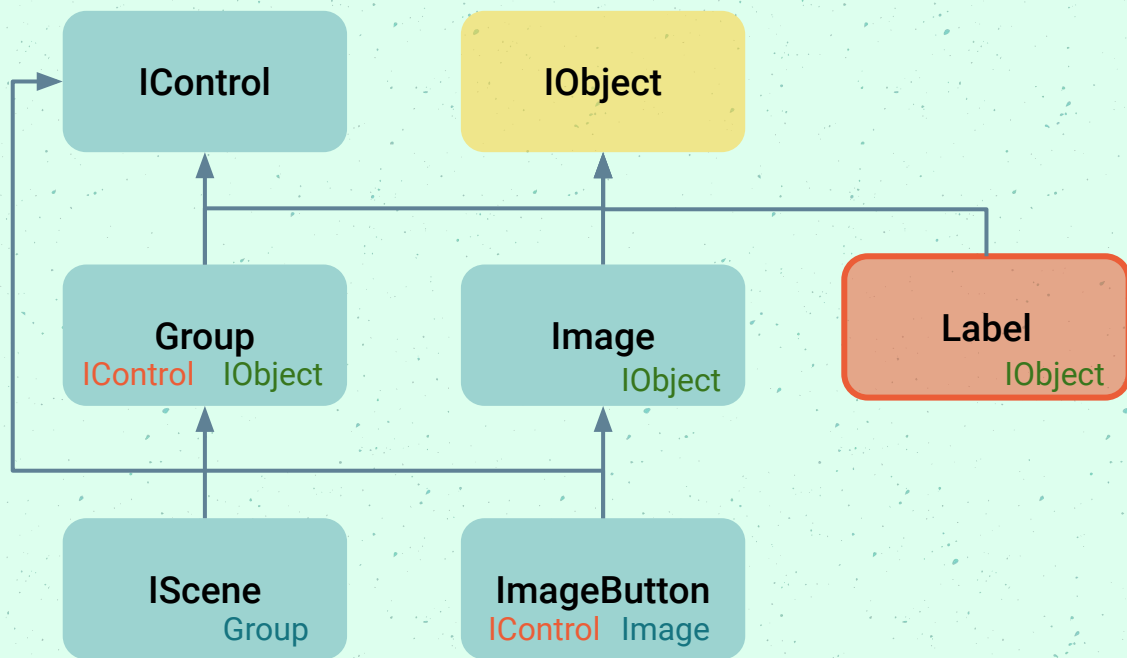
IObject

- The base class of objects that need to be drawn
- Main definition of Draw and Update

IObject
類別

▲ public
- ⬡ ~IObject
- 🔵 Anchor
- ⬡ Draw
- ⬡ GetObjectIterat...
- ⬡ IObject
- ⬡ operator=
- 🔵 Position
- 🔵 Size
- ⬡ Update
- 🔵 Visible

