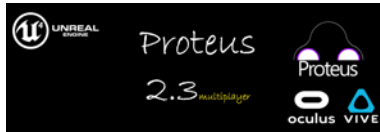# Proteus VR template

Single Player Version: 1.2

Multiplayer Version: 2.3

Latest release May 18 2017

Features

- A heavily-modified version of Epic's VR Template plus:

  - 3 fully animated controllers meshes: Hands, Oculus Touch controllers and HTC Vive controllers
    - Can be controlled with Oculus Touch or HTC Vive controllers, and support for Oculus remote
    - Full input mapping
  - Control over controllers opacity, scale, HTC Vive controllers skins, Avatar color
  - Function to spawn poles at the 4 corners of the Oculus Guardian or SteamVR chaperone limits
  - Optimizations for Oculus Rift and HTC Vive HMDs
  - "Ghost Mode" with gamepad
  - Avatar head
  - Rumble functions adapted to work with Touch & Vive
  - UI interactions, VR keyboard
  - Fade out vision when head goes through objects with VRCollision enabled
  - Skeletal socket use when grabbing objects
  - Vive Tracker tracking
  - Network and single player mode
    - Works single player, or multiplayer via LAN, Steam or Oculus Network
    - Direct IP Connect
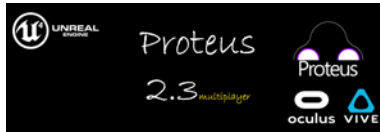   - Oculus Direct Connect
    - VOIP

What's new in version 2.3 and 1.2?

Single player (1.2) and Multiplayer (2.3)

➢ Fade out vision when head goes through objects with VRCollision enabled

➢ Skeletal socket use when grabbing objects

➢ Single/Multiple Vive Trackers tracking

➢ Vive Trigger input clamped

➢ General optimization of all blueprints

Multiplayer only (2.3)

➢ Session selection via Steam and LAN

➢ Oculus direct connect

➢ Direct IP Connect

➢ VOIP for LAN & Steam

➢ VR Keyboard for menus

➢ Multiplayer Vive Tracker tracking

➢ [FIXED] Avatar material client-client

➢ [FIXED] Playground client-side

➢ Network optimizations

Let's begin with some quick Q&A

So, what this is about?

This template consists of HTC Vive and Oculus Rift compatible pawn and settings, ready to drop in your single or multiplayer app. So what you can do is choose the features you want, and build yourself/modify a pawn based on the functionalities you need.

Source material

- Epic VR template
- Epic Twitch on Steam blueprints
- All other meshes, animations and blueprints are from Proteus

Which HMD works with the template?

The template is optimized for the HTC Vive and Oculus Rift with Vive or Touch controllers w/wo gamepad

Which Unreal Engine 4 version works with the template?

The template has been developed and tested with Unreal Engine 4.15.2

Which Steam / Oculus version is compatible with it?

UE4.15 is natively compatible with Steam SDK 1.32 and Oculus SDK 1.10

You can use latest Steam SDK by compiling from source and changing SDK.

You can use the latest Oculus SDK by compiling the latest UE4 from Oculus at https://github.com/oculus-vr/unrealengine

Want to try Unreal Engine Preview 4.16?

Two things to do:

1) Deselect "Is 4.15" boolean in MainMenuPC and MultiPC
2) Update the function "Project Point to Navigation" in MotionControllerBP/TraceTeleportDestination

NOTE: The templates have not been yet tested with 4.16

How can I install it?

Files can be found at https://1drv.ms/f/s!Av77lIIxt2OY0XGGW8UDwykohjuT

GitHub version at https://github.com/ProteusVR/ProteusTemplate *(you need to be logged to Github to open the link)*

Main infos found in the forum at https://forums.unrealengine.com/showthread.php?133957-Single-Multiplayer-Touch-amp-Vive-Proteus-blueprint-only-Template

To install as a template, just unzip into the appropriate templates directory like C:\Program Files\Unreal Engine[Version]\Templates for launcher version or[ForkLocation]\UE4\Templates for source version. Launch a new project, and you'll find it in the blueprint section.

To open as a project file, open the project with the launcher or directly from the .uproject file.
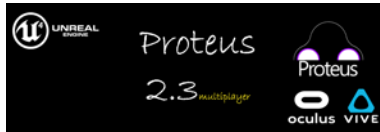
What is the default input mapping for the Oculus Rift Touch Controllers?

- **Both controllers**
    - Thumbstick directions / Controller orientation: Playground rotation before teleportation
    - Index Trigger: Grab / Release
- **Right Controller**
    - A Button: Teleport
    - B Button: UI Interaction
- **Left Controller**
    - Thumbstick button: VR keyboard
    - X Button: Teleport
    - Y Button: Guardian poles on/off

What is the default input mapping for the Vive controllers?

- **Both controllers**
    - Trackpad directions / Controller orientation: Playground rotation before teleportation
    - Trackpad release: Teleport
    - Trigger: Grab / Release
- **Right Controller**
    - Menu Button: UI Interaction
- **Left Controller**
    - Left or Right Grab Button: VR keyboard
    - Menu Button: Chaperone poles on/off

What is the input mapping for the Xbox One gamepad?

- Primary (left) thumbstick: Move in "ghost" mode
- Secondary (right) thumbstick: Rotate in "ghost" mode

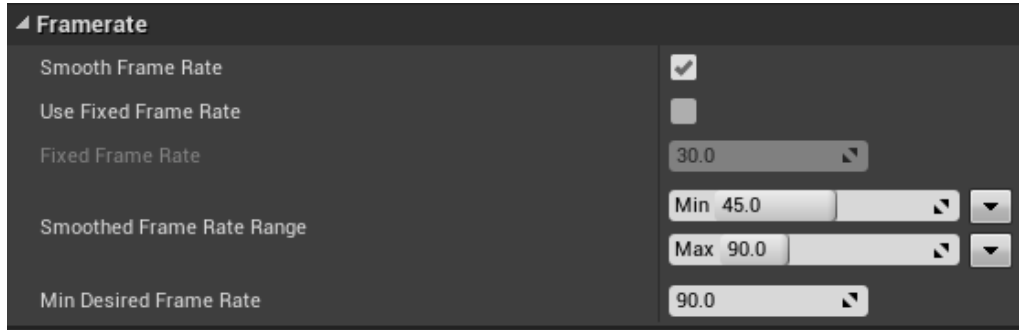## What is the input mapping for the Oculus Rift remote?

