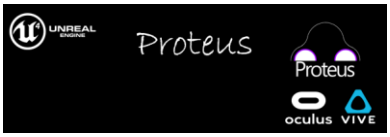


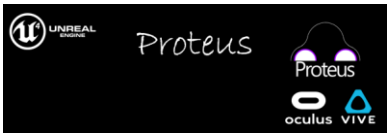
Proteus VR template

Latest Version: 3.0

Latest release June 21, 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
    - Oculus Avatars compatible
    - "VR Essential Kit" compatible
    - 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 3.0?

- Update to Unreal 4.16.1
- Everything has been redone from the ground. Rather than adapting Epic's VR template, all functions have been redone with multiplayer in mind. Always lost my mind doing it but it's done.
- VR Tracker: The mesh has been changed for a very simple one, preventing cooking problems. Adding/removing Vive Trackers is now working well whether the owner is a listen-server or a client.
- The grabbing functions and interactive objects are now fully compatible with the VR Interaction Kit (included).
- Major multiplayer optimization has been done, with very good replication on fast connections.
- All bugs related from previous version solved.
- Works Single or Multiplayer
- Oculus Avatar: pre-wiring done, integrate with my mini-plugin "Proteus Avatars" if present (soon)
- Inclusion of a 3rd person "Test Pawn", for debugging and do all kind of tests

A note on delays

Delays have been put in the AvatarMaster and MotionControllerBP Initialization Functions. You can try to remove or shorten them, but remember that it may prevent functions to execute on the proper order on different systems. A suggestion is to "hide" pawn initialization with a fade in or a loading screen.

Known problems

Extra Sphere collision is shown when using debug shapes including the debug line for the widget interaction component. This is an issue currently related to the 4.16.1 version. By disabling Instanced Stereo the bug goes away. This has been logged as UE-44947 at https://issues.unrealengine.com/issue/UE-44947 .

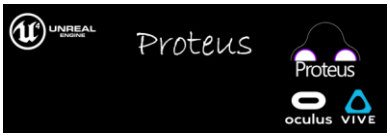
VR Essential Kit won't work with clients in multiplayer mode. I'll have to review/rethink @jamis 's excellent work to enable interactions with clients.

Physics objects: It's normal to experience client-side lag on physics objects (i.e. Interactive Objects). Many tricks exist to fix that problem; search for "multiplayer physics objects". This would be an entire different topic and is not specifically related to VR.

What's coming just down the road:

Oculus Network: I had a working version done for version 4.15, but happy fellows at Epic changed the way Oculus friend's lists are retrieved on the oculus Network, with version 4.16. Working on that should be fixed in days. Fix will include:

- Enabling the use of Oculus Avatars and all template pawn's functions
- Enabling finding friend's sessions through Oculus Network
- Enabling VOIP over the Oculus Network



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 4.16.1

Which Steam / Oculus version is compatible with it?

UE4.16 is natively compatible with Steam SDK 1.39 and Oculus SDK 1.12

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

How can I install it?

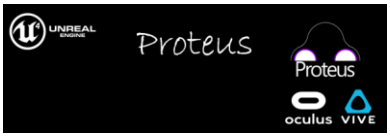
Files can be found at https://1drv.ms/f/s!Av77lIIxt2OY0XGGW8UDwykohjuT

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

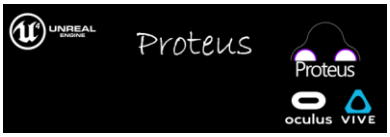
What is the input mapping for the Xbox One gamepad?