▲ protected
- ⬡ IObject (+ 1 多...
- ⬡ objectIterator

| Wait for event | → | Process event | → | Draw |

Label

- **Derived from IObject class**
- **A simple static text object**

Label (Tower defense)
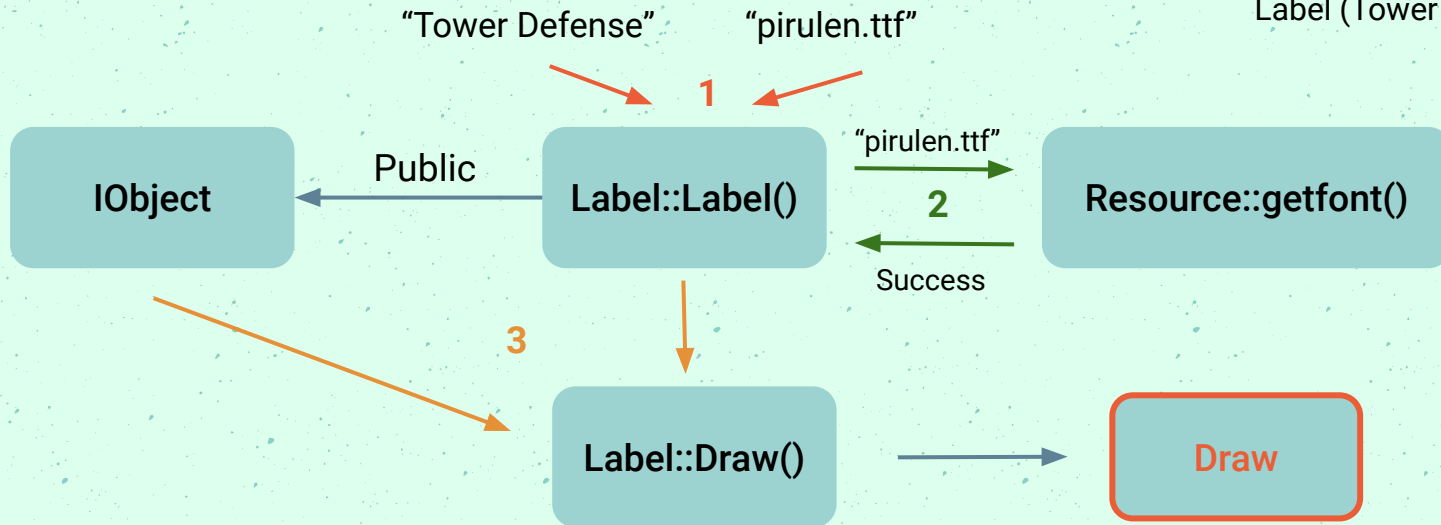
"Tower Defense"   "pirulen.ttf"

1

IObject	Public ←	**Label::Label()**	"pirulen.ttf" →	**Resource::getfont()**

2

Success

3

Label::Draw() → **Draw**

Template: StartScene

01 GameEngine, Resources, Collider

02 Label

03 ImageButton

04 IScene

05 Scene Extension

StartScene ImageButton

TOWER DEFENSE
PLAY

TOWER DEFENSE
PLAY

IControl

IObject

GameEngine

Group
IControl IObject

Image
IObject

Label
IObject

PLAY

Resources

Collider

IScene
Group
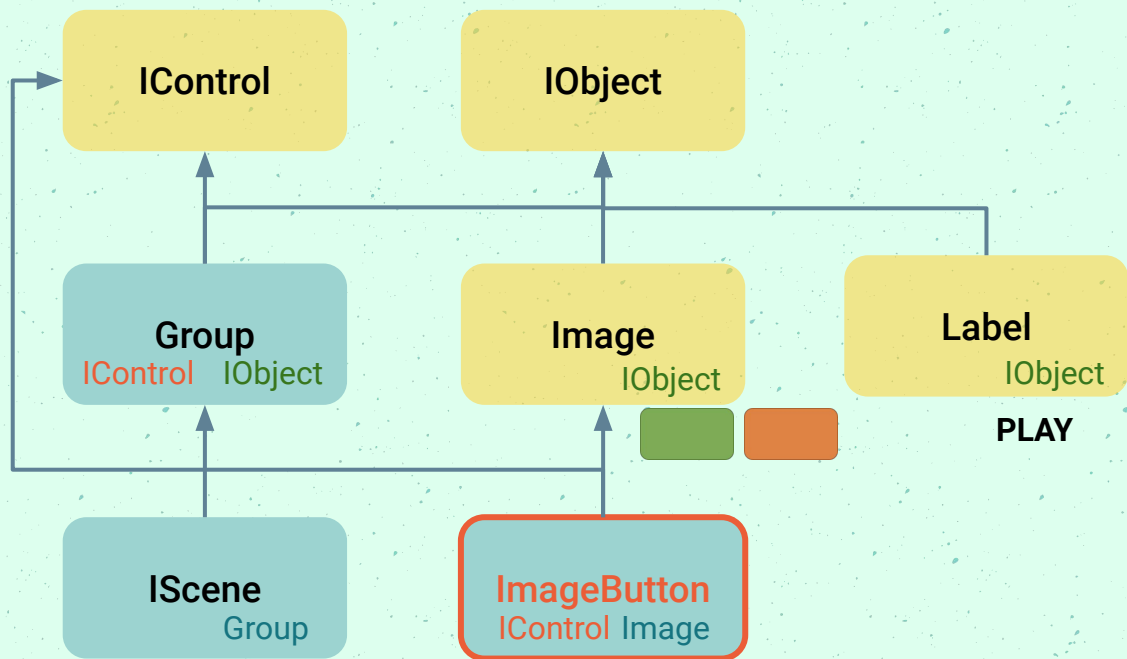
ImageButton
IControl Image

IControl

- The base class of objects that can process event

IControl
類別

public
- ~IControl
- IControl
- OnKeyDown
- OnKeyUp
- OnMouseDown
- OnMouseMove
- OnMouseScroll
- OnMouseUp
- operator=