- By default it is not mapped to anything

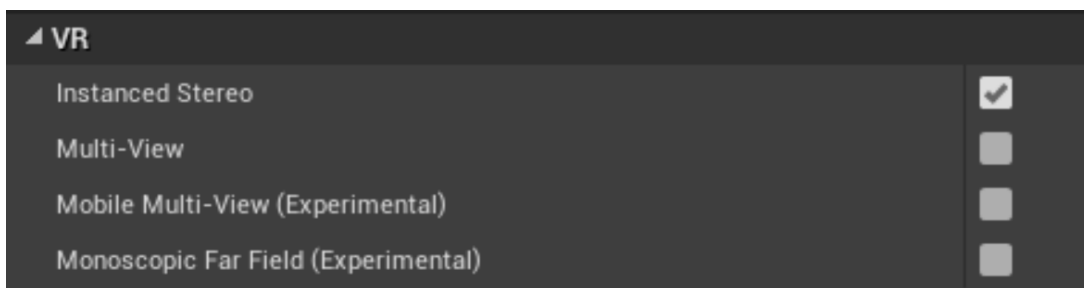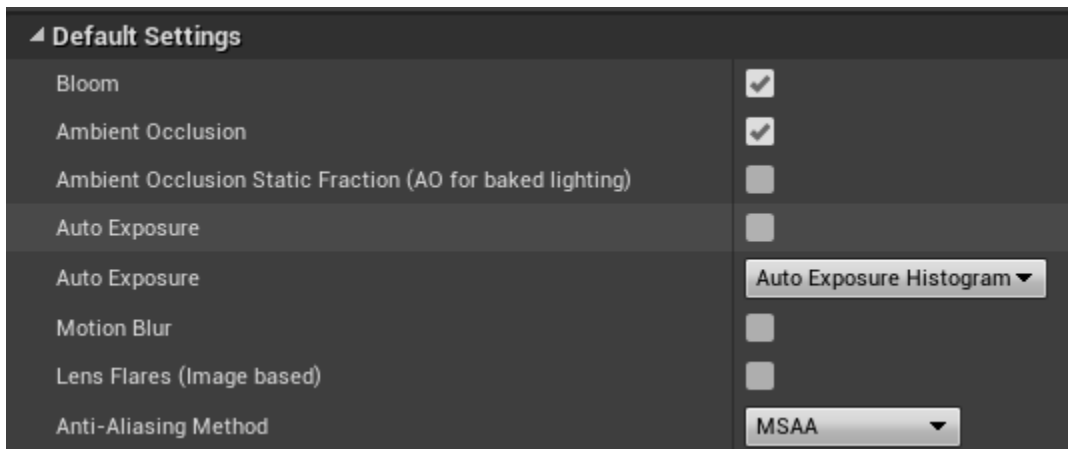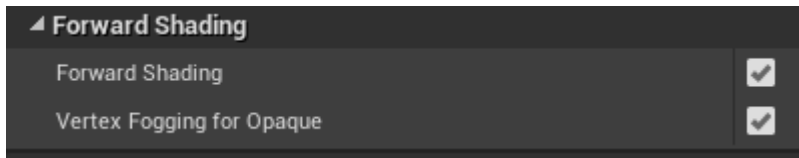> **You'll find the input mappings in the Avatar_Master pawn.**

What are the best Project Settings for VR?

> ➢ **Different settings may fit better your project. This is only suggestions.**

- In settings/General Settings/Framerate

Framerate	
Smooth Frame Rate	☑
Use Fixed Frame Rate	☐
Fixed Frame Rate	30.0
Smoothed Frame Rate Range	Min 45.0
	Max 90.0
Min Desired Frame Rate	90.0

- In settings/Rendering

Forward Shading	
Forward Shading	☑
Vertex Fogging for Opaque	☑

Default Settings	
Bloom	☑
Ambient Occlusion	☑
Ambient Occlusion Static Fraction (AO for baked lighting)	☐
Auto Exposure	☐
Auto Exposure	Auto Exposure Histogram ▼
Motion Blur	☐
Lens Flares (Image based)	☐
Anti-Aliasing Method	MSAA ▼

| VR	
Instanced Stereo	☑
Multi-View	☐
Mobile Multi-View (Experimental)	☐
Monoscopic Far Field (Experimental)	☐

- Avoid using auto exposure, motion blur, lens flares and screen space reflections

- Pawn will spawn at playerstart (placed on the floor) and will teleport on navmesh
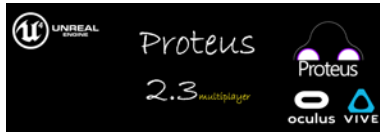
MULTIPLAYER MODE

IMPORTANT

- **Ensure that ProjectSettings/Maps & Mode/Game Instance Class/GameInfoInstance is selected**

- **Start at MainMenu map**

- **Select MainMenuGM as GameMode**
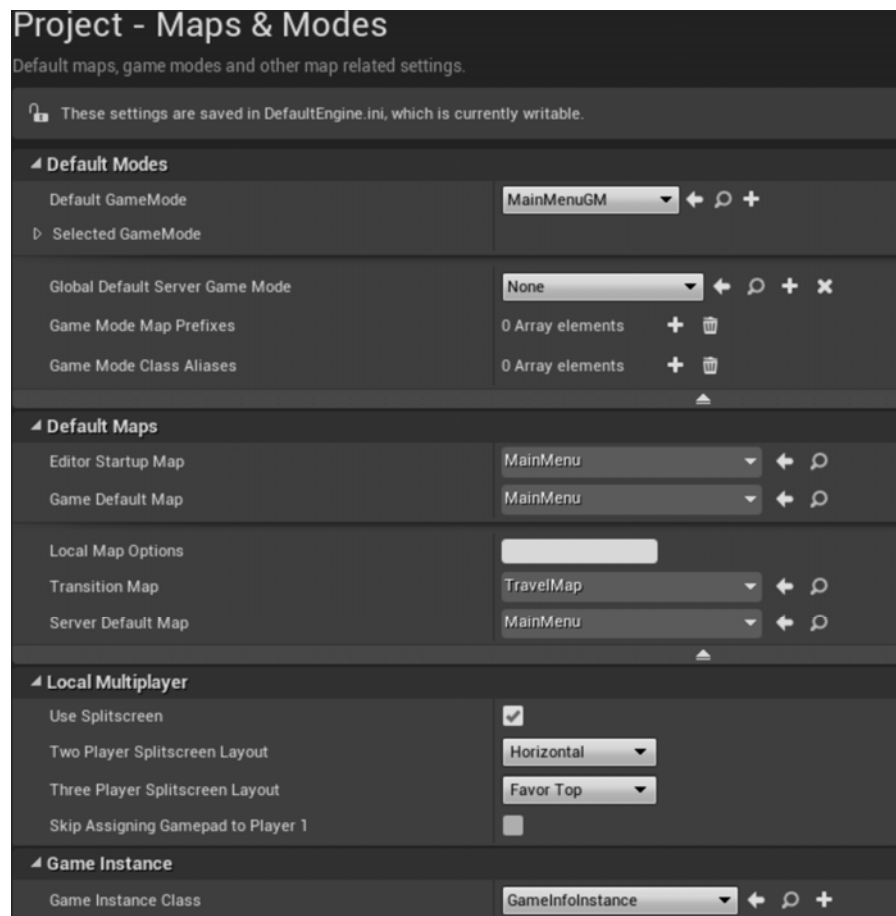
How does it work?

