Unity3D tutorial for beginner

This is a simple tutorial for unity 3D beginner. Provided by JiaZexuan, feel free to ask me anything in the appropriate manner.

Introduction

Unity is a 2D & 3D game engine that has been around since 2005. Developed by Unity Technologies, it was made in order to provide more developers access to game development tools, which in those days was a novel venture. Over the course of its long life, the engine has changed and expanded dramatically, managing to keep up with the latest practices and technologies.

Why Unity?

- Cross platform: Create on Windows, Linux, Mac, product used on PCs, consoles, smartphone, web, VR/AR, etc.
- Simple and intuitive interface: Visual script, visual interface.
- Comprehensive and simple scripting language: Use C# (a java-like language), unityscript (js for unity), lua, etc.

In addition, there are more game engines, such as Unreal, Godot, etc. But none of them are easier for beginners to make games than Unity.

Composition

1. A game engine, that allow you to create, test and play 2D/3D games and experiences in various devices.

2. An editior, that combines design and user interface with graphics preview and playback controls.

3. A library, that encapsulates many commonly used methods.

Environment setup

I assume that you have already registered a Unity account and obtained a license to use it. If you don't have one, search for it yourself.

Windows and MacOS

1. Install UnityHub

   ```
   https://public-cdn.cloud.unity3d.com/hub/prod/UnityHubSetup.exe
   ```

2. Install a LTS verison editor

   ```
   See "Installs" in UnityHub, and select a LTS version editor
   ```

Linux

1. Add public signing key

   ```
   wget -qO - https://hub.unity3d.com/linux/keys/public | gpg --dearmor | sudo tee
   /usr/share/keyrings/Unity_Technologies_ApS.gpg > /dev/null
   ```

2. Add UnityHub repository in `/etc/apt/sources.list.d`

   ```
   sudo sh -c 'echo "deb [signed-by=/usr/share/keyrings/Unity_Technologies_ApS.gpg]
   https://hub.unity3d.com/linux/repos/deb stable main" >
   /etc/apt/sources.list.d/unityhub.list'
   ```

3. Update package cache and install

   ```
   sudo apt update
   sudo apt-get install unityhub
   ```

4. Install dotnet SDK

   ```
   # download script
   wget https://dot.net/v1/dotnet-install.sh -O dotnet-install.sh
   # update permission
   sudo chmod +x ./dotnet-install.sh
   # install
   ./dotnet-install.sh --version latest
   ```

5. Update environment variable, insert the follows into `~/.bashrc`

```
export DOTNET_ROOT=$HOME/.dotnet
export PATH=$PATH:$HOME/.dotnet:$HOME/.dotnet/tools
```