protected
- controlIterator
- IControl

```
Wait for event  →  Process event  →  Draw
```
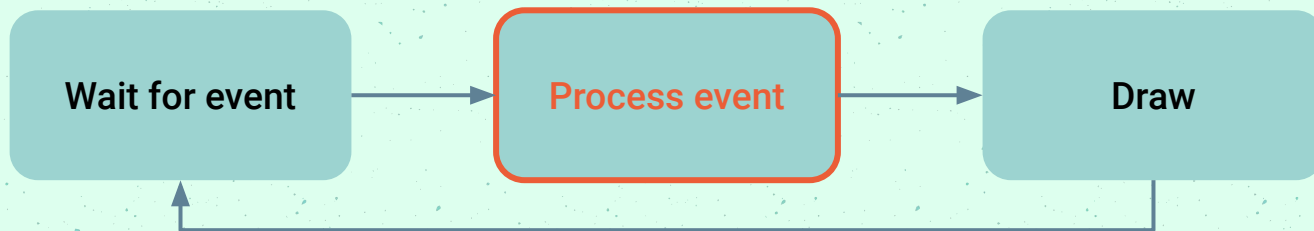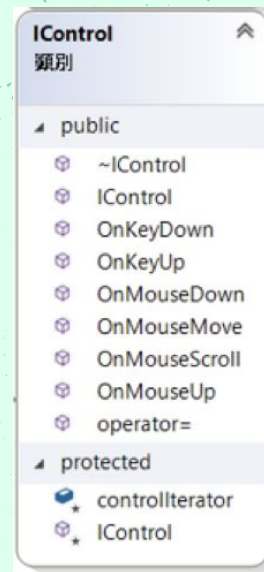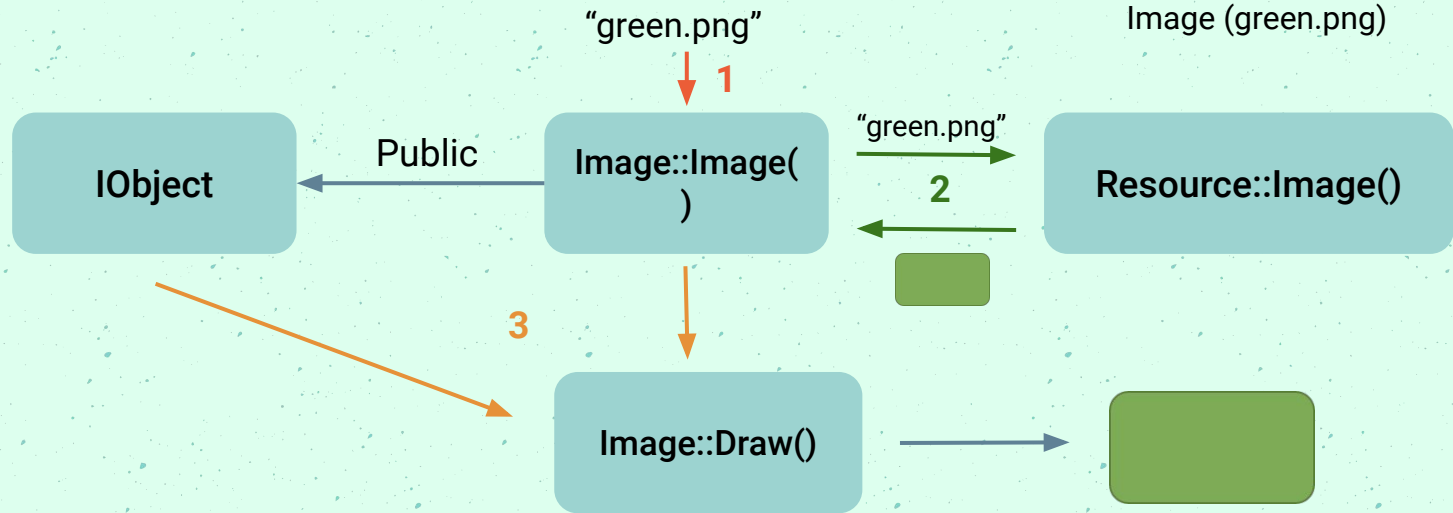
Image

