

Unity Multiplayer Tutorial

For using Networking in Unity.

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Multiplayer Tutorial

Welcome, Unity User.

Here you will learn advanced usage of Unity Networking.

Have a great time and we hope that this tutorial will be helpful.



1. Introduction

The aim of this tutorial is to show the essence of Unity Networking. We will show how to create basic and advanced network applications using Master Server/Client, UDP Server/Client and Direct Connect. In this tutorial we will use Unity iPhone 1.6, iPhone 3GS and the StarTrooper demo from the Unity web site.

2. Getting Started

There are a few things that you should know before you start.

- You will learn how to:
 - ✦ Use basic and advanced components of networking.
 - ✦ Create a server and client.
 - ✦ Use the Master Server.
 - ✦ Use Direct Connect.
 - ✦ Use UDP Broadcast Server.
 - ✦ Create a simple scene on the network.
 - ✦ Convert the StarTrooper game to multiplayer.

 Use other Unity components and more.

- You should have:

 Unity iPhone 1.6.

 iPhone or iPod.


 Knowledge about networks and how they work.

 Advanced C# and JavaScript skills.


 Basic Unity skills. You can find more information [here](#).

- Important notes:

 Unity supports .NET 1.1 and 2.1.

 You can disable or enable Networking in: Edit -> Project Settings -> Player -> Enable Unity Networking.

 Unity Networking supports wifi, 3G and GSM connections.


 You can connect between different types of Unity targets. For example you can connect from Unity on the desktop to Unity iPhone, from Unity Web Player to Unity iPhone, etc.


3. Creating Your First Client / Server Application

In this chapter, we will cover the basics needed to create a simple multiplayer application. We will create our first example featuring moving objects on the network and basic handshaking between the client and server. The example uses all basic multiplayer components such as: [Network](#) and [NetworkView](#). We will use Direct Connect for connection between client and server.


3.1 Preparing Scene

- Now let's start with a simple scene. Your first steps:

 Create a new Project.

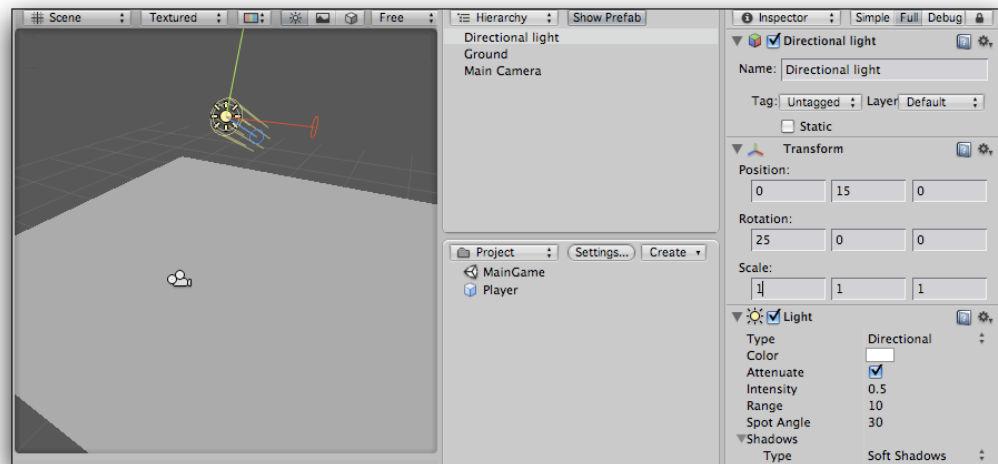
 Create a new Prefab and name it Player: Assets -> Create -> Prefab.

 Create a new Cube GameObject: GameObject -> Create other -> Cube.

 Drag your Cube from the Hierarchy to your Player Prefab in the Project and then delete your Cube from the scene.

- ✎ Create a new Plane and name it Ground: GameObject -> Create other -> Plane. Your Plane parameters should be: Position (0,0,0), Rotation (0,0,0), Scale (5,5,5).
- ✎ Create a Directional Light: GameObject -> Create other -> Directional Light. Light parameters: Position (0,15,0), Rotation (25,0,0), Scale (1,1,1) Shadows -> Type -> Soft Shadows.
- ✎ Finally, save your scene and name it MainGame: File -> Save Scene.

Everything should look like this image:



3.2 Creating Scripts & Adding Components

- Next you will learn how to create the server and client, instantiate the scene and objects on the network, move objects, and connect everything together.

3.2.1 Server & Client

- We will start with the most important — the creation of Server and Client:

- ✎ Create a new JavaScript file and name it ConnectionGUI: Assets -> Create -> JavaScript.
- ✎ Add this file (by dragging) to the Main Camera object in the Hierarchy, then open the file and create some variables:

```
var remoteIP = "127.0.0.1";
var remotePort = 25000;
var listenPort = 25000;
var useNAT = false;
var yourIP = "";
var yourPort = "";
```



Now we will create an interface using Unity [GUI](#) for creating the server and connecting to it:

```
function OnGUI () {
    // Checking if you are connected to the server or not
    if (Network.peerType == NetworkPeerType.Disconnected)
    {
        // If not connected

        if (GUI.Button (new Rect(10,10,100,30),"Connect"))
        {
            Network.useNat = useNAT;
            // Connecting to the server
            Network.Connect(remoteIP, remotePort);
        }
        if (GUI.Button (new Rect(10,50,100,30),"Start Server"))
        {
            Network.useNat = useNAT;
            // Creating server
            Network.InitializeServer(32, listenPort);

            // Notify our objects that the level and the network is ready
            for (var go : GameObject in FindObjectsOfType(GameObject))
            {
                go.SendMessage("OnNetworkLoadedLevel",
                SendMessageOptions.DontRequireReceiver);
            }
        }

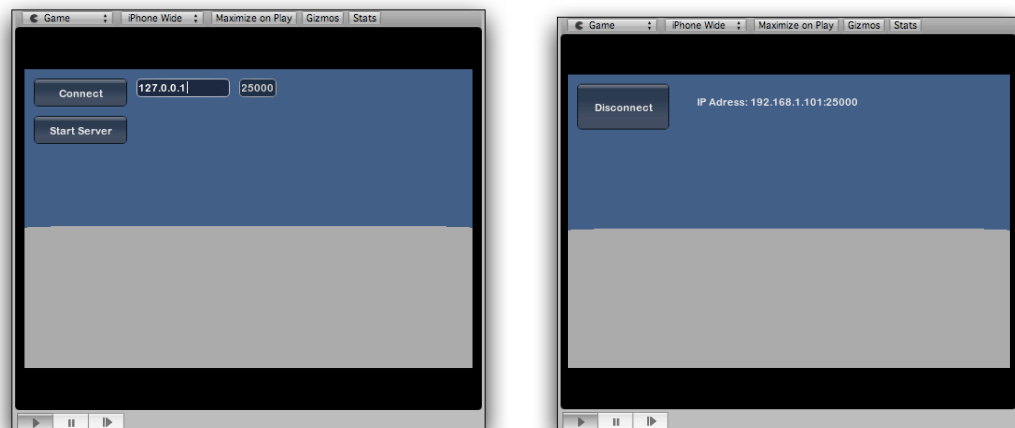
        // Fields to insert ip address and port
        remoteIP = GUI.TextField(new Rect(120,10,100,20),remoteIP);
        remotePort = parseInt(GUI.TextField(new
        Rect(230,10,40,20),remotePort.ToString()));
    }
    else
    {
        // Getting your ip address and port
        ipaddress = Network.player.ipAddress;
        port = Network.player.port.ToString();

        GUI.Label(new Rect(140,20,250,40),"IP Adress: "+ipaddress+":"+port);
        if (GUI.Button (new Rect(10,10,100,50),"Disconnect"))
        {
            // Disconnect from the server
            Network.Disconnect(200);
        }
    }
}
```