You can use any combination of Oculus Rifts and HTC Vive via LAN or Steam networks, and only Oculus Rifts via Oculus Network. Everyone must be in VR.
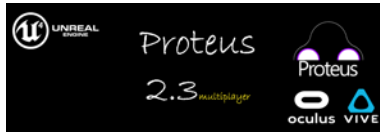
Each HMD must be connected to a different computer

IMPORTANT: You cannot connect to Steam, LAN or Oculus networks in the editor or VR Preview. To connect, you must first package your game, then start from the compiled .exe
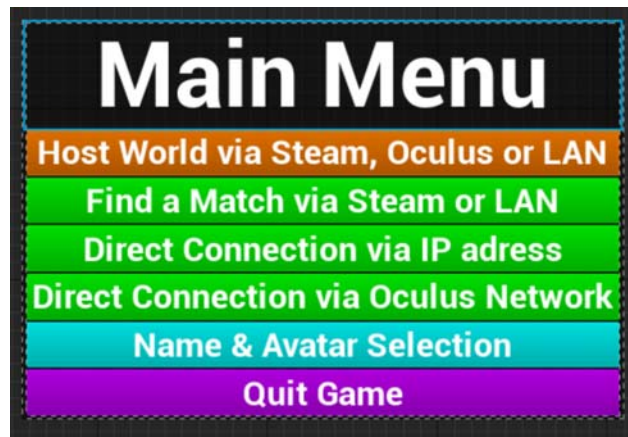
The first time you'll launch the game you will be directed to the Options Menu. You will then be able to select Avatar Icon (for future use) and Avatar color
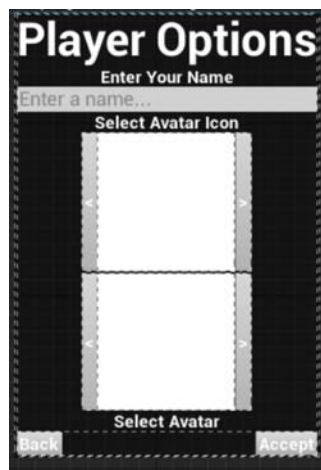
USING STEAM NETWORK

- ➢ Plugins/Virtual Reality/Steam VR must be selected

- ➢ Plugins/Online Platform/Online Subsystem Steam must be selected

- ➢ GameInfoInstance/Oculus Network must be deselected

- ➢ Each player must be connected to Steam with a different account

- ➢ The file /Config/DefaultGame.ini must contain the following lines:

```
[/Script/Engine.GameSession]
bRequiresPushToTalk=false
```

- ➢ The file /Config/DefaultEngine.ini must contain the following lines:

```
[/Script/Engine.AudioSettings]
VoiPSoundClass=/Game/Proteus_Multi/VOIPSoundClass.VOIPSoundClass
DefaultSoundClassName=/Game/Proteus_Multi/VOIPSoundClass.VOIPSoundClass

[OnlineSubsystem]
DefaultPlatformService=Steam
;DefaultPlatformService=Oculus
bHasVoiceEnabled=true
PollingIntervalInMs=20
VoiceNotificationDelta=0.2

[OnlineSubsystemSteam]
bEnabledSteam=true
bEnabled=true
SteamDevAppId=480
SteamAppId=480
GameServerQueryPort=27015
bRelaunchInSteam=false
GameVersion=1.0.0.0
bVACEnabled=1
bAllowP2PPacketRelay=true
P2PConnectionTimeout=90
; This is to prevent subsystem from reading other achievements that may be defined in parent .ini
Achievement_0_Id=""

[OnlineSubsystemOculus]
;Enable this if using Oculus Network
;Then enter you app ID
bEnabled=false
OculusAppId=111111111111111

[/Script/Engine.GameEngine]
!NetDriverDefinitions=ClearArray
; Uncomment the next line if you are using the Null Subsystem
;+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="/Script/OnlineSubsystemUtils.IpNetDriver",DriverClassNameFallback="/Script/OnlineSubsystemUtils.IpNetDriver")
; Uncomment the next line if you are using the Steam Subsystem
+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemSteam.SteamNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")
; Uncomment the next line if you are using the Oculus Subsystem
;+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemOculus.OculusNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")

[/Script/OnlineSubsystemOculus.OculusNetDriver]
NetConnectionClassName="OnlineSubsystemOculus.OculusNetConnection"
```

```
[/Script/Engine.Player]
;ConfiguredInternetSpeed=(Desired data rate cap)
;ConfiguredLanSpeed=(Desired data rate cap)
ConfiguredInternetSpeed=50000
ConfiguredLanSpeed=50000

[/Script/Engine.GameNetworkManager]
;TotalNetBandwidth=Total available bandwidth between all connections
;MaxDynamicBandwidth=Min and max per connection
;MinDynamicBandwidth=Min and max per connection
TotalNetBandwidth=500000
MaxDynamicBandwidth=80000
MinDynamicBandwidth=20000

[/Script/OnlineSubsystemUtils.IpNetDriver]
MaxClientRate=80000
MaxInternetClientRate=80000

[Voice]
bEnabled=true
```

➢ By default, you'll be playing the App ID #480, which is Space Wars. Your friends will see you're playing Space Wars. When developing your own app, replace with your correct Steam App ID.

HOSTING A GAME

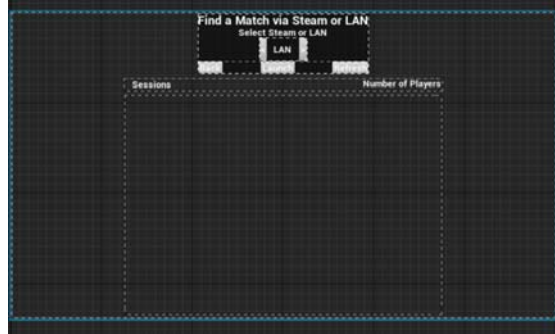Select Host World via LAN, Steam or Oculus Network

Select Steam/Oculus, Map, Maximum number of players, Time (not linked to anything yet), and Accept.

JOINING A GAME

Select Find a match via Steam or LAN, select Steam and Refresh.

Steam friends hosting a session should appear. Select the session and Accept.

CONNECT VIA LAN / DIRECT IP CONNECT

> ➢ Plugins/OnlineSubsystem/Online Subsystem NULL must be selected

You can use the same settings as Steam Network, with one exception: be sure that everyone is logged out of Steam. You can still use Steam VR. Select LAN when hosting a game.