ImageButton

- Derived from IControl, Image
- A clickable button which process events when mouse on/move
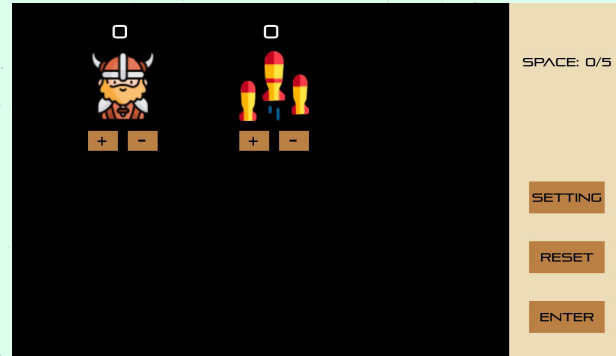

"green.png"

1

| IControl | ← Public — | ImageButton::ImageButton() | "green.ttf" → | Resource::Image() |

2

3

ImageButton::OnMouseDown()

→ Process Event
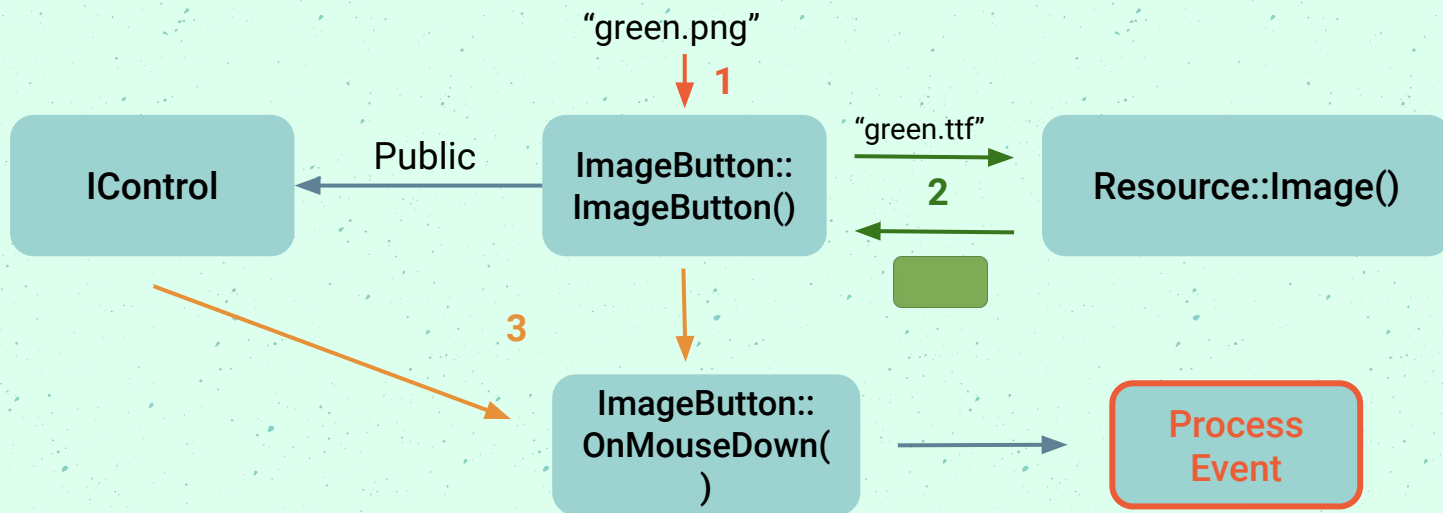
ImageButton (Cont.)

New scene

OnMouseMove(): change image

OnMouseDown(): change scene

Click!