Start Here

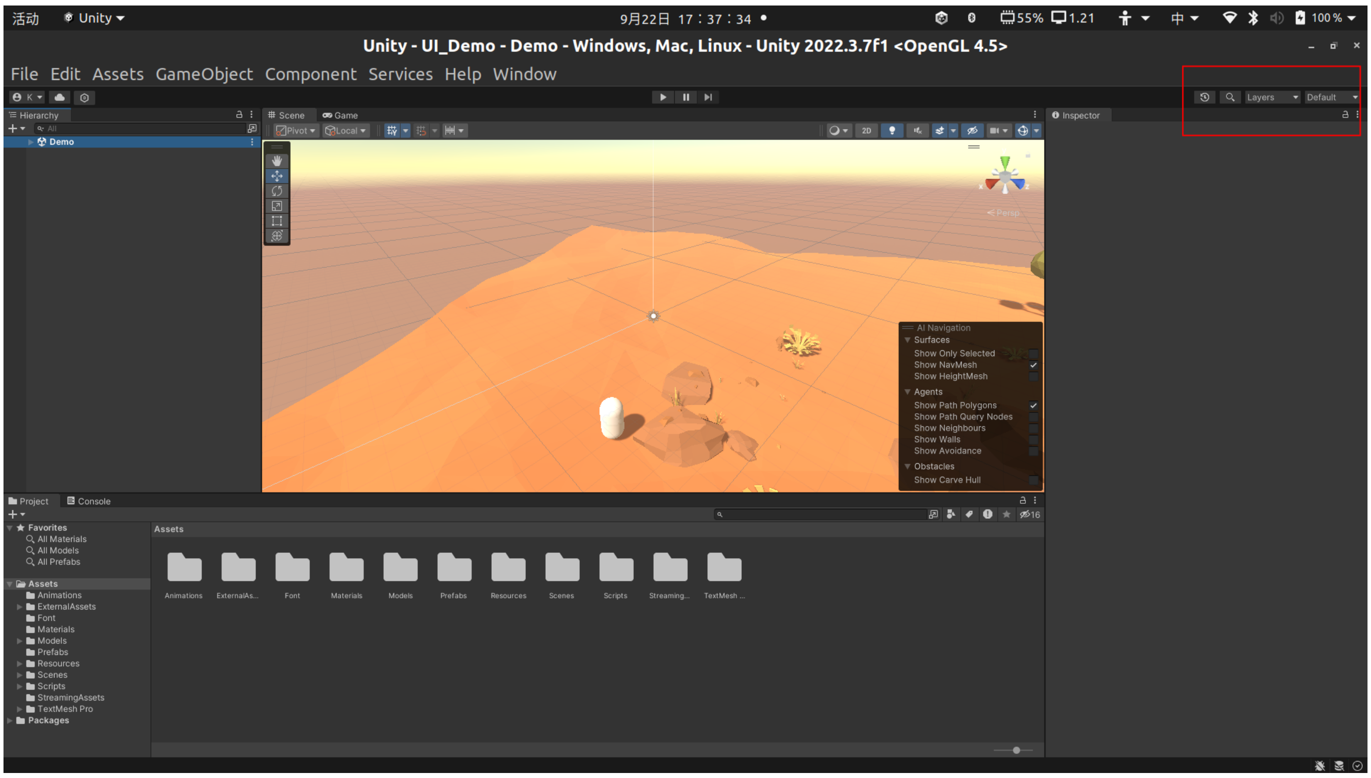
Connect Unity with IDE

I suggest you to use Visual Studio (only for windows) or Jetbrains Rider as your unity IDE. About how to install it, please search yourself.

