Proteus VR Template

Latest Version 4.0

Latest release May 8, 2018

This template consists of virtual reality 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.

Discussion on Unreal forum at https://forums.unrealengine.com/development-discussion/vr-ar-development/106631-single-multiplayer-touch-vive-proteus-blueprint-only-template

There are 2 versions:

1) **Single Player, and Multiplayer via Steam or LAN version**

   - Based on Unreal 4.19, launcher version
   - Find at https://github.com/ProteusVRpublic/ProteusTemplate
   - Oculus Rift & DK2 (using Oculus Home)
   - HTC Vive & Windows Mixed Reality headsets (using SteamVR)
   - Compatible with Vive Trackers (using SteamVR)
   - Single Player & Multiplayer via Steam or LAN

2) **Single Player, and Multiplayer via Oculus Network or LAN version**

   - Based on Unreal 4.19, Oculus version (at https://github.com/Oculus-VR/UnrealEngine)
   - Oculus Rift & DK2 (using Oculus Home)
   - Compatible with Oculus Mixed Reality
   - Single Player & Multiplayer via Oculus Network or LAN

Other versions of the template are available, although WIP:

- Multiplayer via Direct IP Connection (no VOIP) – Unreal 4.18
  - https://github.com/ProteusVR/DirectIPVOIP
- Multiplayer Leap Motion Version (fully functional) – Unreal 4.18
  - https://1drv.ms/f/s!Av77lIIxt2OY0XGGW8UDwykohjuT
- Single Player WMR headsets (using Windows Home) (partially working) – Unreal 4.16
  - https://github.com/ProteusVR/WindowsStore
- Single Player with Oculus Avatars (fully working) – Unreal 4.17
  - https://github.com/ProteusVR/OculusAvatars
- Single Player with Hololens (partially working) – Unreal 4.16
  - https://github.com/ProteusVR/Hololens

What's new in version 4.0

- **Unreal 4.19**
- **Entirely redesigned**
- **More stable**
- **Multiplayer VREssentialKit Map**
- **Rotate player in the direction of playerstart**
- **VOIP component enable VOIP through Oculus Store (Oculus Store version)**

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.

PROTEUS TEMPLATE 4.0	**Steam/LAN Version**	**Oculus Store Version**
Unreal Version	4.19	4.19
HMD and Controllers Tested	Oculus with Touch, Vive with controllers, NOTE 1	Oculus with Touch
OVRPlugin	1.21	1.24
Oculus Avatars SDK		1.25
Steam SDK	1.39	
Mode of Connection	LAN, Direct IP, Steam, Oculus, Oculus Direct	LAN, Oculus
Multiplayer		
Vive Tracker compatible		
Animated Hands		
Touch, Vive controllers		
Avatar head and hands skins		
Spawn poles at boundaries		
Ghost Mode with Gamepad		
Rumble functions		
UI interactions, VR keyboard		
Fade out when goes through objects		
Interactive Objects		
Skeletal sockets examples		
VR Essential Kit Compatible		
VOIP		
Microsoft Speech Recognition		
Spectator Mode		
Oculus Store compatible		
Steam Compatible		
Blueprint Only		

How can I install it in my project?

In the template

- Open “Proteus.uproject”
- Inside the editor, right-click on the folder “Proteus_Multi” and select Migrate
- Migrate everything inside the folder to your project, inside the folder your project/Content/

In your project

- If needed, adjust Project settings (see “What are the best Project Settings for VR?”)
- In ProjectSettings/Maps & Mode (see page 10):
    - Ensure that Game Instance Class/GameInfoInstance is selected
    - Select MainMenu as Editor Starting Map and Game Default Map
    - Select MainMenuGM as GameMode
- Don’t forget to put a navmesh bound volume to allow teleportation!
- Pawn will spawn at playerstart (placed on the floor) and will teleport on navmesh
    - Put a PlayerStart tag in MainMenu level: PS1
    - In the all other maps, PS1, PS2, PS3, PS4
- Set a VR Collision preset in Project Settings/Engine/Collision/Preset; or copy settings from Engine.ini
- In the control panel found in MainMenuPC, select your options

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: Widget Interaction
  - Thumbstick Button: Chaperone/Guardian corners on/off
- **Left Controller**
  - X Button: Teleport
  - Y Button: Spectator Mode on/off
  - Thumbstick Button: VR Keyboard 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: Widget Interaction
  - Left or Right Grip Button: Spectator Mode on/off
- **Left Controller**
  - Menu Button: VR Keyboard on/off<
  - Left or Right Grip Button: Chaperone/Guardian corners on/off

What is the default input mapping for the Windows Mixed Reality controllers?