SPACE: 0/5

SETTING

RESET

ENTER

Template: StartScene

01 GameEngine, Resources, Collider

02 Label

03 ImageButton

04 IScene

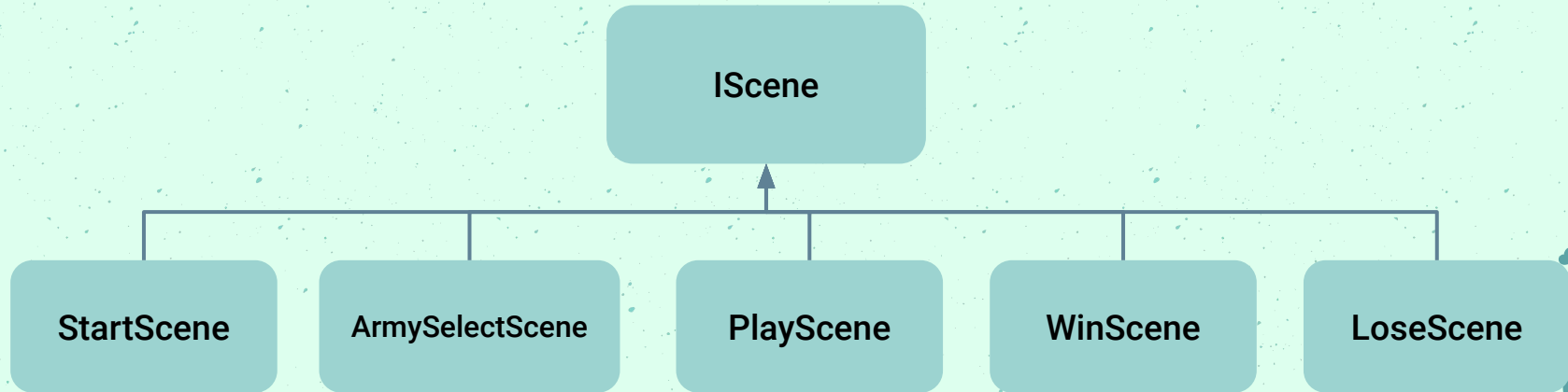**05** Scene Extension

StartScene IScene

TOWER DEFENSE

PLAY

```
IControl          IObject                    GameEngine

Group             Image           Label      Resources
IControl  IObject           IObject  IObject
                                               Collider

IScene            ImageButton
Group             IControl  Image
```
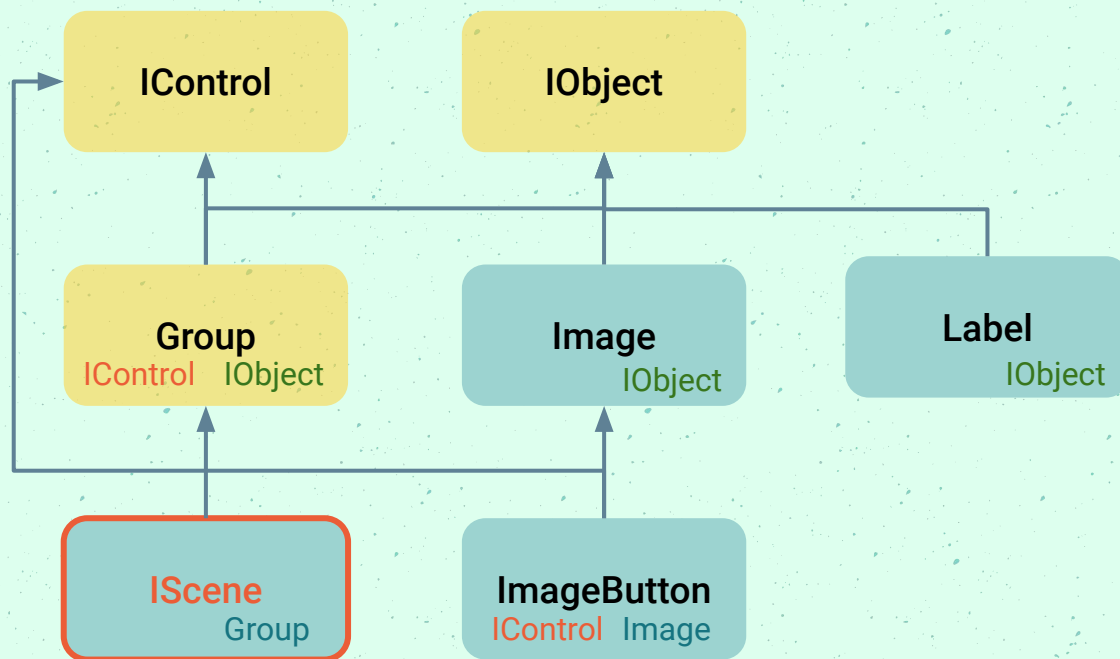
Group