- Pay attention to the function below. This function is called every time someone successfully connects. When this happens, we notify all objects that the scene and the network are ready.

```
function OnConnectedToServer () {
    // Notify our objects that the level and the network are ready
    for (var go : GameObject in FindObjectsOfType(GameObject))
        go.SendMessage("OnNetworkLoadedLevel",
            SendMessageOptions.DontRequireReceiver);
}
```

- In Play mode your screen should look like these images:

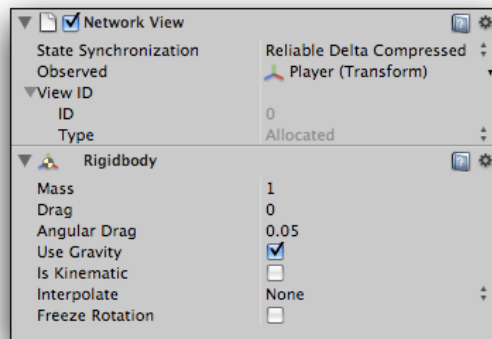


- Now you can test your server and client. Edit your Player Settings (Edit -> Project Settings -> Player) to set up your iPhone Bundle Identifier and switch the Default Screen Orientation to Landscape Right. Build your project to the iPhone and create a server in the Editor. Try to connect to the server using the IP address you can find on the server screen — if everything goes OK you will see “Disconnect” button and your IP address on both screens. Note that both applications must be on the same network for everything to work.

3.2.2 Scene & Objects Instantiation On The Network

- Now we need to add the network components to your Player (Cube) and write code to instantiate it:

- ✎ Select Player Prefab and add a [NetworkView](#): Components -> Miscellaneous -> NetworkView.
- ✎ When the component appears on your object change the State Synchronization parameter to Reliable Delta Compressed. This is needed to show your synchronized transformation to all users.
- ✎ Add a Rigidbody to your Player Prefab: Select Prefab -> Component -> Physics -> Rigidbody.
- ✎ Your new components should look like this image:



- Now we will instantiate your Player and objects on the network:
- ✎ Create a new empty GameObject and name it Spawn. Object parameters: Position (0,5,0), Rotation (0,0,0), Scale (1,1,1).
- ✎ Create a new JavaScript file and name it Instantiate.
- ✎ Open the file and write following code:

```
var SpaceCraft : Transform;

function OnNetworkLoadedLevel () {
    // Instantiating SpaceCraft when Network is loaded
    Network.Instantiate(SpaceCraft, transform.position, transform.rotation, 0);
}

function OnPlayerDisconnected (player : NetworkPlayer) {
    Network.RemoveRPCs(player, 0);
    Network.DestroyPlayerObjects(player);
}
```

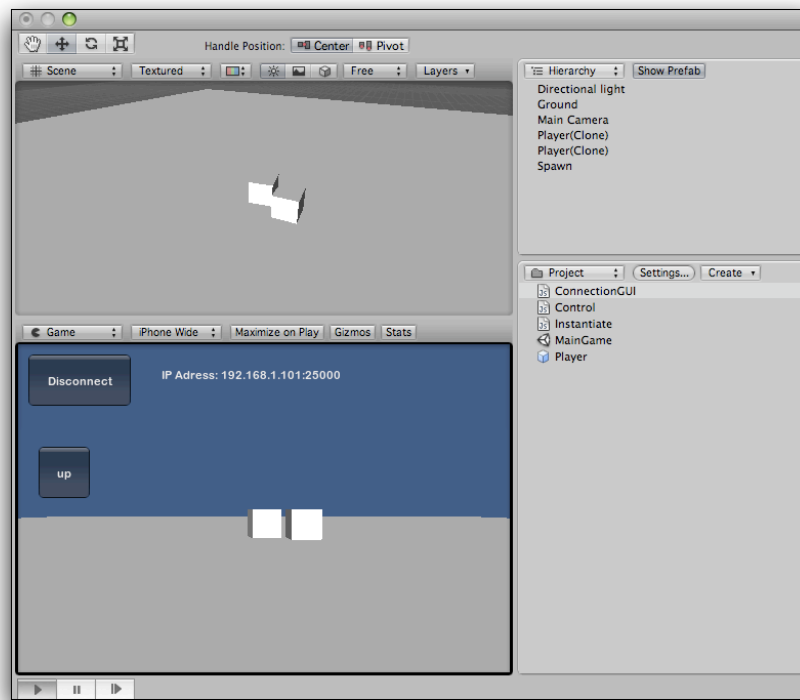

- ✎ Add this file to your Spawn object: Select Spawn Object -> Component -> Scripts -> Instantiate.
- ✎ Select your Spawn object and change the Player parameter to "Player (Transform)" by selecting your prefab from the list.

- If you test your example you will see that the server and each connected user will have their own Player (Cube). To be sure, we will create a simple test:

- ✎ Create a new JavaScript file and name it Control.js.
- ✎ Add this code to the file:

```
function OnGUI() {
    if(GUI.Button(new Rect(20,100,50,50),"up"))
    {
        GameObject.Find("Player(Clone)").transform.position = new Vector3(0,5,0);
    }
}
```

- ✎ Add this file to the Spawn object in the Hierarchy.
- ✎ Build your project, create a server and connect to it. Now you can see that everyone can move their own Player (Cube).
- ✎ Your editor screen should look like this image:



3.3 Quick Overview

Congratulations! You have covered all of the basics needed to create a multiplayer application.

- You have learned how to:
 - 🔗 Prepare a basic scene for a multiplayer game.
 - 🔗 Create a server.
 - 🔗 Create a client.
 - 🔗 Use Direct Connect.
 - 🔗 Use the basic network components.
 - 🔗 Instantiate a scene and objects on the network.
 - 🔗 Connect everything together.

[Download the whole NetworkExample project.](#)

In the next chapter, we will expand on the ideas that we have already covered and create an advanced networking setup.

4. Implementing Multiplayer in Startrooper

In this chapter you will learn how to convert the StarTrooper game from single player to multiplayer. We will use complex components and three different connection types: Direct Connect (that you have seen in chapter 4), MasterServer Connection and UDP Broadcast connection. At the end of this chapter you will be able to fly around and kill other users in multiplayer mode.

- Download [StarTrooper](#) from the Unity Web Site and make yourself familiar with it.