  - 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 AvatarMaster pawn.**

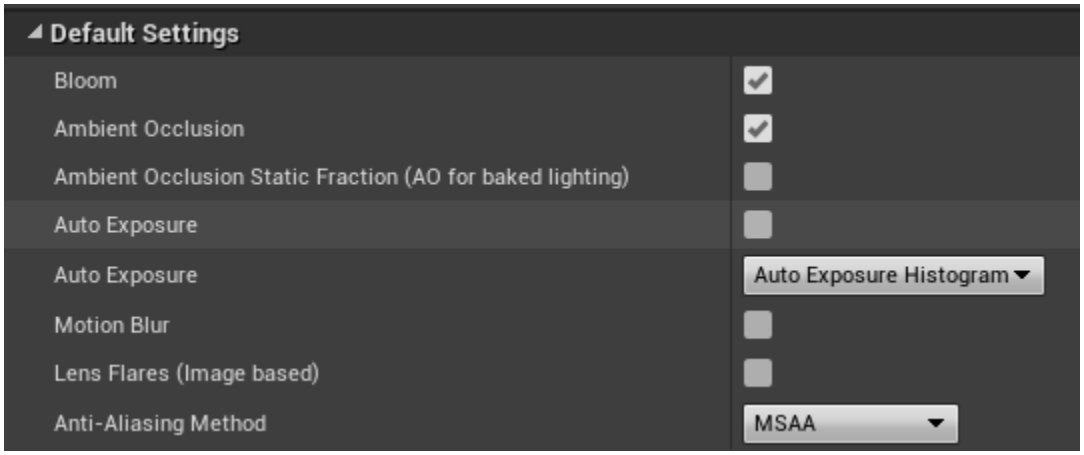


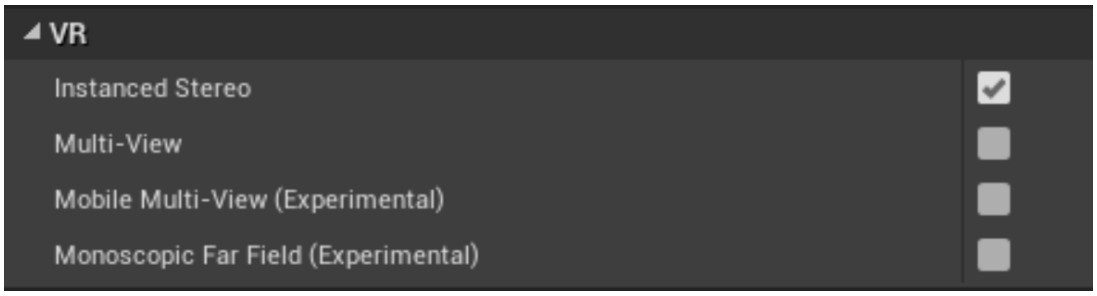
What are the best Project Settings for VR?