- A class that contains objects / controls

- All objects of IObject and IControl are stored into a individual list respectively to manage

IScene

- Encapsulates a scene
- It must be inherited and customized

```
                    ┌──────────────┐
                    │              │
                    │    IScene    │
                    │              │
                    └──────▲───────┘
```

| StartScene | ArmySelectScene | PlayScene | WinScene | LoseScene |

Template: StartScene

01 GameEngine, Resources, Collider

02 Label

03 ImageButton

04 IScene

05 Scene Extension

Scene Extension
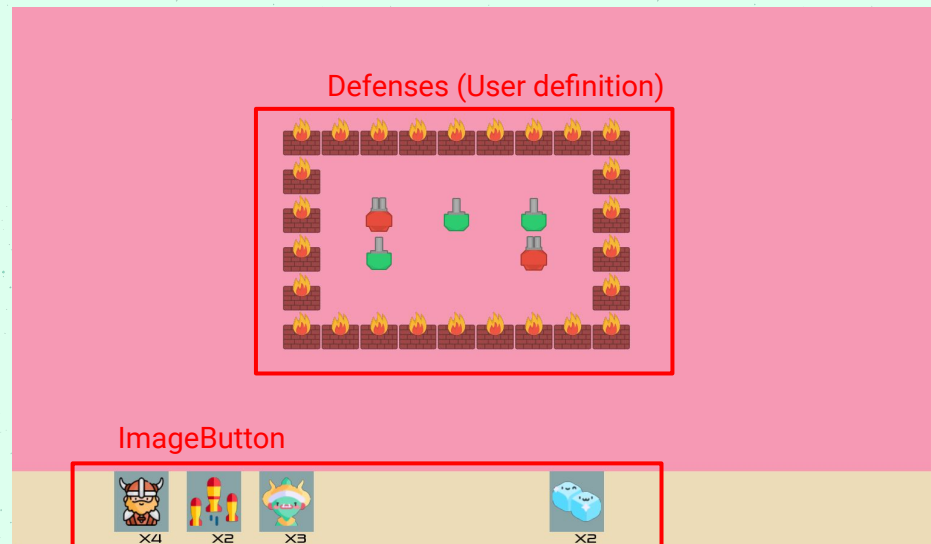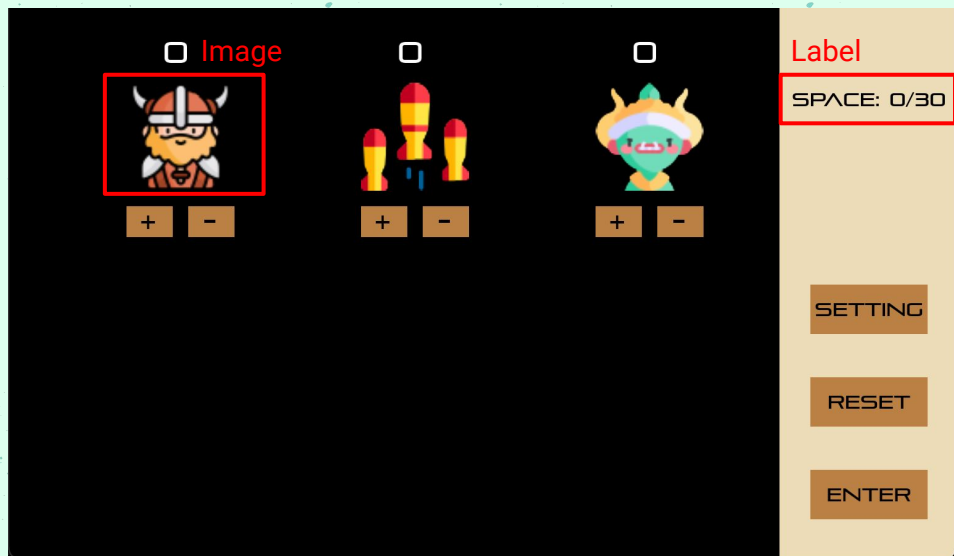
Outline