4.1 Changing Scene

- As the scene we're going to modify was designed for single player game, we need to change it a little bit. We will make more changes here later, but we'll start with some basics:

- ✎ Open the downloaded StarTrooper project.
- ✎ Select the StarTrooper scene.
- ✎ Select SpaceCraftFBX in Hierarchy.
- ✎ Add a NetworkView Component: Component -> Miscellaneous -> NetworkView.
- ✎ Remove the Player Controls script from the object.
- ✎ Remove the Missile Launcher script from the object.
- ✎ Add a Trail Render: Component -> Particles -> Trail Render.
- ✎ In the Trail Render set Materials -> Element 0 -> missileTracer.
- ✎ Create a new GameObject and name it Spawn: GameObject -> Create Empty. Set Transform parameters: Position (0,30,11), Rotation (0,0,0), Scale (1,1,1).

4.2 Integration

Now we will make our main changes and integrate networking into the project. Let's begin by preparing the scene and SpaceCraft for the network. When we are done, we will create a server and client.

4.2.1 Integrating Objects & Scene

- Now we need to create a script that will translate our Rigidbody on the Network:
 - ✎ First, create two folders: "NetworkFiles" for new scripts and "Plugins" for C# files that should be pre-compiled.
 - ✎ Create a C# file and name it NetworkRigidbody.
 - ✎ Move the NetworkRigidbody.cs file to the Plugins folder.

- Do not worry much about this file, just use it where it is required.
- You can use this script on any project you want, because it's suitable for all Rigidbody objects.
- Open your NetworkRigidbody.cs file and use this code:

```
using UnityEngine;
using System.Collections;

public class NetworkRigidbody : MonoBehaviour {

    public double m_InterpolationBackTime = 0.1;
    public double m_ExtrapolationLimit = 0.5;

    internal struct State
    {
        internal double timestamp;
        internal Vector3 pos;
        internal Vector3 velocity;
        internal Quaternion rot;
        internal Vector3 angularVelocity;
    }

    // We store twenty states with "playback" information
    State[] m_BufferedState = new State[20];
    // Keep track of what slots are used
    int m_TimestampCount;

    void OnSerializeNetworkView(BitStream stream, NetworkMessageInfo info) {
        // Send data to server
        if (stream.isWriting)
        {
            Vector3 pos = rigidbody.position;
            Quaternion rot = rigidbody.rotation;
            Vector3 velocity = rigidbody.velocity;
            Vector3 angularVelocity = rigidbody.angularVelocity;

            stream.Serialize(ref pos);
            stream.Serialize(ref velocity);
            stream.Serialize(ref rot);
            stream.Serialize(ref angularVelocity);
        }
        // Read data from remote client
        else
        {
            Vector3 pos = Vector3.zero;
            Vector3 velocity = Vector3.zero;
            Quaternion rot = Quaternion.identity;
```

```

        Vector3 angularVelocity = Vector3.zero;
        stream.Serialize(ref pos);
        stream.Serialize(ref velocity);
        stream.Serialize(ref rot);
        stream.Serialize(ref angularVelocity);

        // Shift the buffer sideways, deleting state 20
        for (int i=m_BufferedState.Length-1;i>=1;i--)
        {
            m_BufferedState[i] = m_BufferedState[i-1];
        }

        // Record current state in slot 0
        State state;
        state.timestamp = info.timestamp;
        state.pos = pos;
        state.velocity = velocity;
        state.rot = rot;
        state.angularVelocity = angularVelocity;
        m_BufferedState[0] = state;

        // Update used slot count, however never exceed the buffer size
        // Slots aren't actually freed so this just makes sure the buffer is
        // filled up and that uninitialized slots aren't used.
        m_TimestampCount = Mathf.Min(m_TimestampCount + 1,
m_BufferedState.Length);

        // Check if states are in order, if it is inconsistent you could reshuffle or
        // drop the out-of-order state. Nothing is done here
        for (int i=0;i<m_TimestampCount-1;i++)
        {
            if (m_BufferedState[i].timestamp < m_BufferedState[i+1].timestamp)
                Debug.Log("State inconsistent");
        }
    }

    // We have a window of interpolationBackTime where we basically play
    // By having interpolationBackTime the average ping, you will usually use
    interpolation.
    // And only if no more data arrives we will use extra polation
    void Update () {
        // This is the target playback time of the rigid body
        double interpolationTime = Network.time - m_InterpolationBackTime;

        // Use interpolation if the target playback time is present in the buffer
        if (m_BufferedState[0].timestamp > interpolationTime)
        {

```

```

        // Go through buffer and find correct state to play back
        for (int i=0;i<m_TimestampCount;i++)
        {
            if (m_BufferedState[i].timestamp <= interpolationTime || i ==
m_TimestampCount-1)
            {
                // The state one slot newer (<100ms) than the best playback state
                State rhs = m_BufferedState[Mathf.Max(i-1, 0)];
                // The best playback state (closest to 100 ms old (default time))
                State lhs = m_BufferedState[i];

                // Use the time between the two slots to determine if interpolation is
necessary
                double length = rhs.timestamp - lhs.timestamp;
                float t = 0.0F;
                // As the time difference gets closer to 100 ms t gets closer to 1 in
                // which case rhs is only used
                // Example:
                // Time is 10.000, so sampleTime is 9.900
                // lhs.time is 9.910 rhs.time is 9.980 length is 0.070
                // t is 9.900 - 9.910 / 0.070 = 0.14. So it uses 14% of rhs, 86% of
lhs
                if (length > 0.0001)
                    t = (float)((interpolationTime - lhs.timestamp) / length);

                // if t=0 => lhs is used directly
                transform.localPosition = Vector3.Lerp(lhs.pos, rhs.pos, t);
                transform.localRotation = Quaternion.Slerp(lhs.rot, rhs.rot, t);
                return;
            }
        }
        // Use extrapolation
        else
        {
            State latest = m_BufferedState[0];

            float extrapolationLength = (float)(interpolationTime - latest.timestamp);
            // Don't extrapolation for more than 500 ms, you would need to do that
carefully
            if (extrapolationLength < m_ExtrapolationLimit)
            {
                float axisLength = extrapolationLength * latest.angularVelocity.magnitude
* Mathf.Rad2Deg;
                Quaternion angularRotation = Quaternion.AngleAxis(axisLength,
latest.angularVelocity);

                rigibody.position = latest.pos + latest.velocity * extrapolationLength;

```

```

        rigidbody.rotation = angularRotation * latest.rot;
        rigidbody.velocity = latest.velocity;
        rigidbody.angularVelocity = latest.angularVelocity;
    }
}
}
}