To join a match, select Find a Match via Steam or Lan/Select LAN for LAN, or Direct Connection via IP Address for direct connection.

Using Oculus Network

- ➢ Plugins/Virtual Reality/Oculus Rift and Oculus Library must be selected

- ➢ Plugins/Online Platform/Online Subsystem Oculus must be selected

- ➢ GameInfoInstance/Oculus Network must be selected

- ➢ Each player must be connected to Oculus Home with a different account

- ➢ The file /Config/DefaultEngine.ini must contain the following changes:

- [OnlineSubsystem]
- ;DefaultPlatformService=Steam
- DefaultPlatformService=Oculus
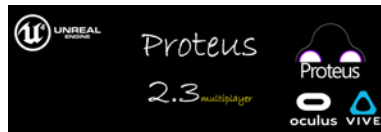- bHasVoiceEnabled=true
- PollingIntervalInMs=20
- VoiceNotificationDelta=0.2
-
- [OnlineSubsystemSteam]
- bEnabledSteam=false
- bEnabled=false
- SteamDevAppId=480
- SteamAppId=480
- GameServerQueryPort=27015
- bRelaunchInSteam=false
- GameVersion=1.0.0.0
- bVACEnabled=1
- bAllowP2PPacketRelay=true
- P2PConnectionTimeout=90
- ; This is to prevent subsystem from reading other achievements that may be defined in parent .ini
- Achievement_0_Id=""
-
- [OnlineSubsystemOculus]
- ;Enable this if using Oculus Network
- ;Then enter you app ID
- bEnabled=true
- OculusAppId=1111111111111111
-
- [/Script/Engine.GameEngine]
- !NetDriverDefinitions=ClearArray
- ; Uncomment the next line if you are using the Null Subsystem
- ;+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="/Script/OnlineSubsystemUtils.IpNetDriver",DriverClassNameFallback="/Script/OnlineSubsystemUtils.IpNetDriver")
- ; Uncomment the next line if you are using the Steam Subsystem
- ;+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemSteam.SteamNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")
- ; Uncomment the next line if you are using the Oculus Subsystem
- +NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemOculus.OculusNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")

The 16-digits App ID is your Oculus App ID found in your App Oculus dashboard URL (i.e. https://dashboard.oculus.com/application/111111111111111/build). For more information on publishing your game on Oculus platform see https://developer3.oculus.com/documentation/publish/latest/ .
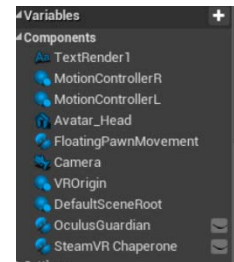
IMPORTANT:

- ➤ **Plugins/Virtual Reality/Steam VR must be deselected**

- ➤ **Plugins/Online Platform/Online Subsystem Steam must be deselected**

- ➤ **In Avatar_Master/Chaperone & Guardian Set, delete the following code:**
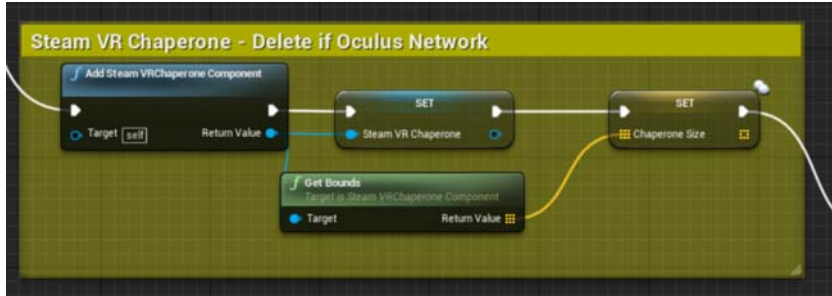
- ➤ **Finally in Avatar_Master, remove the SteamVR Chaperone component**
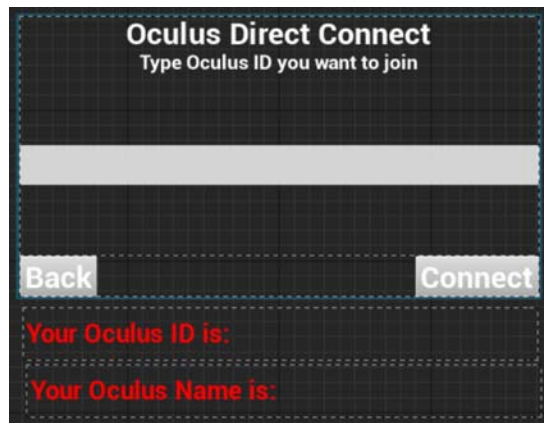
HOSTING A GAME:

Same as hosting a game on Steam Network

JOINING A GAME:

Select Direct Connection via Oculus Network

Type the 16-digits Oculus ID of your Oculus friend who is hosting a session, and Connect.

- ➤ **You'll also find there your Oculus ID and your Oculus Name**

- ➤ **VOIP doesn't work yet via the Oculus Network**

Using the Multiplayer Map

The first to login becomes the host. All other players are clients.

MultiMap01 and 03 are the same thing. Only the landscape color is different. All Avatars are the same.

What are the possible settings?

TAKE THE TIME TO REVIEW EACH SETTING BEFORE LAUNCHING / PACKAGING THE GAME

DefaulEngine.ini and DefaultGame.ini specific lines are mandatory (see above)

Project Settings should accommodate most, but there may be cases where you select otherwise

There are 3 type of settings:

- The PlayerSettings are chosen in the Options and Host Menu during gameplay (see above)

- The VRSettings are chosen within the MainMenuPC

- Some other settings are set in specific blueprints

VR Settings:

| Setting	
Controller Mesh	Hands / Oculus Touch / Vive controller
Controller Opacity	0 up to whatever
Controller Scale	For the hands, the scale is 1:1 with Epic VR template. Reduce scale to approx. 0.75 to come close to real-life
Vive Controller Skin (if Vive controller is selected in Controller Mesh)	Default / Apperture / Carbon / Tron Aqua / Tron Clu
Enable Screen Messages	Yes / No
Monitor Screen Resolution	by default, 1920x1080
GPU VRAM	GPU Video Memory, can be useful to tweak to stream large textures, by default 3000 (MB). You should put it around 1GB under your GPU VRAM
Show Pointer Controller	Yes / No
Avatar Color	Color of the Avatar (in single player mode)
HMD Mirror Mode	Distorted / Undistorted / Single Eye / Single Eye Letterboxed / Single Eye Cropped (default); for the HTC Vive, there is only 2 modes: Distorted all Single Eye (all other will lead to Single Eye)
HMD Screen Percentage	Set the screen percentage. Use a higher number for better quality, and a lower one for better performance
Teleport Rotation from Controller	If unselected, rotation is from thumbstick (Touch) or Trackpad (Vive)

Multiplayer settings:

Setting	You can change it in the following blueprint:
Max Number of Players available to host	/HostMenu/MaximumPlayers
Default Server Name	/HostMenu/DefaultServerName
List of Game Maps	/HostMenu/MapNames
Game Map Icons	/HostMenu/MapImages
Avatar Icon Images	/OptionsMenu/AvatarIcons
Avatar Images	/OptionsMenu/AvatarImages
Default Player Name	/OptionsMenu/MyPlayerName

Finally: Don't modify / rename Structure files (PlayerSettings and VRSettings) unless you want a festival of errors in your game cooking. If you modifiy something in it (you shouldn't), you'll have to reconnect and redo most of their related connections in many blueprints. If you do so, follow compiling error log to fix them.