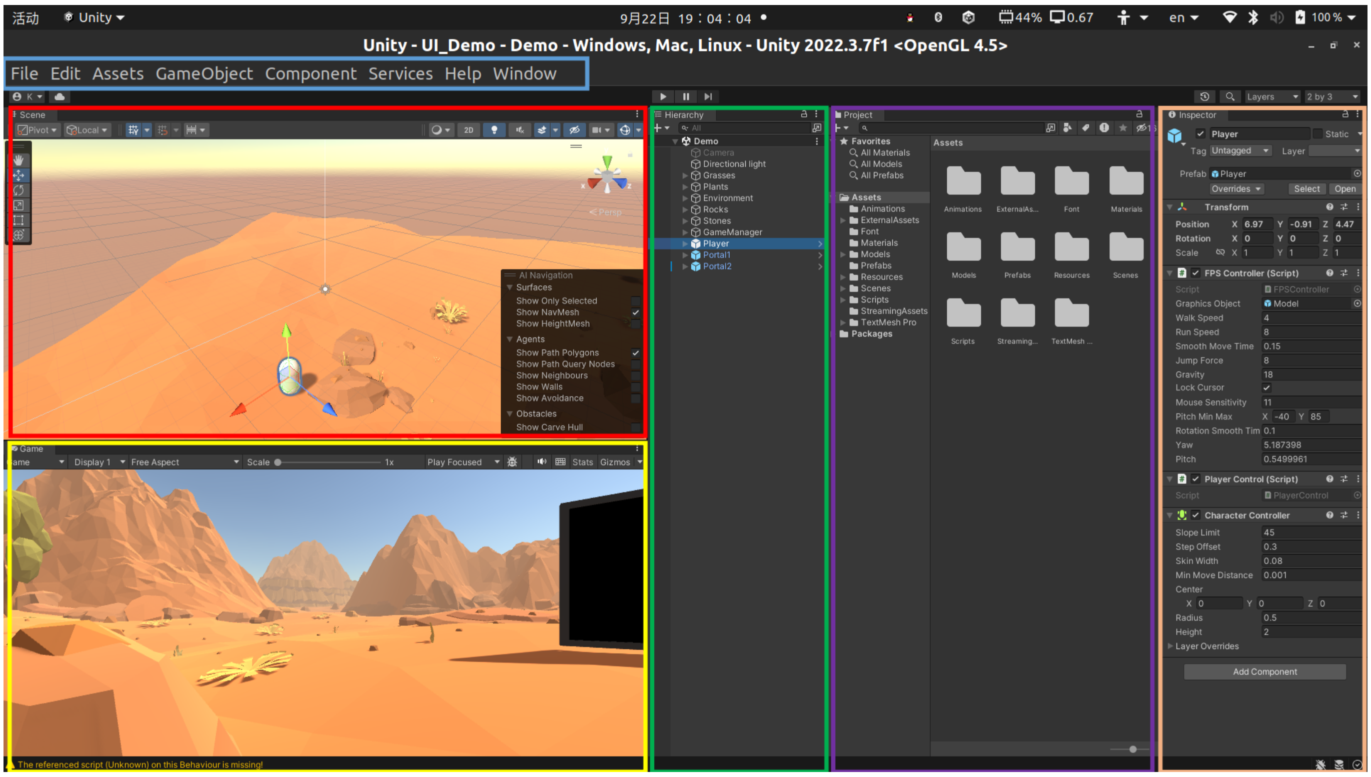
```
Edit->Preferences->External Tools->External Script Editor
```

Layout and panel

In initial state, you will see the interface like this:



I strongly suggest you to set the layout as "2by3" mode, just presh the button rightest of red block and choose "2by3". Then the interface will be like this:



Unity - UI_Demo - Demo - Windows, Mac, Linux - Unity 2022.3.7f1 <OpenGL 4.5>

```
Player                      Static
Tag Untagged   Layer
Prefab Player
Overrides   Select   Open
Transform
Position   X 6.97  Y -0.91  Z 4.47
Rotation   X 0     Y 0      Z 0
Scale      X 1     Y 1      Z 1
FPS Controller (Script)
Script                 FPSController
Graphics Object        Model
Walk Speed             4
Run Speed              8
Smooth Move Time       0.15
Jump Force             8
Gravity                18
Lock Cursor            ✓
Mouse Sensitivity      11
Pitch Min Max          X -40  Y 85
Rotation Smooth Tim    0.1
Yaw                    5.187398
Pitch                  0.5499961
Player Control (Script)
Script                 PlayerControl
Character Controller
Slope Limit            45
Step Offset            0.3
Skin Width             0.08
Min Move Distance      0.001
Center
  X 0    Y 0    Z 0
Radius                 0.5
Height                 2
Layer Overrides
```

The referenced script (Unknown) on this Behaviour is missing!

The editor interface is divided into 6 parts (1 bar + 5 panel):

- Blue: **Editor bar**, just like other software you usually use.
- Red: **Scene panel**, used to display the hierarchical structure of the current scene and the specific performance of objects in the world.
- Yellow: **Game panel**, used to preview the running effect of the game in the Unity editor.
- Green: **Hierarchy panel**, showing the hierarchical structure of all objects in the scene.
- Purple: **Project panel**, showing all resource files in the Unity project, including scenes, scripts, materials, textures, etc.
- Orange: **Inspector panel**, used to view and edit the properties and components of the selected object, add, configure and customize the components of the object.

Special folder

- **Assets**: The Assets folder is the main folder that contains the Assets used by a Unity project. Most API functions assume that everything is located in the Assets folder and don't require it to be mentioned explicitly.
- **Editor**: Editor scripts add functionality to Unity during development but aren't available in builds at runtime. Scripts in an Editor folder run as Editor scripts, not runtime scripts.