```

- ✎ Select your SpaceCraftFBX object in the Hierarchy (not in the Project files).
- ✎ Add NetworkRigidbody.cs to your selected object: Component -> Scripts -> Network Rigidbody.
- ✎ Disable the NetworkRigidbody component (just remove a tick from component). We will enable it later with some conditions.
- ✎ In the Network View component: change the Observed parameter from SpaceCraftFBX (Transform) to SpaceCraftFBX (NetworkRigidbody).
- ✎ Create a new JavaScript file and name it RigidAssign.
- ✎ Add RigidAssign.js to your object and edit the file:

```

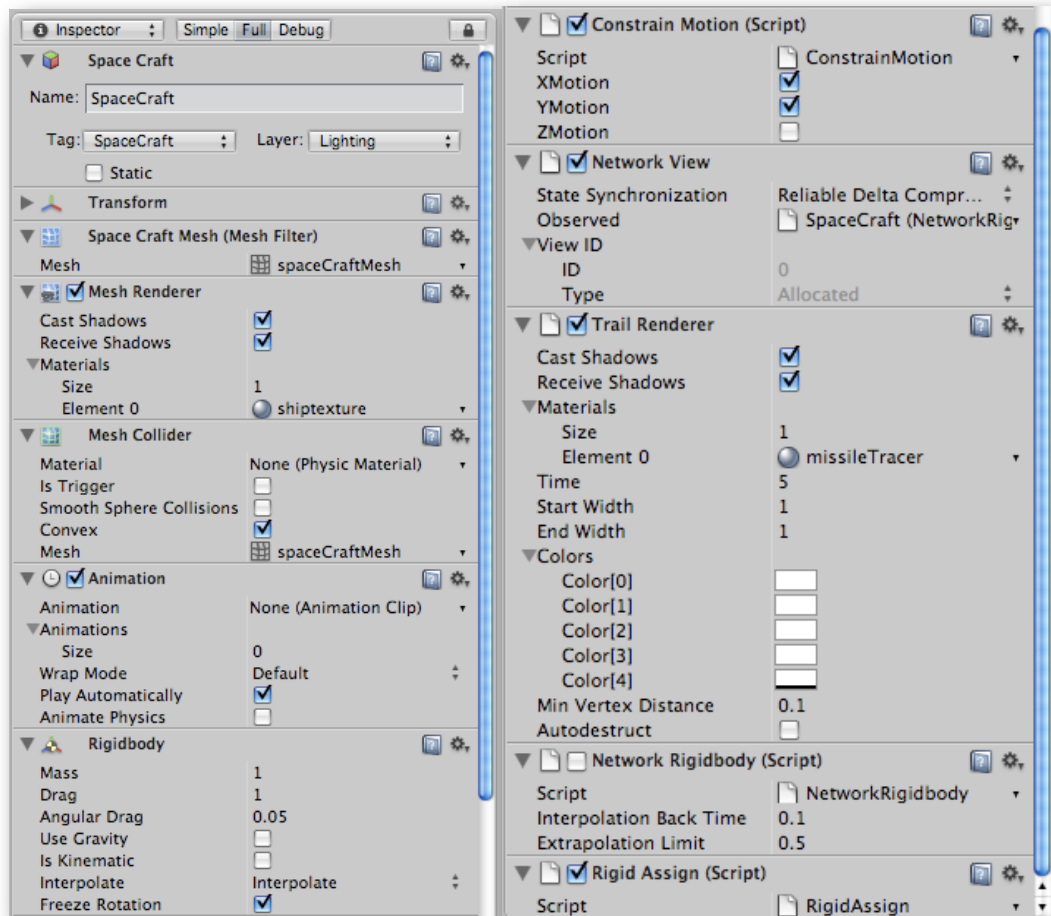
function OnNetworkInstantiate (msg : NetworkMessageInfo) {
    if (networkView.isMine)
    {
        var _NetworkRigidbody : NetworkRigidbody =
GetComponent("NetworkRigidbody");
        _NetworkRigidbody.enabled = false;
    }
    else
    {
        name += "Remote";
        var _NetworkRigidbody2 : NetworkRigidbody =
GetComponent("NetworkRigidbody");
        _NetworkRigidbody2.enabled = true;
    }
}
}

```

- ✎ Create a new Prefab, name it SpaceCraft and move it to your Prefabs folder.
- ✎ Drag your SpaceCraftFBX from the Hierarchy to your new Prefab (SpaceCraft) in Project window.
- ✎ Delete SpaceCraftFBX from the scene.
- ✎ Create the Tag "SpaceCraft" for your SpaceCraft Prefab: Edit -> Project Settings -> Tags.

✎ Select your SpaceCraft Prefab again and assign the Tag to it: click on "Untagged" and select "SpaceCraft".

- Your SpaceCraft Prefab should look like this image:



The SpaceCraft is now prepared for the Network!

✎ Create a new JavaScript file and name it Instantiate.js

✎ Add the file to the Spawn object in the Hierarchy and write this code to it:

```
var SpaceCraft : Transform;

function OnNetworkLoadedLevel () {
    // Instantiating SpaceCraft when Network is loaded
    Network.Instantiate(SpaceCraft, transform.position, transform.rotation, 0);
}




function OnPlayerDisconnected (player : NetworkPlayer) {
    // Removing player if Network is disconnected
```



```

Debug.Log("Server destroying player");
Network.RemoveRPCs(player, 0);
Network.DestroyPlayerObjects(player);
}

```

-  Select the Spawn object in the Hierarchy and set the Space Craft parameter to SpaceCraft (Transform) (select your SpaceCraft Prefab from list).
-  Select the Main Camera object in the Hierarchy.
-  Open the Smooth Follow script and change everything to:

```

var target : Transform;
var distance : float = 10.0;
var height : float = 5.0;
var heightDamping : float = 2.0;
var rotationDamping : float = 3.0;

function LateUpdate () {
    if(GameObject.FindWithTag("SpaceCraft"))
    {
        if (!target)
            target = GameObject.FindWithTag("SpaceCraft").transform;

        // Calculate the current rotation angles
        var wantedRotationAngle : float = target.eulerAngles.y;
        var wantedHeight : float = target.position.y + height;
        var currentRotationAngle : float = transform.eulerAngles.y;
        var currentHeight : float = transform.position.y;

        // Damp the rotation around the y-axis
        var dt : float = Time.deltaTime;
        currentRotationAngle = Mathf.LerpAngle (currentRotationAngle,
wantedRotationAngle, rotationDamping * dt);
        // Damp the height
        currentHeight = Mathf.Lerp (currentHeight, wantedHeight, heightDamping * dt);

        // Convert the angle into a rotation
        var currentRotation : Quaternion = Quaternion.Euler (0, currentRotationAngle,
0);

        // Set the position of the camera on the x-z plane to:
        // distance meters behind the target
        //transform.position = target.position;
        var pos : Vector3 = target.position - currentRotation * Vector3.forward *
distance;
        pos.y = currentHeight;

        // Set the height of the camera

```

```

        transform.position = pos;
        // Always look at the target
        transform.LookAt (target);
    }
}

```

✎ Add the Player Controls script to the Main Camera and open it to edit.