How can I grab objects?

To enable object to be picked up, you have to:

- Make a blueprint of the mesh
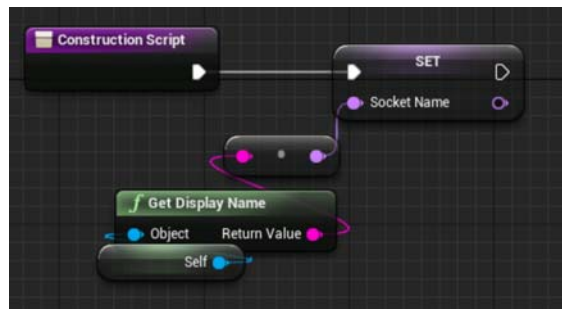- Be sure that the mesh inside the blueprint is set at Collision/BlockAllDynamic or PhysicsActor
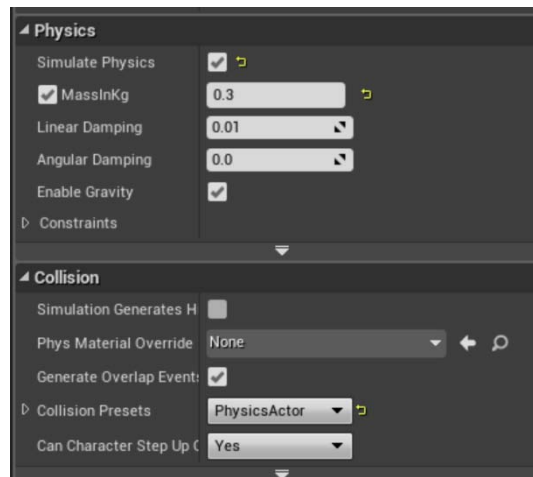

- Implement Pickup Actor Interface

- Put Event Pickup and Event Drop functions: look at the BP_PickupCube for an example

In Construction Script

In Event Graph

Using Sockets

There a many ways you can use sockets. In this template you'll find one example. You can try to pick up the baton, the gun, the book and the sword. Simply said, to use them, put a socket on the controller mesh you use. For an example, the CVR_Hand_Skeleton has 4 sockets, one for each object. Name the socket the same as the blueprint holding the object. You can then attach it to a bone, place and orient the socket to fit in the controller mesh you use.
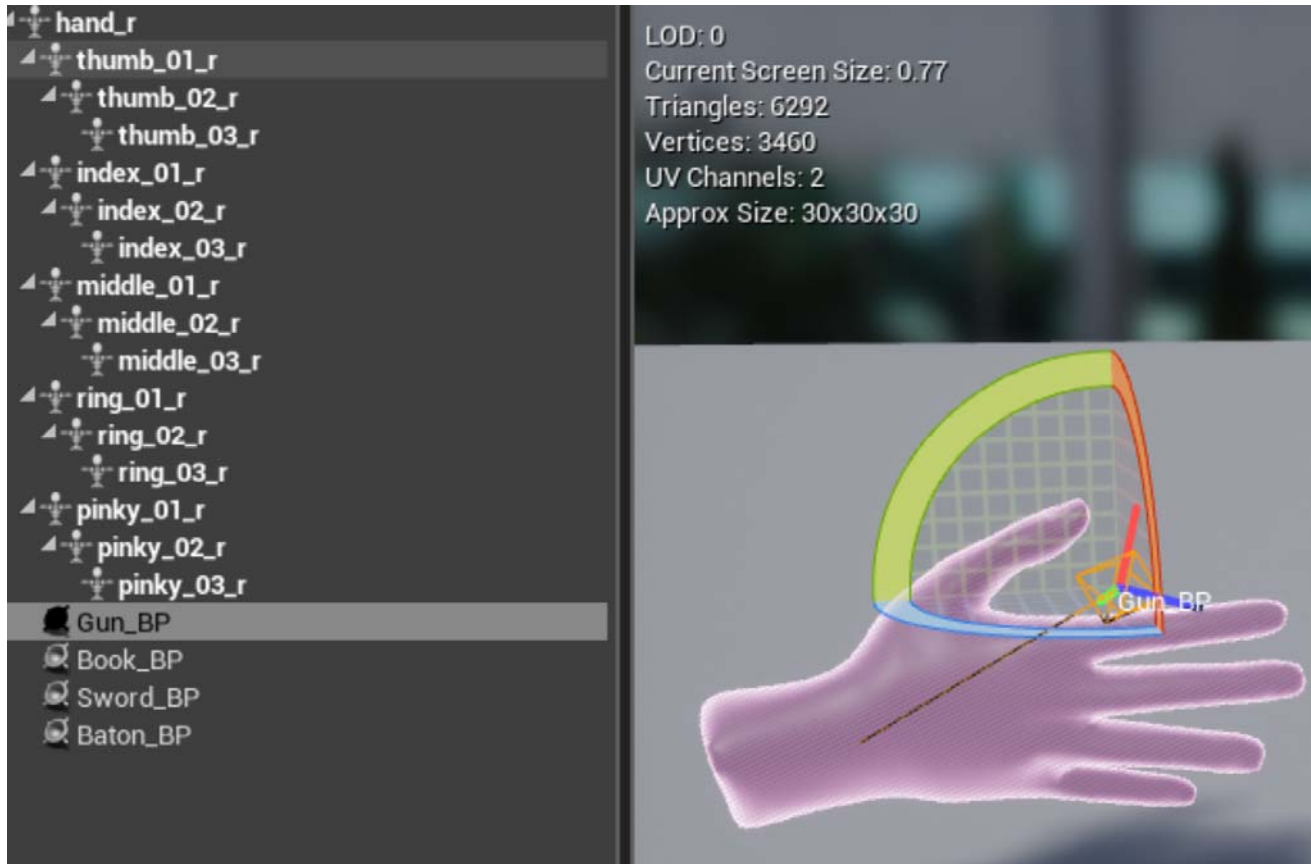
> ➢ **NOTE: The sockets have been roughly calibrated for the Oculus Touch Closed Hands Pose, you'll want to adjust the sockets if using the Vive.**