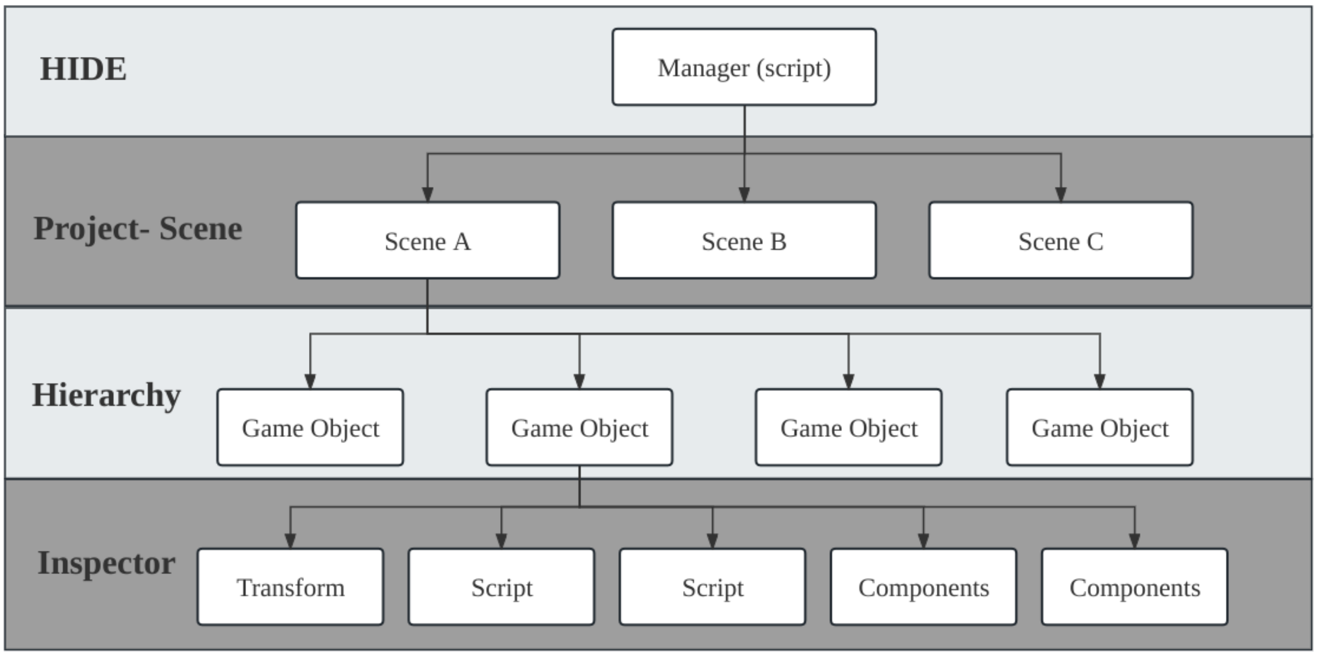
- **Resources**: You can load Assets on-demand from a script instead of creating instances of Assets in a Scene for use in gameplay. You can use `Resources.Load(string objectName)` to load objects.
- **Scenes**: Store the scenarios of your project.
- **Scripts**: Store the script files you wrote.

Structure , Unity and C#

This section is some theoretical knowledge of Unity and C#. It may be relatively abstract, but it is very helpful for completing a complete project.

Structure

Simply, the structures of a unity game are like this, and you can find them on the specific plane shown on the left.



Unity and C#

1. **C#**

   As a compiled language (statically typed language), C# code needs to be compiled by a compiler before running and generate an executable local code file (usually an .exe or .dll file).

2. **Lifecycle method**

The Predetermined Order to execute a number of event functions from top to bottom in Unity Script is called Unity Life Cycle. You could find more details at Understanding the Unity life cycle - Unity Virtual Reality Projects - Second Edition [Book].