User extension

IControl

IObject

GameEngine

Group
IControl IObject

Image
IObject

Label
IObject

Resources

Collider

IScene
Group

ImageButton
Image

Sprite
Image

Add scene

Add button

Add defense, army
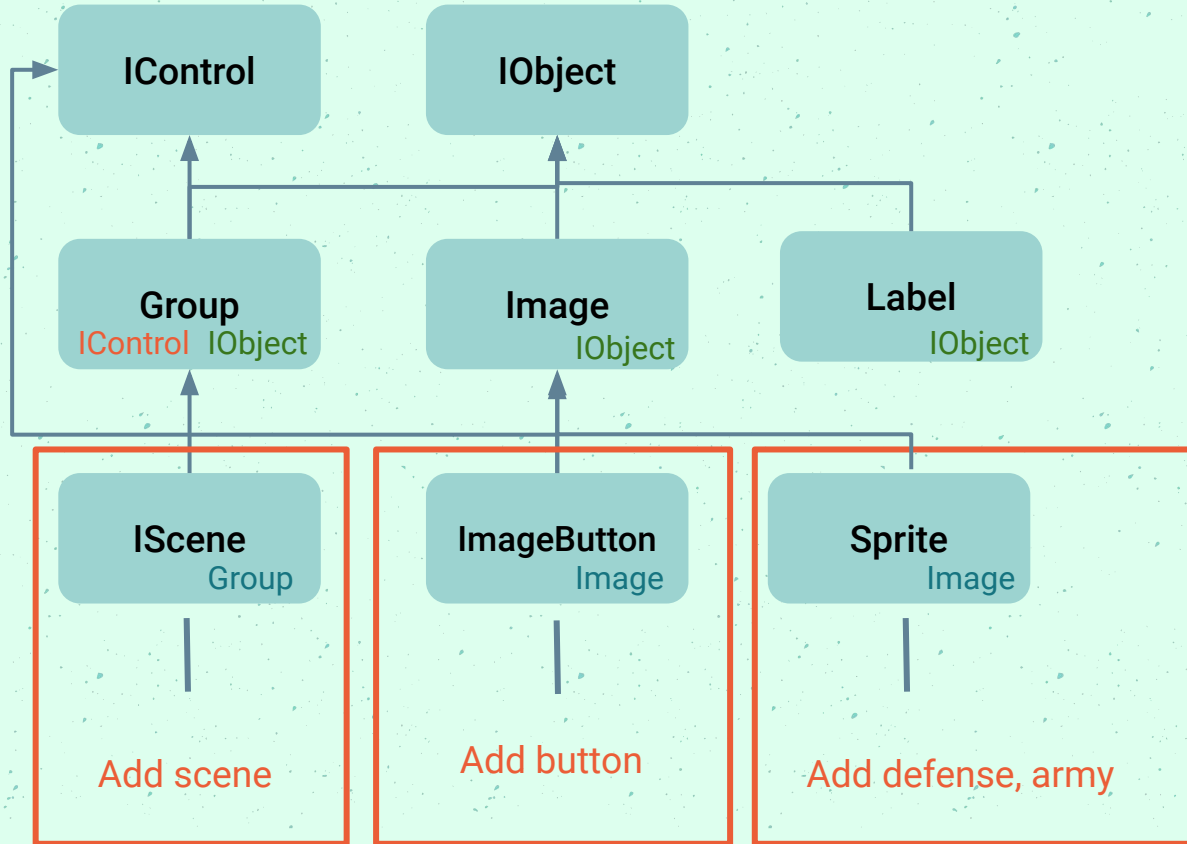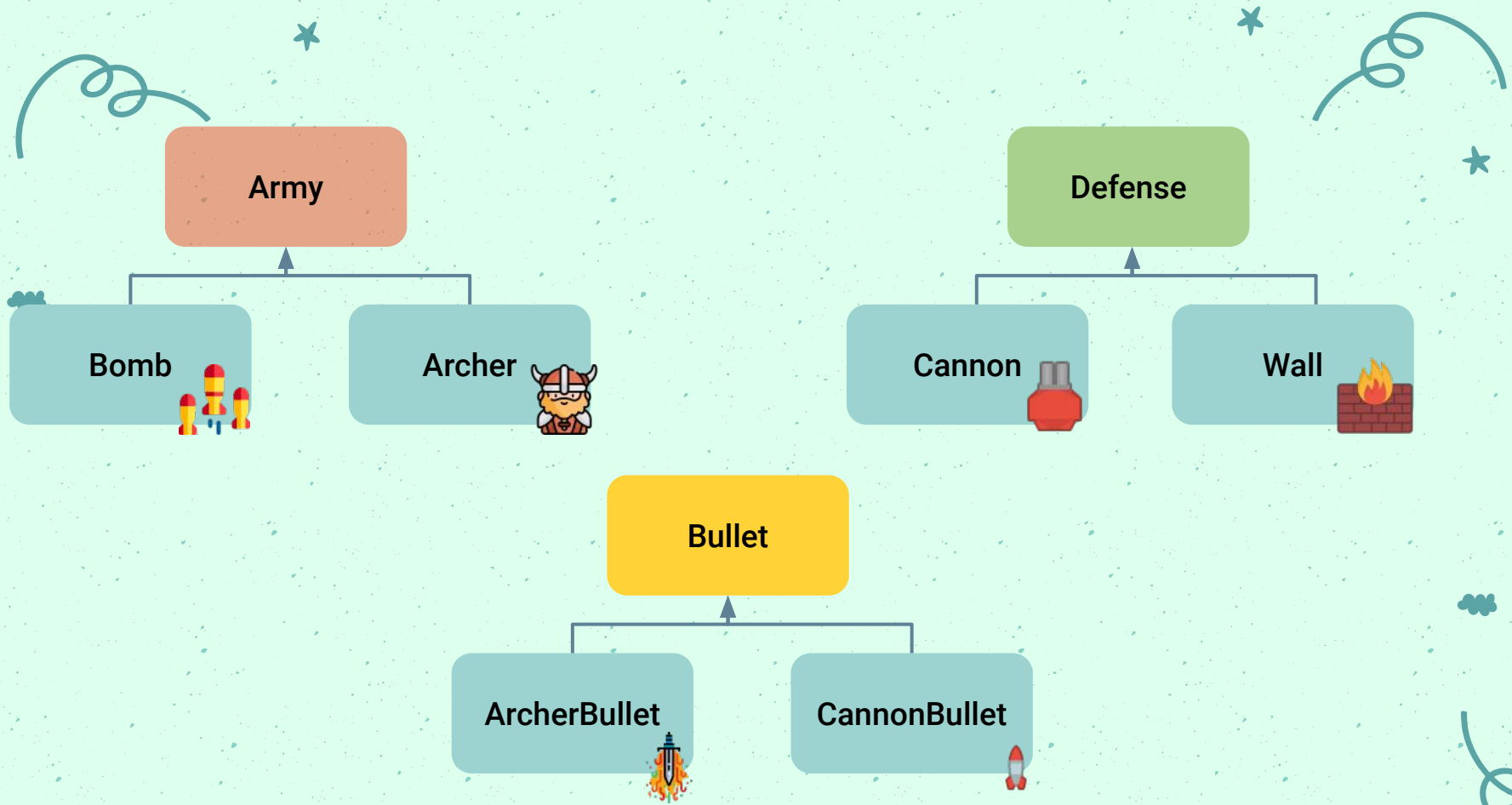
Outline

01 Allegro5 game development process

02 Template: StartScene

03 User Extension

04 Hackathon schedule

Hackathon schedule (5/14)

10:00 – 11:00   QA time

12:00 – 13:00   Demo (morning session)

14:30 – 16:00   QA time

16:30 – 17:30   Demo (afternoon session)

Some details of hackathon

- During the QA time, you can directly join the Teams.

- Otherwise, please type in chat first to make sure TA is online, then join the Teams.

- Each student have 5 mins to demo the hackathon, and TAs will only score by your demonstration, so make sure you prepare before the demo.

- For more details, please check the spec of the hackathon.