- **Both controllers**
  - Trackpad directions / Controller orientation: Playground rotation before teleportation
  - Trackpad release: Teleport
  - Trigger: Grab / Release
- **Right Controller**
  - Menu Button: Widget Interaction
  - Grip Button: Spectator Mode on/off
- **Left Controller**
  - Menu Button: VR Keyboard on/off<
  - Grip Button: Chaperone/Guardian corners 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.**

How can I enable Oculus Dash?

- Works only with Oculus Rift HMD
- See related functions in AvatarMaster and MotionControllerbp
- Put these lines in Engine.ini:

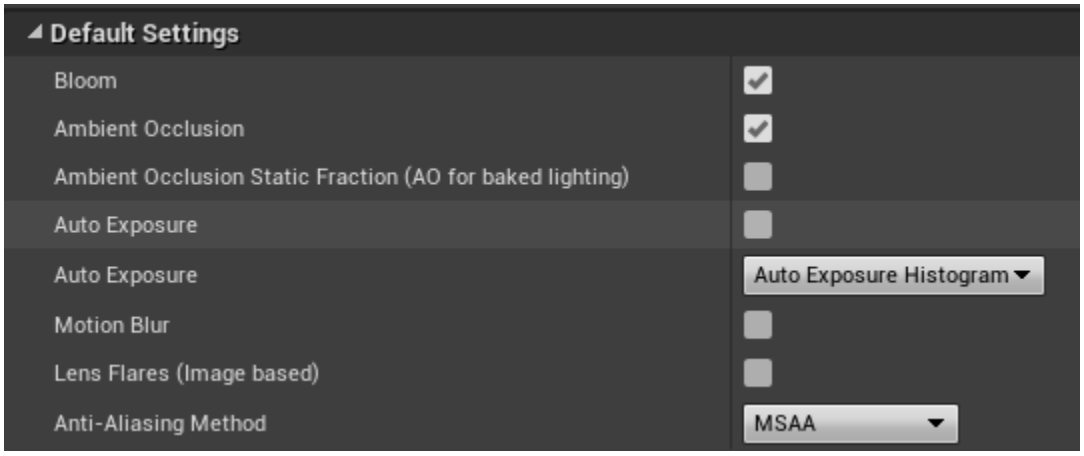
```
[Oculus.Settings]

bSupportsDash=true
```

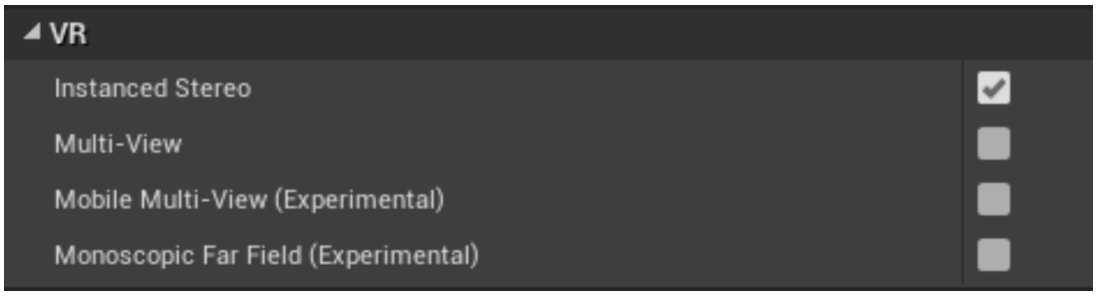
What are the best Project Settings for VR?

➢ **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
Output Resolution	The resolution on your monitor.
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	See below
VR Pixel Density	Use a higher number for better quality, and a lower one for better performance
Is Single Player Only.	Check if you don't use multiplayer functionalities. See the Single Player section.
Debug Mode	Enable debug mode (no VR)
Use Leap Motion	For Leap Motion version
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.**
StartMenuMap	Name of the StartMenu Map
Connection Type	LAN/OculusSTore/Steam/DIrectIP

HMD Mirror Modes

Mode	Oculus Rift	SteamVR	PS VR	Notes
Disabled	✓	✓		For the best performance on HMDs, this mode disables Spectator Screen output.
SingleEyeLetterboxed	✓	✓	✓	This mode is primarily intended for debugging purposes, showing only one letterboxed eye on the screen.
Undistorted	✓	✓	✓	This is a debug mode, showing the entire rendered area for both eyes.
Distorted	✓			This mode is only supported by Oculus. Specifically, this is an Oculus specific debug mode, showing chromatic abberations, etc.
SingleEye	✓	✓	✓	Much like the **Undistorted** mode, this a debug mode for only one eye. Because this mode stretches the scene, it may be useful for identifying small artifacts in the scene.
SingleEyeCroppedToFit	✓	✓	✓	This mode crops the eye to fill the entire screen.