3. **Thread**

   There is and only main thread can get and control game object of unity game, use multi-thread to control a game object is impossible. It is hard to use multi-thread to render. Almost all operations about gameobject are high-cost, such as `GameObject.Find()` `GameObject.GetComponent()`, `GameObject.AddComponent()`, `GameObject.setActive()`, call these functions as little as possible.

4. **Coroutine** (advance)

   Since Unity can only operate GameObject in the main thread, coroutines are used to achieve an effect similar to multi-threading. It should be noted that coroutine is not multi-threaded. We use coroutines to simply write a timer to save resources.

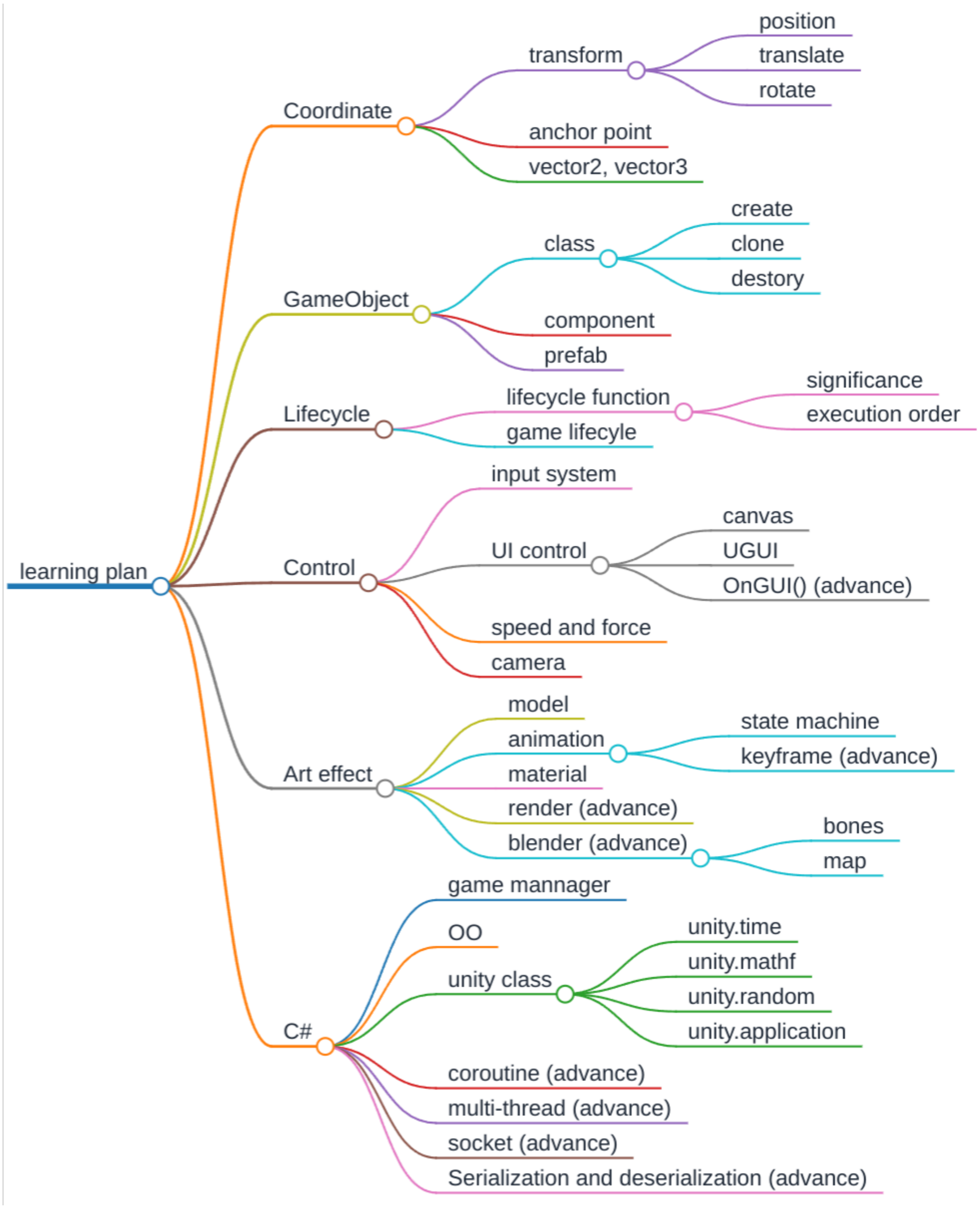
```
public class CoroutineTimer: MonoBehaviour
{
    void Start()
    {
        StartCoroutine(Timer(1));
    }

    IEnumerator Timer(float second)
    {
        int cnt = 0;
        while(true)
        {
            // wait for "second" time, then countine
            yield return new WaitForSeconds(second);
            cnt++;
            Debug.Log(cnt);
            gameObject.GetComponent<TextMeshPro>().text = cnt.ToString();
        }
        // return the conroutine
        yield break;
    }

    void StopTimer()
    {
        // stop all running coroutine named "Timer"
        StopCoroutine("Timer");
    }
}
```