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

- In settings/General Settings/Framerate

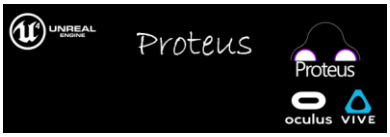
- In settings/Rendering





- 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

The Control Panel

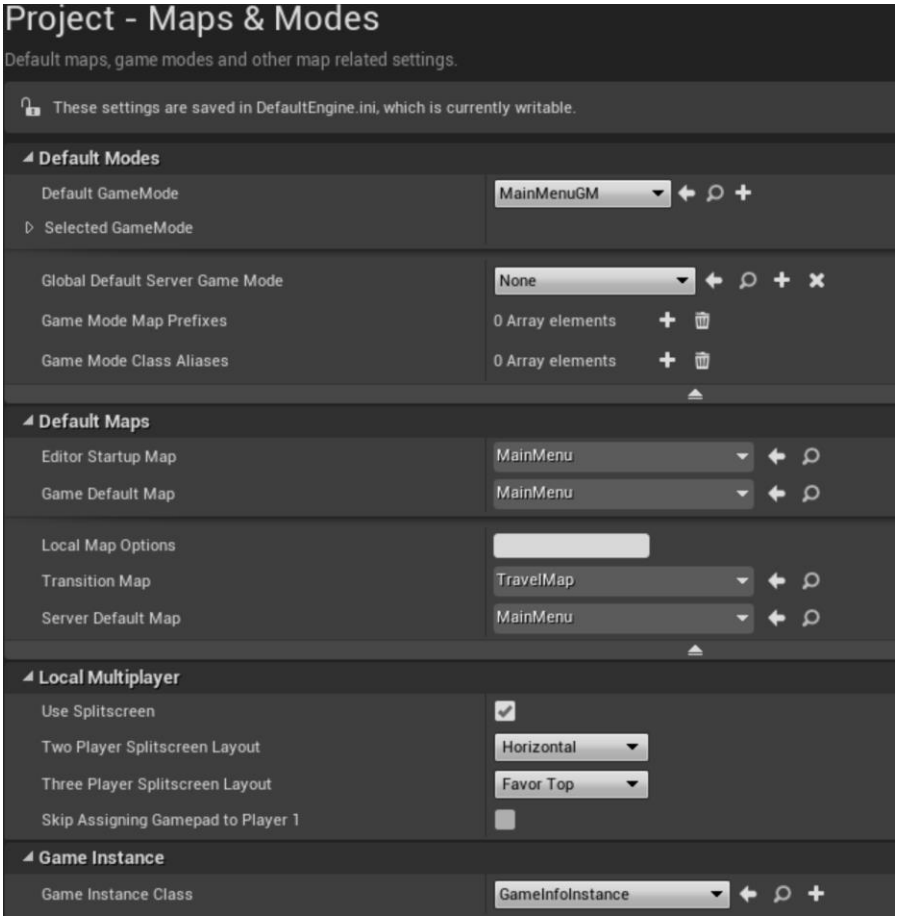


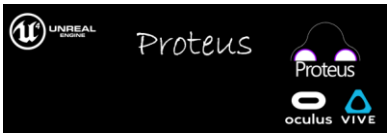
Setting	
Controller Mesh	Hands / Oculus Touch / Vive controller
Controller Opacity	0 up to whatever
Controller Scale	For the hands, the scale is 1:1 with Epic VR template. Reduce scale to approx. 0.75 to come close to real-life for the hands.
Vive Controller Skin (if Vive controller is selected in Controller Mesh)	Default / Apperture / Carbon / Tron Aqua / Tron Clu
Teleport Rotation from Controller	If unselected, rotation is from thumbstick (Touch) or Trackpad (Vive)
Teleport Angle Tolerance	Safety feature to teleport only on surfaces under a certain inclination. Between 0 and 90 degrees. Put 90 degrees to disable it.
Enable Screen Messages	Yes / No
Teleport Rotation from Controller	If unselected, rotation is from thumbstick (Touch) or Trackpad (Vive)
Output Resolution	The resolution on your monitor. **Oculus Rift Only.**
GPU VRAM	GPU Video Memory, can be useful to tweak to stream large textures, by default 4000 (MB). You should put it around 1GB under your GPU VRAM
HMD Mirror Mode	Distorted / Undistorted / Single Eye / Single Eye Letterboxed / Single Eye Cropped (default); **for the HTC Vive, there is only 2 modes: Distorted and 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
Is Using Test Pawn	Test Pawn used for development without HMD, is useful to test replication and other features without having an HMD plugged.
Is Emulating Oculus Rift when Using Test Pawn	**Works only if Is Using Test Pawn is selected.** If checked, it will emulate an Oculus Rift; if not it will emulate an HTC Vive.
Is Single Player Only.	Check if you don't use multiplayer functionalities. See the Single Player section.
Avatar Color	Avatar color **in Single Player mode.**
Is Showing Laser Pointer – Single Player	**If Single Player Only is selected,** will display the widget debug on / off.
Is Showing Laser Pointer in MainMenu	Will display the widget debug in the MainMenu Map
Is Showing Laser Pointer in Game	Will display the widget debug in the other maps
Is Using Oculus Subsystem	Check to use the Oculus subsystem (direct mode or via sessions). **Mandatory for Oculus Avatars.**
Is Using Oculus Avatars	Use Oculus Avatars. If not selected, the default AvatarMaster will be used. **ProteusAvatar plugin must be enabled.**
Alternative Oculus ID	Enter a 16-digits Oculus ID number to use a friend's / random Avatar, rather than you own. **Is Using Oculus Avatars must be enabled.**

MULTIPLAYER MODE

IMPORTANT

- **Ensure that ProjectSettings/Maps & Mode/Game Instance Class/GameInfoInstance is selected**
- **Start at MainMenu map**
- **Select MainMenuGM as GameMode in the Main Menu map, and override game mode with MultiGM in all other maps.**





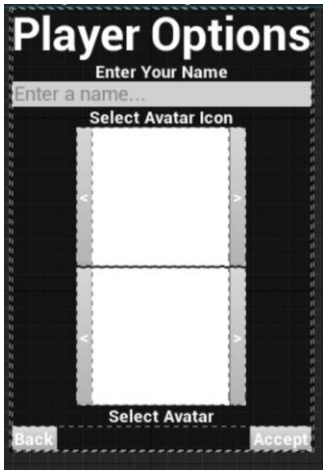
How does it work?

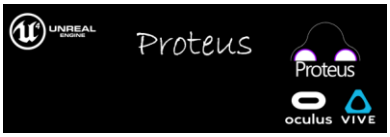
You can use any combination of Oculus Rifts and HTC Vive via LAN or Steam networks, and only Oculus Rifts via Oculus Network. Everyone must be in VR.

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
bHasVoiceEnabled=true
PollingIntervalInMs=20
VoiceNotificationDelta=0.2

[OnlineSubsystemSteam]
bEnabled=true
SteamDevAppId=480
GameServerQueryPort=27015
bRelaunchInSteam=false
GameVersion=1.0.0.0
bVACEnabled=1
bAllowP2PPacketRelay=true
P2PConnectionTimeout=90
Achievement_0_Id=

[/Script/OnlineSubsystemSteam.SteamNetDriver]
NetConnectionClassName=OnlineSubsystemSteam.SteamNetConnection

[OnlineSubsystemOculus]
bEnabled=false
OculusAppId=1111111111111111

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

[/Script/Engine.GameEngine]
!NetDriverDefinitions=ClearArray
+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemSteam.SteamNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")