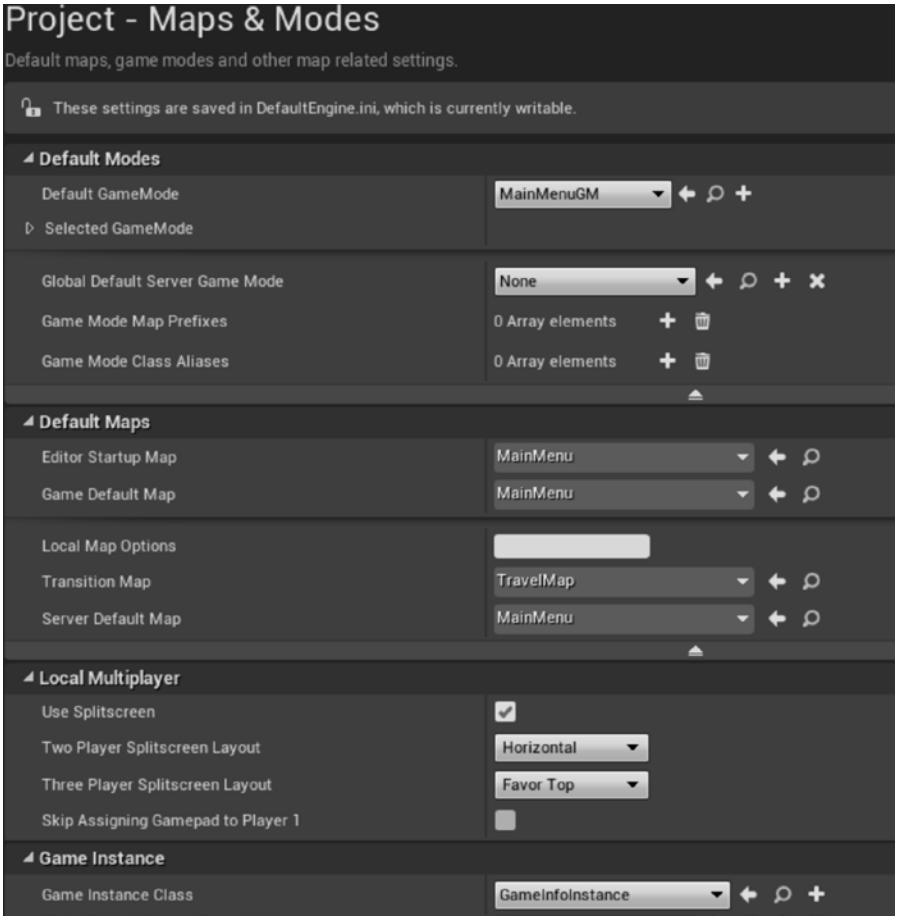
Debug Mode Controls

Left – Right Arrows	Turn left / Turn Right (simulate HMD rotation)
Up – Down Arrows	Go forward / Go back (simulate moving in room-scale)
W,A,S,D:	Move along 2D X,Y axis (simulate HMD location)
Left Shift	Simulate Right Index Trigger / Trigger
Left Control	Simulate Right Hand Trigger / Grip
Left ALT	Simulate B Button / TrackPad Right
Spacebar	Simulate A Button / TrackPad Up
Z	Simulate R Thumbstick Pressed / R Trackpad Pressed

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.**
- **Select ProjectSettings/NavigationSystem/Allow Client Side Navigation**



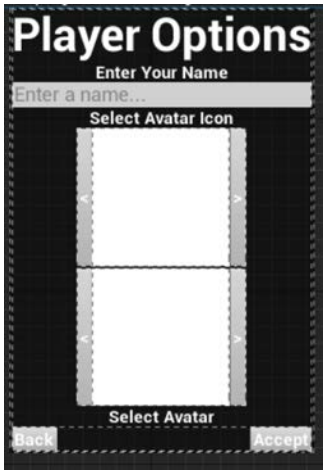
How does it work?

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



Steam/LAN/Direct IP/Oculus Store/Oculus Direct connection Version

- Plugins/Virtual Reality/Steam VR must be selected
- Connection Type Steam must be selected
- Select Steam as connection type in MainMenuPC
- 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/Engine.GameEngine]
!NetDriverDefinitions=ClearArray
+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemSteam.SteamNetDriver",DriverClassNameFallback="OnlineSubsystemU
tils.IpNetDriver")

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

[/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.