✎ Change everything to this code:

```

var turnSpeed : float = 3.0;
var maxTurnLean : float = 70.0;
var maxTilt : float = 50.0;

var sensitivity : float = 0.5;

var forwardForce : float = 5.0;
var guiSpeedElement : Transform;
var craft : GameObject;

private var normalizedSpeed : float = 0.2;
private var euler : Vector3 = Vector3.zero;

var horizontalOrientation : boolean = true;

function Awake () {
    if (horizontalOrientation)
    {
        iPhoneSettings.screenOrientation =
            iPhoneScreenOrientation.LandscapeLeft;
    }
    else
    {
        iPhoneSettings.screenOrientation =
            iPhoneScreenOrientation.Portrait;
    }

    guiSpeedElement = GameObject.Find("speed").transform;
    guiSpeedElement.position = new Vector3 (0, normalizedSpeed, 0);
}

function FixedUpdate () {

    if(GameObject.FindWithTag("SpaceCraft"))
    {
        GameObject.FindWithTag("SpaceCraft").rigidbody.AddRelativeForce(0, 0,
normalizedSpeed * (forwardForce*3));

        var accelerator : Vector3 = iPhoneInput.acceleration;

```

```

        if (horizontalOrientation)
        {
            var t : float = accelerator.x;
            accelerator.x = -accelerator.y;
            accelerator.y = t;
        }

        // Rotate turn based on acceleration
        euler.y += accelerator.x * turnSpeed;
        // Since we set absolute lean position, do some extra smoothing on it
        euler.z = Mathf.Lerp(euler.z, -accelerator.x * maxTurnLean, 0.2);




        // Since we set absolute lean position, do some extra smoothing on it
        euler.x = Mathf.Lerp(euler.x, accelerator.y * maxTilt, 0.2);

        // Apply rotation and apply some smoothing
        var rot : Quaternion = Quaternion.Euler(euler);

        GameObject.FindWithTag("SpaceCraft").transform.rotation = Quaternion.Lerp
        (transform.rotation, rot, sensitivity);
    }
}

function Update () {
    for (var evt : iPhoneTouch in iPhoneInput.touches)
    {
        if (evt.phase == iPhoneTouchPhase.Moved)
        {
            normalizedSpeed = evt.position.y / Screen.height;
            guiSpeedElement.position = new Vector3 (0, normalizedSpeed, 0);
        }
    }
}

```

-  Add a Missile Launcher script to the Main Camera. Set the Missile parameter to missilePrefab.
-  Open the Missile Launcher script to edit.
-  We will add a timer for shooting and some small changes as well.

```

var missile : GameObject;
var timer : int = 0;

function FixedUpdate() {
    timer++;
}

```




```

function Update () {
    if ((Input.GetMouseButtonDown (0))&&(timer>10))
    {
        // if SpaceCraft exists
        if(GameObject.FindWithTag("SpaceCraft"))
        {
            var position : Vector3 = new Vector3(0, -0.2, 1) * 10.0;
            position = GameObject.FindWithTag("SpaceCraft").transform.TransformPoint
(position);

            // instantiating missile
            var thisMissile : GameObject = Network.Instantiate (missile, position,
GameObject.FindWithTag("SpaceCraft").transform.rotation,0) as GameObject;
            Physics.IgnoreCollision(thisMissile.collider,
GameObject.FindWithTag("SpaceCraft").collider);;

            timer = 0;
        }
    }
}

```

-  Create the new tag "Missile" and assign it to missilePrefab.
-  Select the missilePrefab and open the MissileTrajectory script to edit.
-  We will make the ability to kill other SpaceCraft:

```

var explosion : GameObject;

function OnCollisionEnter(collision : Collision) {
    if(GameObject.FindWithTag("SpaceCraft"))
    {
        if(((collision.gameObject.tag == "Untagged")|| (collision.gameObject.tag ==
"SpaceCraft"))&&(collision.gameObject.tag != "Missile"))
        {
            var contact : ContactPoint = collision.contacts[0];
            Instantiate (explosion, contact.point + (contact.normal * 5.0) ,
Quaternion.identity);

            if (collision.gameObject.tag == "SpaceCraft")
            {
                Instantiate (explosion, contact.point + (contact.normal * 5.0) ,
camera.main.transform.rotation);
                collision.gameObject.transform.position =
GameObject.Find("Spawn").transform.position;
            }
            Destroy (gameObject);
        }
    }
}

```

```

    }
}

function FixedUpdate () {
    if(GameObject.FindWithTag("Missile"))
    {
        rigidbody.AddForce (transform.TransformDirection (Vector3.forward +
Vector3(0,0.1,0)) * 720.0);
    }
}

```

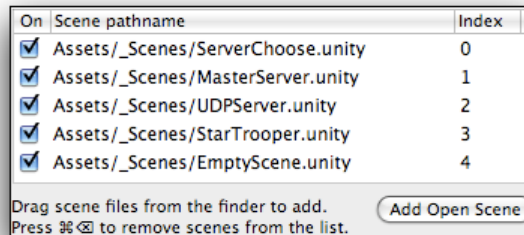
You have prepared the Scene and Objects for the Network.

4.2.2 Server & Client

Now it's time to create the server for this game. We will be creating three different types of servers.

- ✎ Create a new scene and save it as ServerChoose: File -> New Scene, File -> Save Scene. The scene will be used for choosing server type.
- ✎ Create a new scene and save it as UDPServer. This scene will be used for UDP Broadcast connection.
- ✎ Create a new scene and save it as MasterServer. This scene will be used for Master Server.
- ✎ Create a new scene again, save as EmptyScene. We will use this scene when player has disconnected to clear up leftovers before new connection.
- ✎ Add all your scenes to the build settings: File -> Build Settings -> Add Open Scene. Your scene "ServerChoose" should be first in the list, for example:

- PS: you can create a folder and put all scenes together in one place.



- 🔗 Open the ServerChoose scene.
- 🔗 Create a new JavaScript file and name it Menu. We will use this scene and this script for choosing a type of server and connection.
- 🔗 Add this script to the Main Camera and add the following code:

```
function OnGUI() {
    GUI.Label(new Rect((Screen.width/2)-80,(Screen.height/2)-130,200,50),"SELECT
    CONNECTION TYPE");
    GUI.Label(new Rect((Screen.width-220),(Screen.height-30),220,30),"STAR-TROOPER
    MULTIPLAYER DEMO");

    if(GUI.Button(new Rect((Screen.width/2)-100,(Screen.height/
    2)-100,200,50),"Master Server Connection"))
    {
        Application.LoadLevel("MasterServer");
    }

    if(GUI.Button(new Rect((Screen.width/2)-100,(Screen.height/2)-40,200,50),"Direct
    Connection"))
    {
        Application.LoadLevel("StarTrooper");
    }

    if(GUI.Button(new Rect((Screen.width/2)-100,(Screen.height/2)+20,200,50),"UDP
    Connection"))
    {
        Application.LoadLevel("UDPServer");
    }
}
```