Interacting with objects

You can do that many ways. To try many different type of interactions, try @jamis's VR Essential Kit at
https://forums.unrealengine.com/showthread.php?131379-WIP-VR-Essential-Kit&highlight=vr+essential+kit
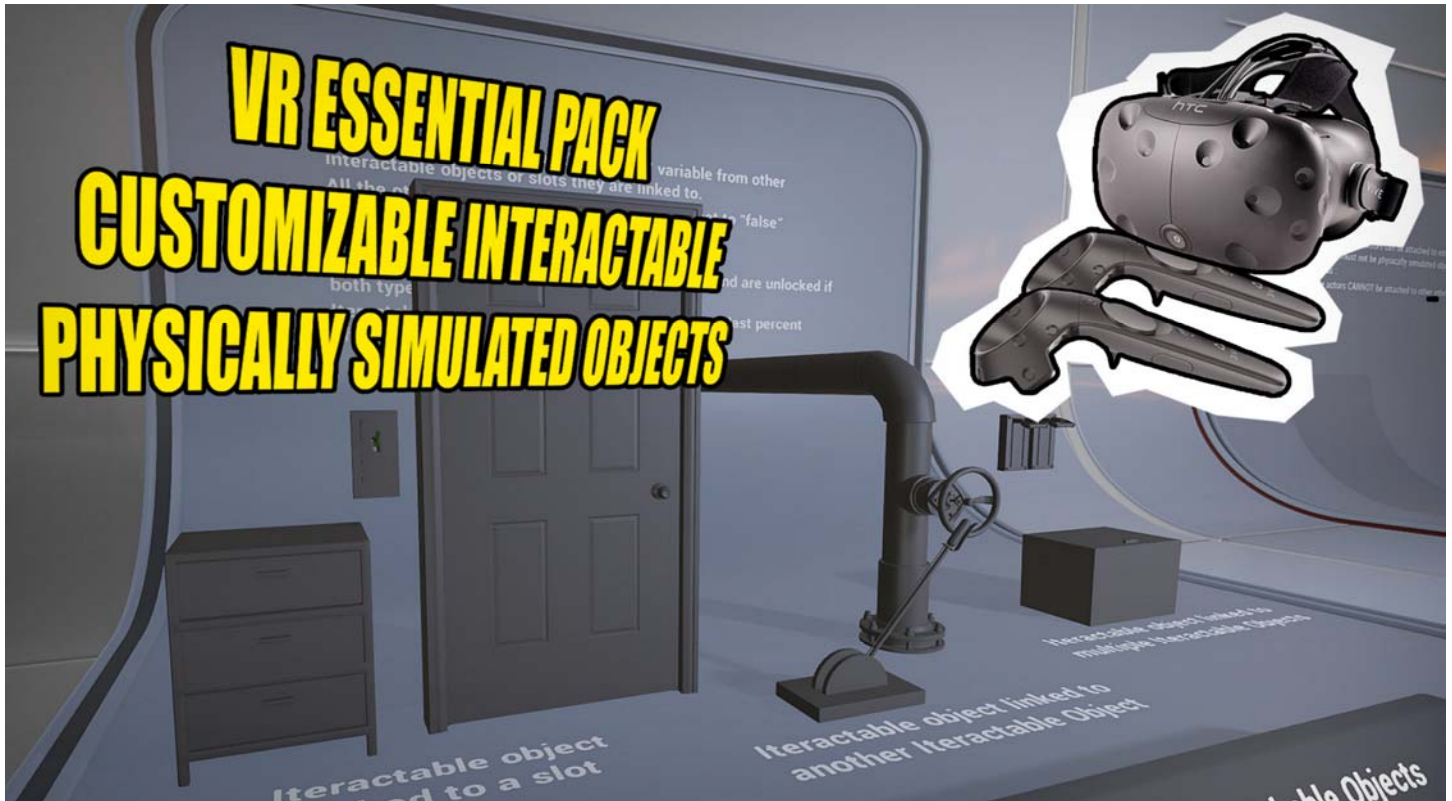

> ➢ **A version of Proteus Single 1.2 compatible with the VR Essential Kit is found on the OneDrive**
> ➢ **Note that the VR Essential Kit is a project made by @jamis. All questions concerning this project should be directed to him.**

Fingers / Controllers Poses

The hand model (.fbx and ASCII Maya) can be found on OneDrive at the same place as the template:

https://1drv.ms/f/s!Av77lIIxt2OY0XGGW8UDwykohjuT
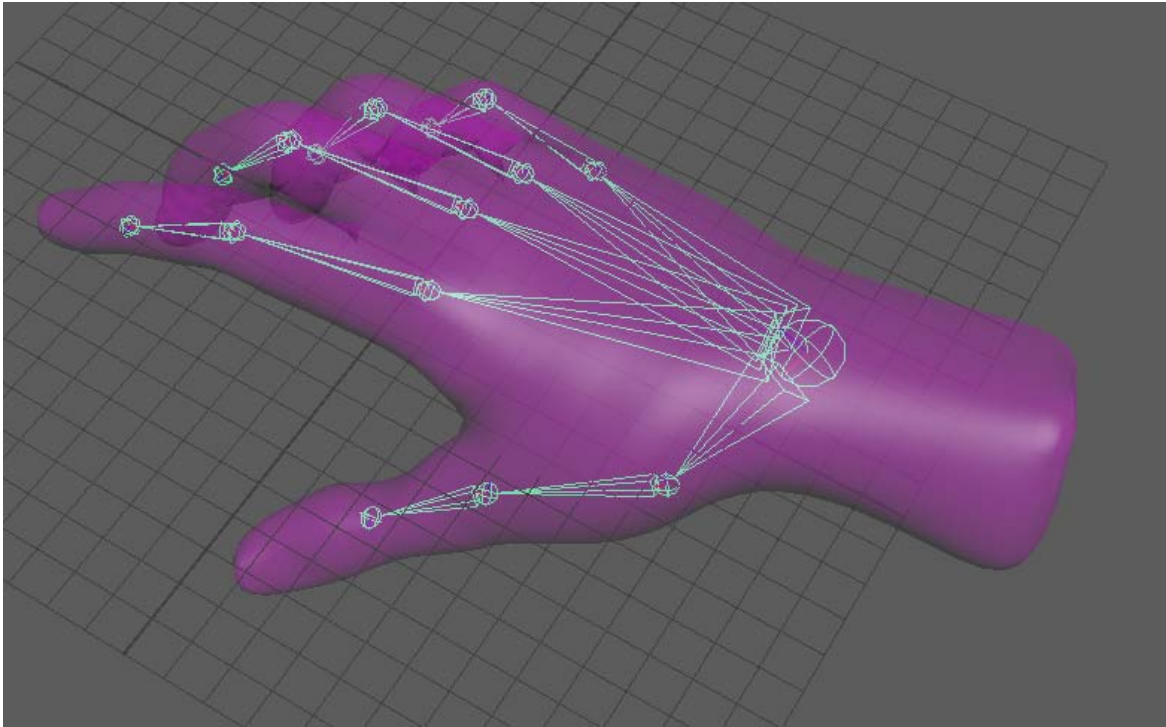
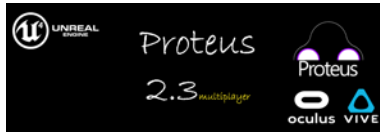You can then use your favorite 3D software to create fingers poses.