[/Script/Engine.Player]
ConfiguredInternetSpeed=500000
ConfiguredLanSpeed=500000

[/Script/Engine.GameNetworkManager]
TotalNetBandwidth=500000
MaxDynamicBandwidth=80000
MinDynamicBandwidth=20000

[/Script/OnlineSubsystemUtils.IpNetDriver]
```

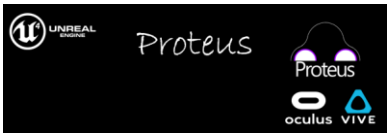
```
MaxClientRate=800000
MaxInternetClientRate=800000

[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

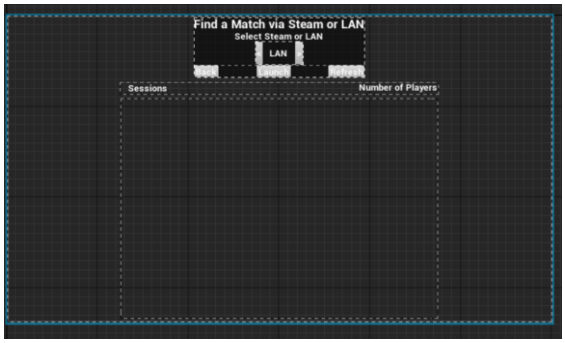
Select Host World via LAN, Steam or Oculus Network

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

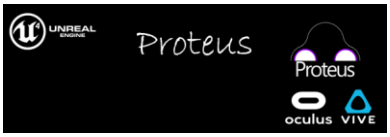


JOINING A GAME

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



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

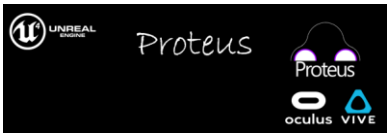


CONNECT VIA LAN / DIRECT IP CONNECT

- 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.

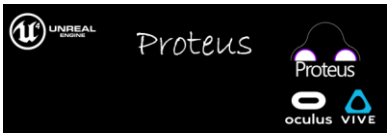


Using Oculus Network

- 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:

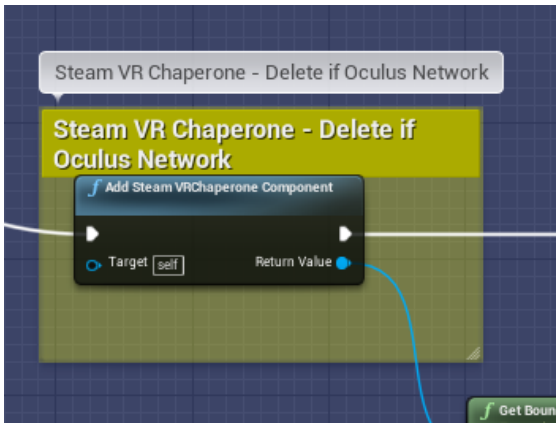
```
[OnlineSubsystem]
;DefaultPlatformService=Steam
DefaultPlatformService=Oculus
bHasVoiceEnabled=true
PollingIntervalInMs=20
VoiceNotificationDelta=0.2

[OnlineSubsystemSteam]
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
```

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 AvatarMaster/Set Boundaries for Chaperone & Guardian, delete the following code:**

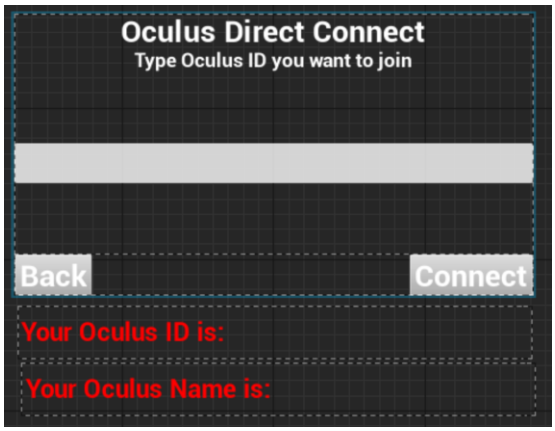


HOSTING A GAME:

Same as hosting a game on Steam Network

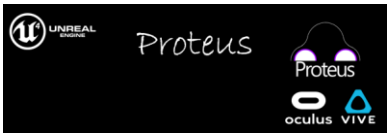
JOINING A GAME:

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 (MultiMap01)

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

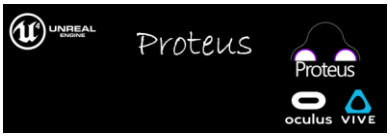
Project Settings should accommodate most, but there may be cases where you select otherwise