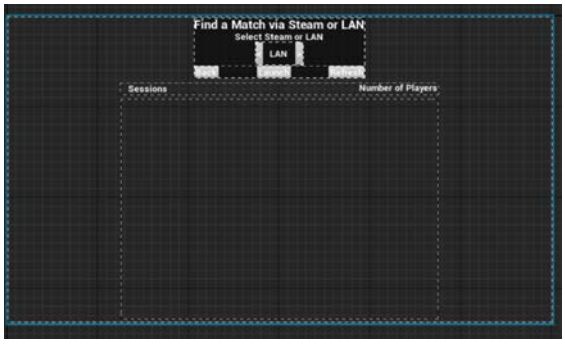
HOSTING A GAME

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.

LAN / DIRECT IP

- **<u>Steam/LAN/Direct IP/Oculus Store/Oculus Direct connection Version</u>**
- **<u>Direct IP with VOIP – to have VOIP over Direct IP connection</u>**

- 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.

Direct IP with VOIP VERSION

How to make it work: Take the NULL subsystem plugin and change the server searching code to refer to your server instead of how it currently is implemented. Keep the UniqueID implementations as they are now and interface them with your master server, then the voice chat that is part of NULL will plug right in and the game data that gets send with player states also gets populated correctly.

Oculus Network

- **Oculus Store version**
- Plugins/Virtual Reality/Oculus Rift and Oculus Library must be selected
  - Plugins/Online Platform/Online Subsystem Oculus must be selected
  - Select Steam as connection type in MainMenuPC
  - Each player must be connected to Oculus Home with a different account
  - Be sure to add VOIP component to AvatarMaster to enable VOIP
  - The file /Config/DefaultEngine.ini must contain the following changes:

```
[/Script/Engine.AudioSettings]

VoiPSoundClass=/Game/Proteus_Multi/VOIPSoundClass.VOIPSoundClass

DefaultSoundClassName=/Game/Proteus_Multi/VOIPSoundClass.VOIPSoundClass


[OnlineSubsystem]

DefaultPlatformService=Oculus

PollingIntervalInMs=20

VoiceNotificationDelta=0.2


[OnlineSubsystemOculus]

bEnabled=true

RiftAppId=xxxxx


[/Script/Engine.GameEngine]

!NetDriverDefinitions=ClearArray

+NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="OnlineSubsystemOculus.OculusNetDriver",DriverClassNameFallback="OnlineSubsystemUtils.IpNetDriver")


[/Script/OnlineSubsystemOculus.OculusNetDriver]

NetConnectionClassName=OnlineSubsystemOculus.OculusNetConnection


[Oculus.Settings]

bSupportsDash=true
```

[/Script/Engine.Player]

ConfiguredInternetSpeed=500000

ConfiguredLanSpeed=500000

[/Script/Engine.GameNetworkManager]

TotalNetBandwidth=500000

MaxDynamicBandwidth=80000

MinDynamicBandwidth=20000

[/Script/OnlineSubsystemUtils.IpNetDriver]

MaxClientRate=800000

MaxInternetClientRate=800000

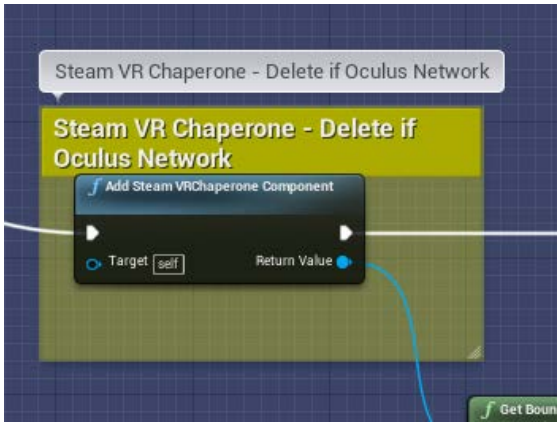
[Voice]