- 🔗 Open the MasterServer scene.
- 🔗 Create a new JavaScript file and name it NetworkLevelLoad. We will use this script for loading the StarTrooper scene and objects to the network.
- 🔗 Create a new Empty GameObject and name it ConnectionGUI.
- 🔗 Add the NetworkLevelLoad script to the ConnectionGUI object and open to edit:

```
// Keep track of the last level prefix (increment each time a new level loads)
private var lastLevelPrefix = 0;

function Awake () {
    // Network level loading is done in a seperate channel.
    DontDestroyOnLoad(this);
    networkView.group = 1;
```

```

    Application.LoadLevel("EmptyScene");
}

function OnGUI () {
    // When network is running (server or client) then display the level "StarTrooper"
    if (Network.peerType != NetworkPeerType.Disconnected)
    {
        if (GUI.Button(new Rect(350,10,100,30),"StarTrooper"))
        {
            // Make sure no old RPC calls are buffered and then send load level command
            Network.RemoveRPCsInGroup(0);
            Network.RemoveRPCsInGroup(1);
            // Load level with incremented level prefix (for view IDs)
            networkView.RPC( "LoadLevel", RPCMode.AllBuffered, "StarTrooper",
lastLevelPrefix + 1);
        }
    }
}

@RPC
function LoadLevel (level : String, levelPrefix : int) {
    Debug.Log("Loading level " + level + " with prefix " + levelPrefix);
    lastLevelPrefix = levelPrefix;

    // There is no reason to send any more data over the network on the default
    channel,
    // because we are about to load the level, because all those objects will get deleted
    anyway
    Network.SetSendingEnabled(0, false);

    // We need to stop receiving because first the level must be loaded.
    // Once the level is loaded, RPC's and other state update attached to objects in the
    level are allowed to fire
    Network.isMessageQueueRunning = false;

    // All network views loaded from a level will get a prefix into their NetworkViewID.
    // This will prevent old updates from clients leaking into a newly created scene.
    Network.SetLevelPrefix(levelPrefix);
    Application.LoadLevel(level);
    yield;
    yield;

    // Allow receiving data again
    Network.isMessageQueueRunning = true;
    // Now the level has been loaded and we can start sending out data
    Network.SetSendingEnabled(0, true);

    // Notify our objects that the level and the network is ready

```

```

var go : Transform[] = FindObjectsOfType(Transform);
var go_len = go.length;

for (var i=0;i<go_len;i++)
{
    go[i].SendMessage("OnNetworkLoadedLevel",
SendMessageOptions.DontRequireReceiver);
}

function OnDisconnectedFromServer () {
    Application.LoadLevel("EmptyScene");
}

@script RequireComponent(NetworkView)

```

- Ensure that this script has added a NetworkView automatically, otherwise add NetworkLevelLoad from the menu (Component->Scripts->NetworkLevelLoad).



Create a new JavaScript file and name it MasterServerGUI. With this script we will create a Master Server/Client and some GUI to use it.



Add this file to the ConnectionGUI object and open the script to edit:

```

DontDestroyOnLoad(this);

var gameName = "YourGameName";
var serverPort = 25002;
private var timeoutHostList = 0.0;
private var lastHostListRequest = -1000.0;
private var hostListRefreshTimeout = 10.0;

private var natCapable : ConnectionTesterStatus =
ConnectionTesterStatus.Undetermined;
private var filterNATHosts = false;
private var probingPublicIP = false;
private var doneTesting = false;
private var timer : float = 0.0;

private var windowRect = Rect (Screen.width-300,0,300,100);
private var hideTest = false;
private var testMessage = "Undetermined NAT capabilities";

// Enable this if not running a client on the server machine
// MasterServer.dedicatedServer = true;

function OnFailedToConnectToMasterServer(info: NetworkConnectionError) {
    Debug.Log(info);
}

```



```

function OnFailedToConnect(info: NetworkConnectionError) {
    Debug.Log(info);
}

function OnGUI () {
    ShowGUI();
}

function Awake () {
    // Start connection test
    natCapable = Network.TestConnection();

    // What kind of IP does this machine have? TestConnection also indicates this in the
    // test results
    if (Network.HavePublicAddress())
        Debug.Log("This machine has a public IP address");
    else
        Debug.Log("This machine has a private IP address");
}

function Update() {
    // If test is undetermined, keep running
    if (!doneTesting) {
        TestConnection();
    }
}

function TestConnection() {
    // Start/Poll the connection test, report the results in a label and react to the results
    accordingly
    natCapable = Network.TestConnection();
    switch (natCapable) {
        case ConnectionTesterStatus.Error:
            testMessage = "Problem determining NAT capabilities";
            doneTesting = true;
            break;

        case ConnectionTesterStatus.Undetermined:
            testMessage = "Undetermined NAT capabilities";
            doneTesting = false;
            break;

        case ConnectionTesterStatus.PrivateIPNoNATPunchthrough:
            testMessage = "Cannot do NAT punchthrough, filtering NAT enabled hosts for
            client connections,"
            +" local LAN games only.";
            filterNATHosts = true;
    }
}

```

```

        Network.useNat = true;
        doneTesting = true;
        break;

    case ConnectionTesterStatus.PrivateIPHasNATPunchThrough:
        if (probingPublicIP)
            testMessage = "Non-connectable public IP address (port " + serverPort + "
blocked),"
            + " NAT punchthrough can circumvent the firewall.";
        else
            testMessage = "NAT punchthrough capable. Enabling NAT punchthrough
functionality.";
        // NAT functionality is enabled in case a server is started,
        // clients should enable this based on if the host requires it
        Network.useNat = true;
        doneTesting = true;
        break;

    case ConnectionTesterStatus.PublicIPIsConnectable:
        testMessage = "Directly connectable public IP address.";
        Network.useNat = false;
        doneTesting = true;
        break;

    // This case is a bit special as we now need to check if we can
    // use the blocking by using NAT punchthrough
    case ConnectionTesterStatus.PublicIPPortBlocked:
        testMessage = "Non-connectble public IP address (port " + serverPort + "
blocked),"
        + " running a server is impossible.";
        Network.useNat = false;
        // If no NAT punchthrough test has been performed on this public IP, force a
test
        if (!probingPublicIP)
        {
            Debug.Log("Testing if firewall can be circumnvented");
            natCapable = Network.TestConnectionNAT();
            probingPublicIP = true;
            timer = Time.time + 10;
        }
        // NAT punchthrough test was performed but we still get blocked
        else if (Time.time > timer)
        {
            probingPublicIP = false; // reset
            Network.useNat = true;
            doneTesting = true;
        }
        break;

```

```

        case ConnectionTesterStatus.PublicIPNoServerStarted:
            testMessage = "Public IP address but server not initialized,"
            +"it must be started to check server accessibility. Restart connection test
when ready.";
            break;
        default:
            testMessage = "Error in test routine, got " + natCapable;
    }
}

function ShowGUI() {

    if (GUI.Button (new Rect(100,10,120,30),"Retest connection"))
    {
        Debug.Log("Redoing connection test");
        probingPublicIP = false;
        doneTesting = false;
        natCapable = Network.TestConnection(true);
    }

    if (Network.peerType == NetworkPeerType.Disconnected)
    {
        // Start a new server
        if (GUI.Button(new Rect(10,10,90,30),"Start Server"))
        {
            Network.InitializeServer(32, serverPort);
            MasterServer.updateRate = 3;
            MasterServer.RegisterHost(gameName, "stuff", "profas chat test");
        }

        // Refresh hosts
        if (GUI.Button(new Rect(10,40,210,30),"Refresh available Servers")
        || Time.realtimeSinceStartup > lastHostListRequest + hostListRefreshTimeout)
        {
            MasterServer.ClearHostList();
            MasterServer.RequestHostList (gameName);
            lastHostListRequest = Time.realtimeSinceStartup;
            Debug.Log("Refresh Click");
        }

        var data : HostData[] = MasterServer.PollHostList();

        var _cnt : int = 0;
        for (var element in data)
        {
            // Do not display NAT enabled games if we cannot do NAT punchthrough
            if ( !(filterNATHosts && element.useNat) )
            {