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

Multiplayer settings:

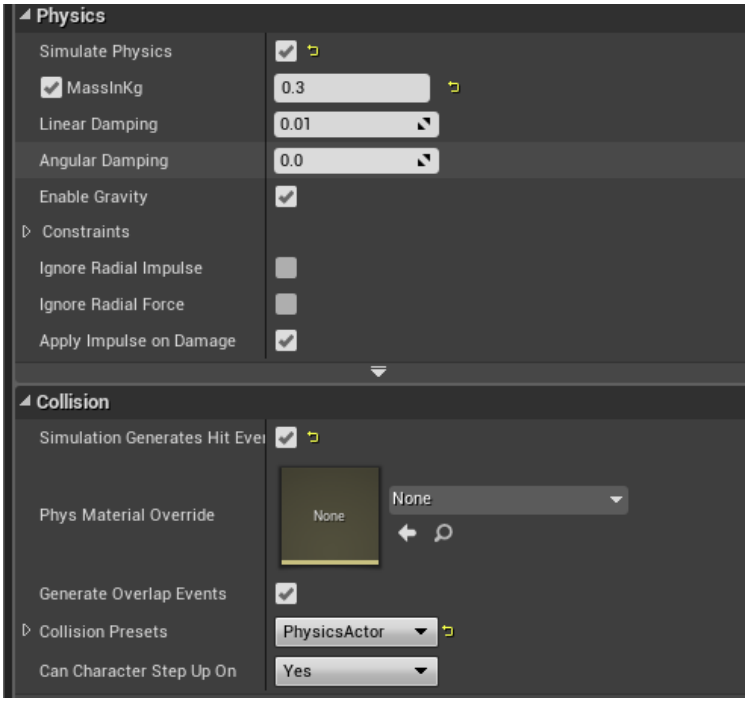
Setting	You can change it in the following blueprint:
Max Number of Players available to host	/HostMenu/MaximumPlayers
Default Server Name	/HostMenu/DefaultServerName
List of Game Maps	/HostMenu/MapNames
Game Map Icons	/HostMenu/MapImages
Avatar Icon Images	/OptionsMenu/AvatarIcons
Avatar Images	/OptionsMenu/AvatarImages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