You may have noticed that, the nature of coroutine is an asynchronous method, implemented using iterators. Therefore, when using a coroutine, there'll be GC. It is best not to call one coroutine in multiple places.

Learning Plan

At this step, you must have some basic understanding of Unity development. Due to limited space, we will not describe too much details of the learning plan.

AS the version I provided before was written haphazardly, when I was in the early stages of learning. It may be confusing and complicated, and many parts of it are not necessary to be too in-depth. A simplified version is provided here.



Tips-network service

This section is an introduction and suggestions for those who want to implement network services.

Transport Protocol

From bottom (the link) to top (the user application), these are the physical, data link, net- work, transport, and application layers.

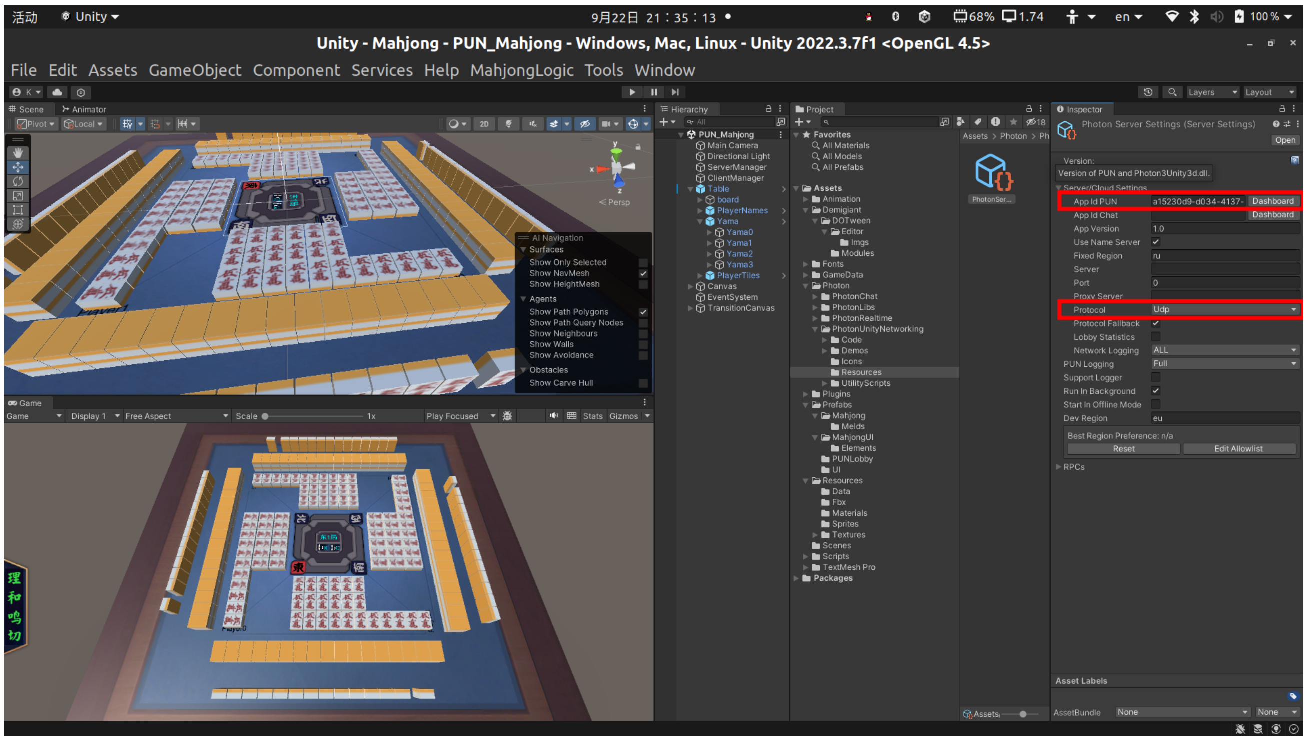
Here, in game development, we just need to foucs on TRANSPORT LAYER and the protocol.