```

```

        var name = element.gameName + " " + element.connectedPlayers + " / "
+ element.playerLimit;
        var hostInfo;
        hostInfo = "[";
        // Here we display all IP addresses, there can be multiple in cases where
        // internal LAN connections are being attempted. In the GUI we could just
display
        // the first one in order not confuse the end user, but internally Unity will
        // do a connection check on all IP addresses in the element.ip list, and
connect to the
        // first valid one.
        for (var host in element.ip)
        {
            hostInfo = hostInfo + host + ":" + element.port + " ";
        }
        hostInfo = hostInfo + "]";

        if (GUI.Button(new Rect(20,(_cnt*50)+90,400,40),hostInfo.ToString()))
        {
            // Enable NAT functionality based on what the hosts if configured to
do
            Network.useNat = element.useNat;

            if (Network.useNat)
                print("Using Nat punchthrough to connect");
            else
                print("Connecting directly to host");

            Network.Connect(element.ip, element.port);
        }
    }
}
else
{
    if (GUI.Button (new Rect(10,10,90,30),"Disconnect"))
    {
        Network.Disconnect();
        MasterServer.UnregisterHost();
    }
}
}

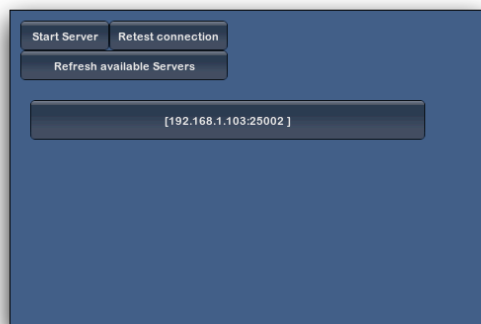
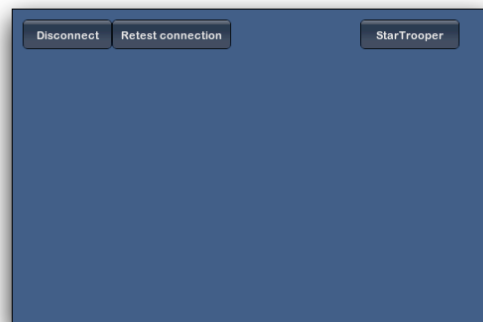
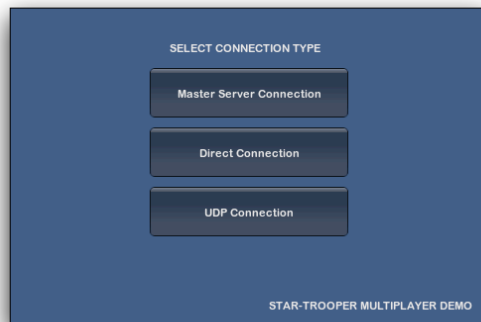
```

- Now you can test your project using the Master Server:



Go to Edit -> Project Settings -> Player and set up your iPhone Bundle Identifier and change the Default Screen Orientation to Landscape Left.

- ✦ Build your project to the iPhone.
- ✦ Run the Server scene in the Editor.
- ✦ Click on Master Server Connection in the Editor and on the iPhone.
- ✦ Click on Start Server on Editor.
- ✦ The server should appear on iPhone (if not, click Refresh available Servers).
- ✦ Connect to the server from the iPhone.
- ✦ Click on the StarTrooper button in the Editor or on the iPhone.
- ✦ Your screens should look like these images:



We have finished our Master Server!

- Now we need to create a second connection type – UDP Broadcast connection:

- 🔗 Open the UDPServer scene.
- 🔗 Create a new C# file and name it UDPConnectionGUI.
- 🔗 Move the UDPConnection file to the Plugins folder.
- 🔗 Create a new empty GameObject and name it UDPServer.
- 🔗 Assign the UDPConnectionGUI file to the UDPServer object. (Or assign it after you write the following code).
- 🔗 Assign a NetworkView Component to the UDPServer object and change the Observed parameter to UDPServer (Transform).
- 🔗 Assign the NetworkLevelLoad Script file to the UDPServer object.
- 🔗 Open UDPConnectionGUI and write the following:

```
using UnityEngine;
using System.Collections;
using System.Net;
using System.Net.Sockets;
using System.Threading;

public class UDPConnectionGUI : MonoBehaviour {

    private UdpClient server;
    private UdpClient client;
    private IPEndPoint receivePoint;
    private string port = "6767";
    private int listenPort = 25001;
    private string ip = "0.0.0.0";
    private string ip_broadcast = "255.255.255.255";
    private bool youServer = false;
    private bool connected = false;
    private string server_name = "";
    private int clear_list = 0;

    public void Update() {
        if(clear_list++>200)
        {
            server_name = "";
            clear_list = 0;
        }
    }
}
```

```

    }

    public void Start() {
        Debug.Log("Start");
        LoadClient();
    }

    public void LoadClient() {
        client = new UdpClient(System.Convert.ToInt32(port));
        receivePoint = new
IPEndPoint(IPAddress.Parse(ip),System.Convert.ToInt32(port));
        Thread startClient = new Thread(new ThreadStart(start_client));
        startClient.Start();
    }

    public void start_client() {
        bool continueLoop =true;

        try
        {
            while(continueLoop)
            {
                byte[] recData = client.Receive(ref receivePoint);

                System.Text.ASCIIEncoding encode = new System.Text.ASCIIEncoding();

                server_name = encode.GetString(recData);

                if(connected)
                {
                    server_name = "";
                    client.Close();
                    break;
                }
            }
        } catch {}
    }

    public void start_server() {
        try
        {
            while(true)
            {
                System.Text.ASCIIEncoding encode = new System.Text.ASCIIEncoding();

                byte[] sendData = encode.GetBytes(Network.player.ipAddress.ToString());

```

```

server.Send(sendData,sendData.Length,ip_broadcast,System.Convert.ToInt32(port));
    Thread.Sleep(100);
}
} catch {}
}

void OnGUI() {
    if(!youServer)
    {
        if(GUI.Button(new Rect(10,10,100,30),"Start Server"))
        {
            youServer = true;
            Network.InitializeServer(32, listenPort);
            string ipaddress = Network.player.ipAddress.ToString();
            ip = ipaddress;

            client.Close();
            server = new UdpClient(System.Convert.ToInt32(port));
            receivePoint = new
IPEndPoint(IPAddress.Parse(ipaddress),System.Convert.ToInt32(port));
            Thread startServer = new Thread(new ThreadStart(start_server));
            startServer.Start();
        }

        if(server_name!="")
        {
            if(GUI.Button(new Rect(20,100,200,50),server_name))
            {
                connected = true;
                Network.Connect(server_name, listenPort);
            }
        }
    }
    else
    {
        if(GUI.Button(new Rect(10,10,100,30),"Disconnect"))
        {
            Network.Disconnect();
            youServer = false;
            server.Close();
            LoadClient();
        }
    }
}
}
}

```


- Now you can test this connection type:
 - ✎ Set your Player Settings (if you haven't changed them yet) as instructed above.
 - ✎ Build the project to the iPhone.
 - ✎ Play the UDPServer scene in the Editor.
 - ✎ Start the server from the Editor by clicking Start Server.
 - ✎ Connect to the server from the iPhone when the IP address button appears.
 - ✎ Your screens should look like these images:



We have finished our UDP Broadcast server!