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 PhysicsActor



- Implement BI Interactable Actor

- Copy the functions found in any objects in “Interactive Objects” folder

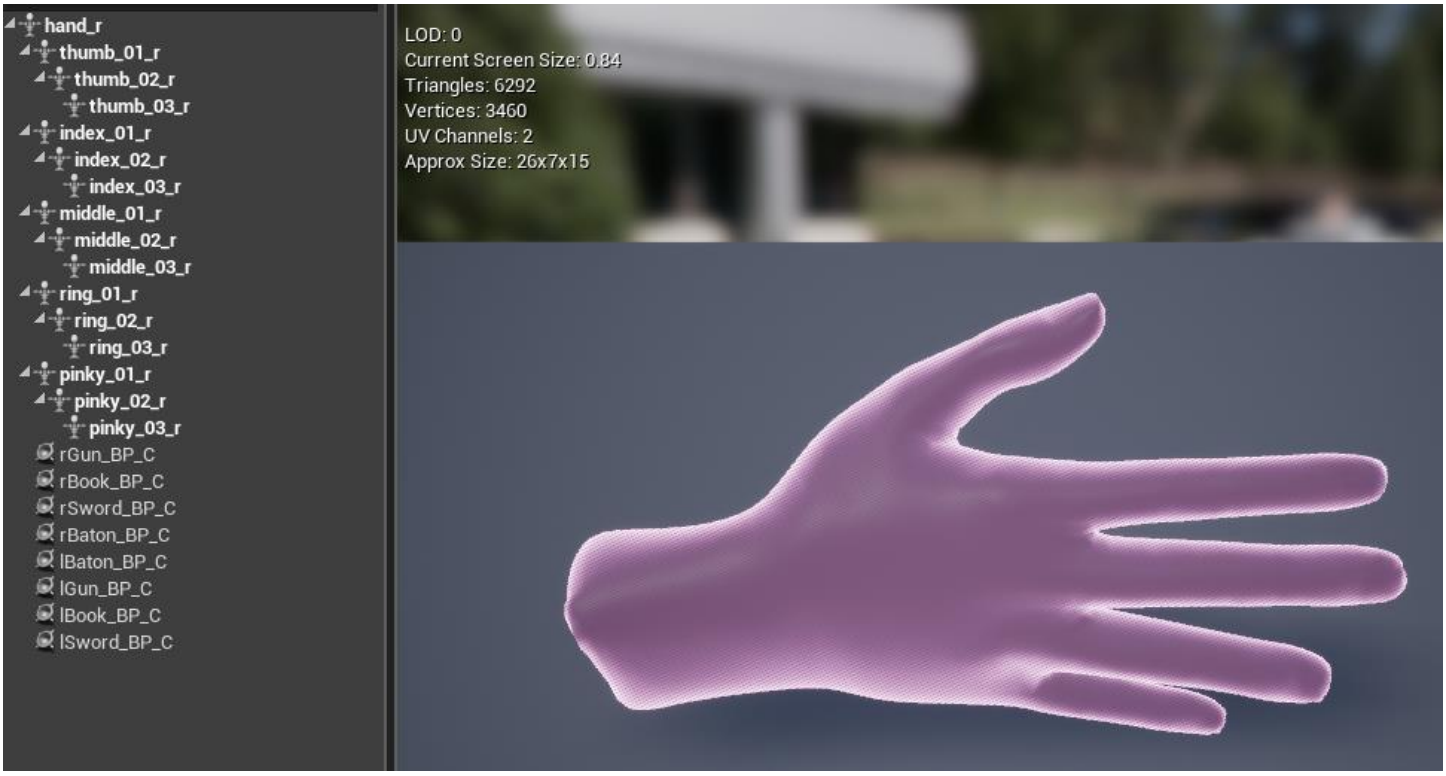
Collision with physics object

By default, when the trigger button is pressed (i.e. hand closed), the sphere on the motioncontroller has its collision channel set to physics objects so it will interact with objects, **and only if not actively grabbing anything.** Otherwise, it is disabled.

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 8 sockets, one for each object and hand side. Name the socket the same as the display name of the class 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.

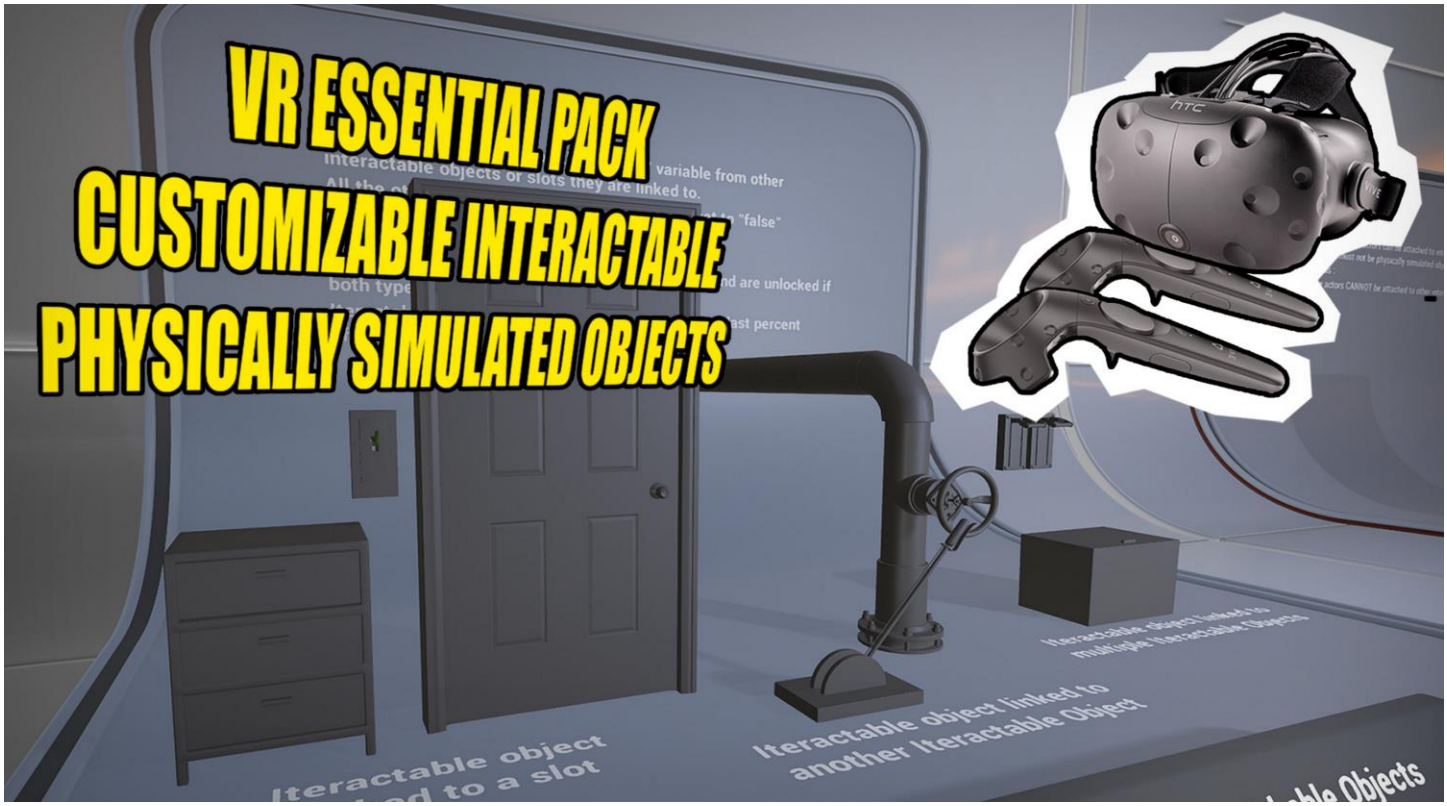
Put "r" or "l" before a socket name to specify a different right or left hand position. If you don't put any socket, the right and left hand will pick up the object by the closest collision mesh surface. An example is found with the cube and the hat.