 ➢ **You'll also find there the Oculus Touch, Vive Tracker and HTC Vive Controllers files**

Using Vive Tracker

➢ You can use a mix of Oculus Rifts and HTC Vive in the game, but the Vive Trackers can only be tracked with an HTC Vive.
➢ If Vive Trackers are detected by SteamVR, they will appear in the level
➢ You can add or remove Trackers during gameplay.
➢ The Vive Trackers are tracked via functions found in the Avatar_Master
➢ By default, the Trackers detected by one Vive will have their position broadcasted in relation to the orientation and position of the Playground Center of this Vive.
➢ It's entirely possible to physically and virtually interact with the same trackers if you have more than one HMD sets in the same real-world room. It doesn't matter if Rifts or Vive are used, as long as:
  o The Trackers are tracked by HTC Vive(s)
  o The playground centers of all players are centered around the same origin
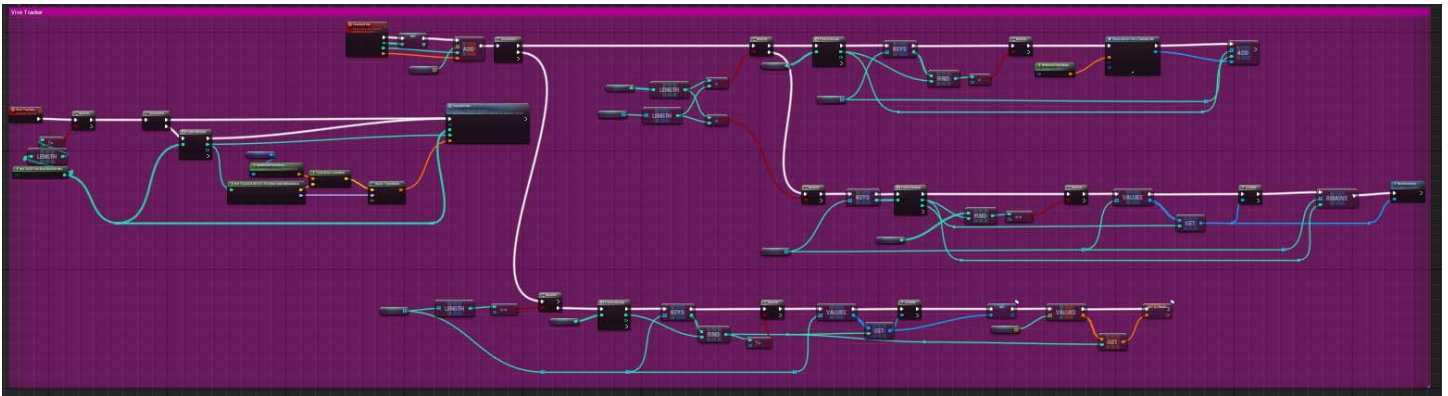
SinglePlayer Template (latest version 1.2)

➢ The SInglePlayer template (latest version 1.2) is a toned-down version of the MultiPlayer Template 2.3.

➢ It has the same features, but features specifically related to multiplayer as well as the MainMenu Map are removed, for the sake of simplicity.

➢ It is entirely possible to play SinglePlayer with the MultiPlayer Template, but you'll feel lonely, don't you?
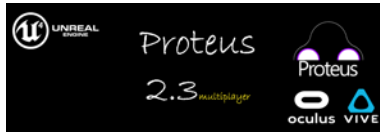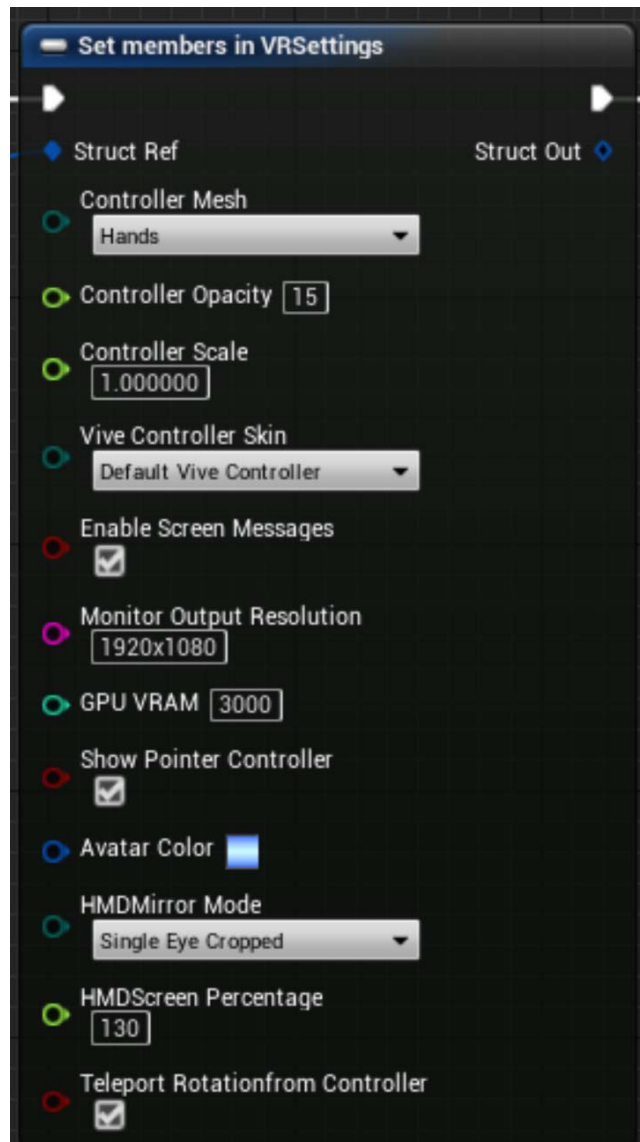
IMPORTANT

- **Ensure that ProjectSettings/Maps & Mode/Game Instance Class/GameInfoInstance is selected**