1. TCP (Transmission Control Protocol): achieves reliable network communication through technologies such as "three handshakes, four waves" and checksum, but the speed is slow.
2. UDP (User Datagram Protocol): does not check, is faster, and is commonly used in the gaming field.

Network framework

1. Photon
    - Register and get a app id
    - Install plugin "PUN 2" in unity official asset store, and load in your project
    - Set your appid here

```
Window-> Photon Unity Networking-> Highlight server setting
```



Unity - Mahjong - PUN_Mahjong - Windows, Mac, Linux - Unity 2022.3.7f1 <OpenGL 4.5>

Photon Server Settings (Server Settings)

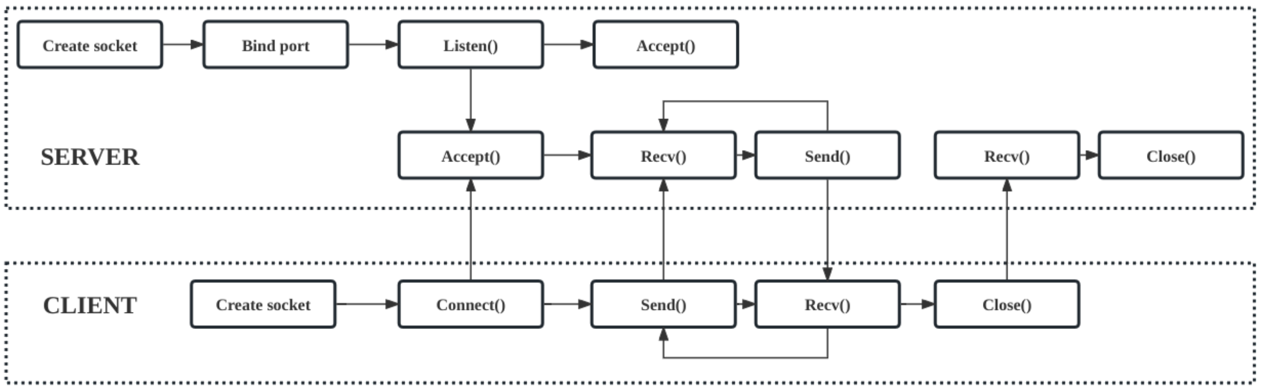
Version:
Version of PUN and Photon3Unity3d.dll.

Server/Cloud Settings

App Id PUN a15230d9-d034-4137-
App Id Chat
App Version 1.0
Use Name Server ✓
Fixed Region ru
Server
Port 0
Proxy Server
Protocol Udp
Protocol Fallback ✓
Lobby Statistics
Network Logging ALL
PUN Logging Full
Support Logger
Run In Background ✓
Start In Offline Mode
Dev Region eu
Best Region Preference: n/a

    - A demo using photon: Tanknarok | Photon Engine

2. C# Socket



The Socket abstraction layer exists between the application layer (user process) and the transport layer (TCP and UDP). It is a set of interfaces that hide the complex TCP/IP protocol family behind the Socket interface in the design pattern.