- **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, @jamis's VR Essential Kit Map has been included with the template. The reason that it is included is that minor changes were made to @jamis' blueprints to be compatible with the AvatarMaster pawn. You'll find more infos at https://forums.unrealengine.com/showthread.php?131379-WIP-VR-Essential-Kit&highlight=vr+essential+kit

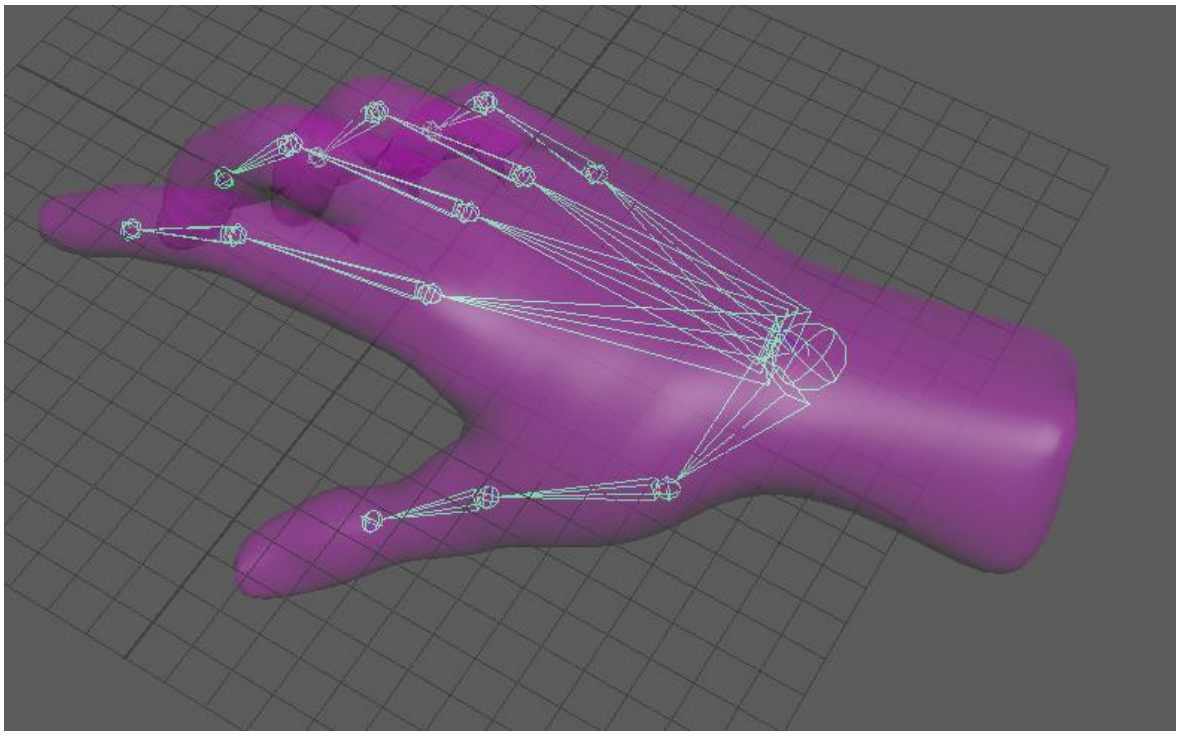


- **Note that the VR Essential Kit is a project made by @jamis. All questions concerning this project should be directed to him.**
- **As of now (version 3.0), the VR Essential Kit won't respond to clients in multiplayer game.**