- Now we need to create a third connection type – Direct Connect:
 - ✎ Open the StarTrooper scene.
 - ✎ Create a new JavaScript file and name it ConnectionGUI.
 - ✎ Assign the ConnectionGUI.js file to the Main Camera and write the following:

```
var remoteIP = "127.0.0.1";
var remotePort = 25000;
var listenPort = 25000;
var useNAT = false;
var yourIP = "";
var yourPort = "";

function Awake() {
  if (FindObjectOfType(MasterServerGUI))
    this.enabled = false;
```

```

        if(FindObjectOfType<UDPConnectionGUI>())
            this.enabled = false;
    }

    function OnGUI () {
        if (Network.peerType == NetworkPeerType.Disconnected)
        {
            // If not connected

            if (GUI.Button (new Rect(10,10,100,30),"Connect"))
            {
                Network.useNat = useNAT;
                // Connecting to the server
                Network.Connect(remoteIP, remotePort);
            }

            if (GUI.Button (new Rect(10,50,100,30),"Start Server"))
            {
                Network.useNat = useNAT;
                // Creating server
                Network.InitializeServer(32, listenPort);

                // Notify our objects that the level and the network is ready
                for (var go : GameObject in FindObjectsOfType(GameObject))
                {
                    go.SendMessage("OnNetworkLoadedLevel",
                        SendMessageOptions.DontRequireReceiver);
                }
            }

            remoteIP = GUI.TextField(new Rect(120,10,100,20),remoteIP);
            remotePort = parseInt(GUI.TextField(new
                Rect(230,10,40,20),remotePort.ToString()));
        }
        else
        {
            // If connected
            // Getting your ip address and port
            ipaddress = Network.player.ipAddress;
            port = Network.player.port.ToString();

            GUI.Label(new Rect(140,20,250,40),"IP Adress: "+ipaddress+":"+port);

            if (GUI.Button (new Rect(10,10,100,50),"Disconnect"))
            {
                // Disconnect from the server
                Network.Disconnect(200);
            }
        }
    }

```

```

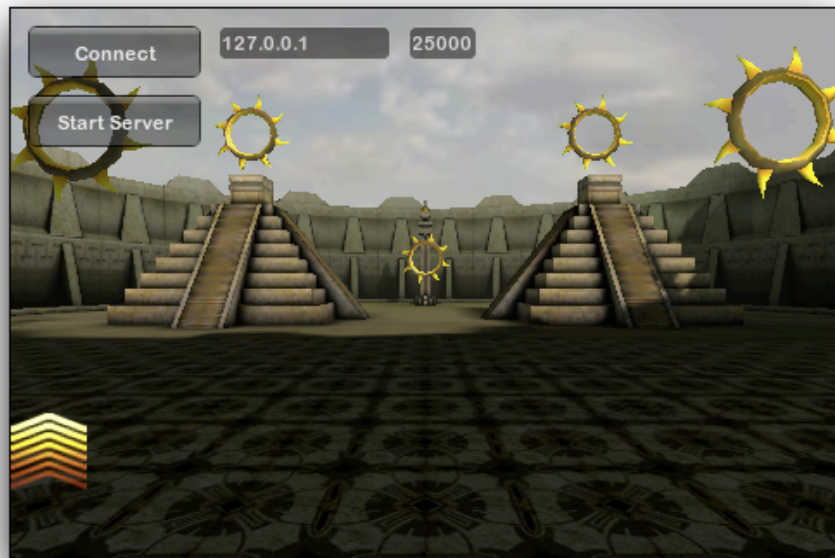
    }
}

function OnConnectedToServer() {
    // Notify our objects that the level and the network is ready
    for (var go : GameObject in FindObjectsOfType(GameObject))
        go.SendMessage("OnNetworkLoadedLevel",
            SendMessageOptions.DontRequireReceiver);
}

function OnDisconnectedFromServer () {
    if (this.enabled != false)
        Application.LoadLevel(Application.loadedLevel);
    else
    {
        var _NetworkLevelLoad : NetworkLevelLoad =
            FindObjectOfType(NetworkLevelLoad);
        _NetworkLevelLoad.OnDisconnectedFromServer();
    }
}

```

- Now you can test this connection type:
 - 🔗 Set your Player Settings (if you haven't changed them yet) as instructed above.
 - 🔗 Build the project to the iPhone.
 - 🔗 Play the StarTrooper scene in the Editor.
 - 🔗 Click Direct Connection in the Editor and on the iPhone.
 - 🔗 Start the server from the Editor by clicking Start Server.
 - 🔗 Enter the IP address on the iPhone in the IP field. You can get the IP address from the Editor Player screen. Click Connect.
 - 🔗 Your screens should look like these images:



We have finished our Client and Server with three connection types.

4.3.3 Final Polishing

- Our project is almost finished now. To make our game more playable we need to add some final polish:
 - ✦ Open the StarTrooper scene.
 - ✦ Select the SpaceCraft Prefab and set the Transform Scale parameters to: 1.8,1.8,1.8.
 - ✦ Select the Main Camera in the Hierarchy and change the public parameters in the Player Controls script: Turn Speed: 3, Max Turn Lean: 70, Max Tilt: 50, Sensitivity: 0.5, Forward Force: 20.
 - ✦ In the Main Camera open MissileLauncher.js script. At line 16, change the vector from Vector3(0,-0.2,1) to Vector3(0,-0.3,0.5).
 - ✦ Select the missilePrefab Prefab and set the Transform Scale parameters to: 8,8,8.
 - ✦ Your last screen should look something like this image:



- PS: These last modifications are based only on my taste, so feel free to make your own modifications or new features.

4.3 Quick Overview

Congratulations! You have finished your MultiPlayer StarTrooper project.

- You have learned how to:
 - 🔗 Prepare a scene and object for the network.
 - 🔗 Translate a scene and objects on the network.
 - 🔗 Convert a single player game into multiplayer.
 - 🔗 Create a Master Server/Client.
 - 🔗 Create a Server/Client using Direct Connection.
 - 🔗 Create a Server/Client using UDP Broadcast connection.
 - 🔗 Use the main Network Components.
 - 🔗 Use advanced Unity Components.

[Download the whole MultiPlayer StarTrooper Project](#)