- **Start at MotionControllerMap**

- **Select VR_GameMode as GameMode**
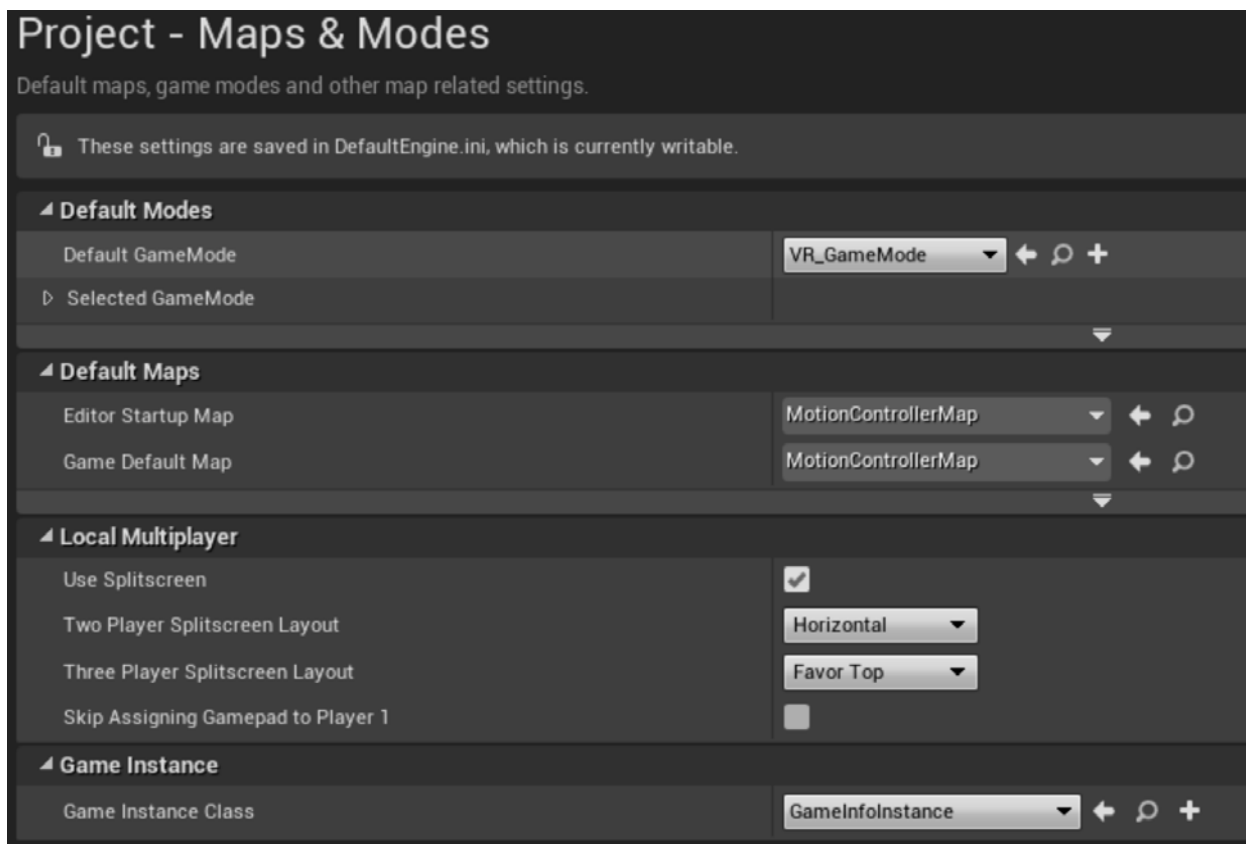
➢ Use it directly or import it to another project, by migrating the ProteusSingle folder into the project

➢ Set the desired **VRSettings in VR_PlayerController**

Set members in VRSettings

Struct Ref   Struct Out

Controller Mesh
Hands

Controller Opacity [15]

Controller Scale
[1.000000]

Vive Controller Skin
Default Vive Controller

Enable Screen Messages
☑

Monitor Output Resolution
[1920x1080]

GPU VRAM [3000]

Show Pointer Controller
☑

Avatar Color ▇

HMDMirror Mode
Single Eye Cropped

HMDScreen Percentage
[130]

Teleport Rotationfrom Controller
☑

Rants

I want to access the camera in the Vive! What can I do?

For now, it works well with the Unreal4AR plugin found at http://www.unreal4ar.com/ (personal license for 99$), but the camera is in low-quality VGA.

I don't have 45/90 fps! Your template is crap!

The template and the functions inside the pawns are not computer-intensive. It has been rigorously tested and within MultiMap, it stays at 90 fps.

99.99% of the time, the problem can be resolved by checking materials, lights and shadows. You have also to carefully assess and tweak the scalability and post-process settings.
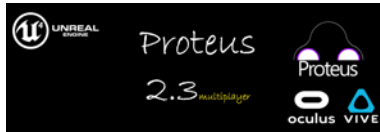
Other settings

- ➢ Try to avoid any other materials than opaque and masked
- ➢ Avoid fancy collision boxes
- ➢ Eliminate / reduce to minimum dynamic lights and shadows
- ➢ Avoid meshes with high poly count
- ➢ Reduce the number of animated objects

I'm still having problems

If you have an NVIDIA card, try the latest iteration of VR Works for Unreal Engine, including features such as Multi-Res shading, VR SLI, Single Pass Stereo and Lens Matched Shading: https://developer.nvidia.com/nvidia-vrworks-and-ue4
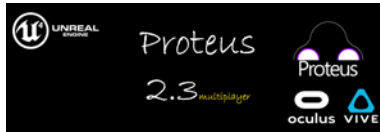
What's coming for the future iterations?

- ✓ **2.3-Oculus Version**
    - o Oculus support for Avatar
    - o Find Sessions via Oculus Network

Supplemental resources

- UE4 Forum/VR development: https://forums.unrealengine.com/forumdisplay.php?27-VR-Development

- UE4 Virtual Reality development: https://docs.unrealengine.com/latest/INT/Platforms/VR/

- UE4 Networking and Multiplayer: https://docs.unrealengine.com/latest/INT/Gameplay/Networking/

- Tom Looman getting started in VR: http://www.tomlooman.com/getting-started-with-vr/

- Cedrik Neukirchen UE4 Multiplayer Network Compendium: http://cedric-neukirchen.net/2017/02/14/multiplayer-network-compendium/

- Mitch McCaffrey Unreal Engine VR Cookbook: http://ue4vrcookbook.com/

- Oculus UE4 GitHub: https://github.com/oculus-vr/unrealengine

- Oculus UE4 Developer Guide: https://developer3.oculus.com/documentation/game-engines/latest/concepts/book-unreal/

- Vive Tracker for developers: https://www.vive.com/ca/vive-tracker-for-developer/

- SteamVR Developer Hardware: https://steamcommunity.com/app/358720/discussions/

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