Fingers / Controllers Poses

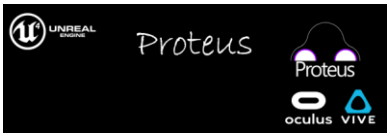
The hand model (.fbx and ASCII Maya) can be found on OneDrive at the same place as the template:

https://1drv.ms/f/s!Av77lIlxt2OY0XGGW8UDwykohjuT



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:
    - The Trackers are tracked by HTC Vive(s)
    - The playground centers of all players are centered around the same origin

Teleporting

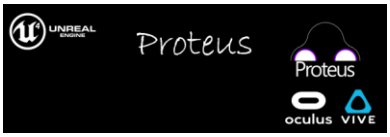
Pawn are able to teleport on surfaces when these 2 conditions are met:

- Has a NavMeshBoundsVolume;
- Is below the teleportation angle limit (see VR settings) – put 90 to this setting to disable it

IMPORTANT: Enable Project Settings / Engine / Navigation System / Allow Client Side Navigation for multiplayer teleportation; if not selected, clients won't be able to detect the Navigation Mesh.

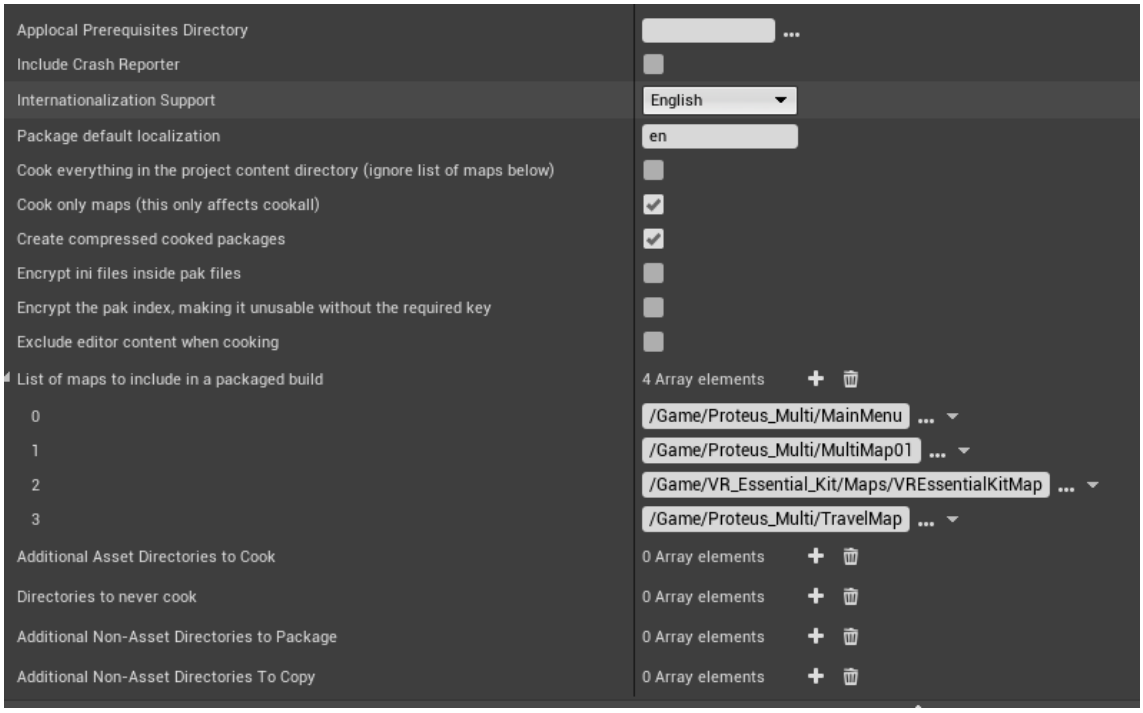
Single Player Only

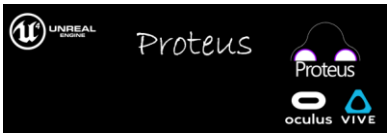
- Use the same settings as the Multiplayer mode
- Select "Is Single Player Only" in VRSettings
- Select Avatar color in VRSettings and other pawn-related settings
- Use MainMenuGM as game mode on all maps



Important dev notes

Before packaging your game, select List of maps to include in a packaged build in Project settings/packaging





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.

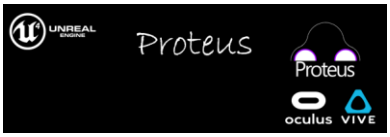
99.99% of the time, the problem can be resolved by checking materials, lights and shadows. You have also to carefully assess and tweak the scalability and post-process settings.

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

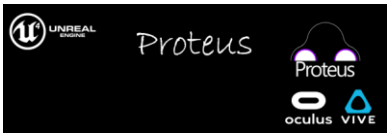
I'm still having problems

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



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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