bEnabled=true

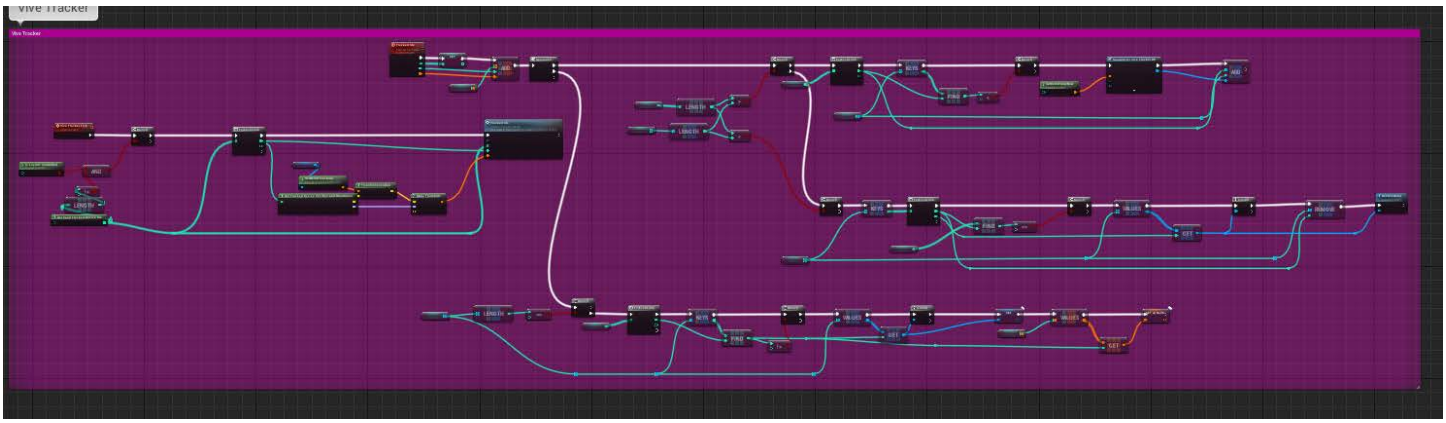
The 16-digits RiftAppId is your Oculus App ID found in your App Oculus dashboard URL (i.e. https://dashboard.oculus.com/application/111111111111111/build). For more information on publishing your game on Oculus platform see https://developer3.oculus.com/documentation/publish/latest/ .

IMPORTANT if USING Steam/LAN/Direct IP/Oculus Store

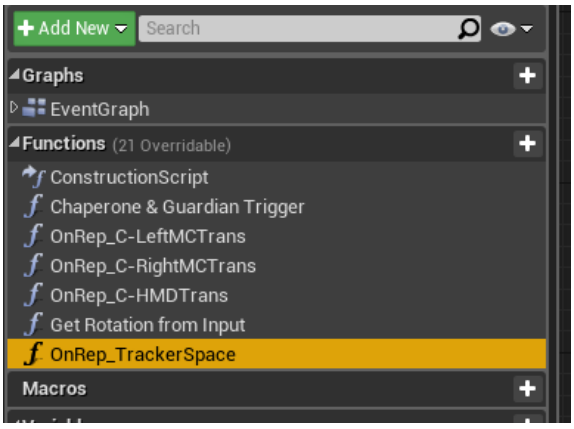
- **Plugins/Virtual Reality/Steam VR must be deselected**
- **Plugins/Online Platform/Online Subsystem Steam must be deselected**
- **In AvatarMaster/Set Boundaries for Chaperone & Guardian, delete the following code:**



- **Delete all functions related to Vive Trackers (in pink)**



- **Delete Tracker OnRep_TrackerSpace RepNotify function**



HOW TO CONNECT:

By default, connecting works via the Oculus Matchmaking Pool Browse1:

View/Edit Matchmaking Pool

TestAvatar - Rift

Pool Key

Non-user-facing alphanumeric/underscore key you'll pass into all your endpoints to use this configuration.

Browse1

Mode

Quickmatch: Users enter the matchmaking queue, and the system will match them together automatically. Browse: Rooms enter the matchmaking queue, and users can search for filtered lists of rooms and then choose one to join.

Browse

Users per Match

The lower and upper limits inclusive of people per match. Min Users is the absolute minimum number of people needed to start a match. Min Preferred Users is the minimum ideal number of people to enjoy a match. Max Preferred Users is the maximum ideal number of people to enjoy a match. Max Users is the absolute maximum number of people that can fit in a match. Only Min Users and Max Users is required. If Min Preferred Users is left blank, then Min Users will also be considered as the Min Preferred Users. If Max Preferred Users is left blank, then Max Users will also be considered as the Max Preferred Users.

Min Users	Min Preferred Users	Max Preferred Users	Max Users
2	2	4	4

Skill Pool

If you want skill-based matchmaking, specify the skill pool within which users will be ranked.

None

Should Consider Ping Time?

Does your game care about peer-to-peer latency?

○ Yes ◉ No

OCULUS AVATARS

SOON! PROBLEMS TO BE SOLVED WITH 4.19…

Using the Multiplayer Map (MultiMap01 and VREssentialKit)

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

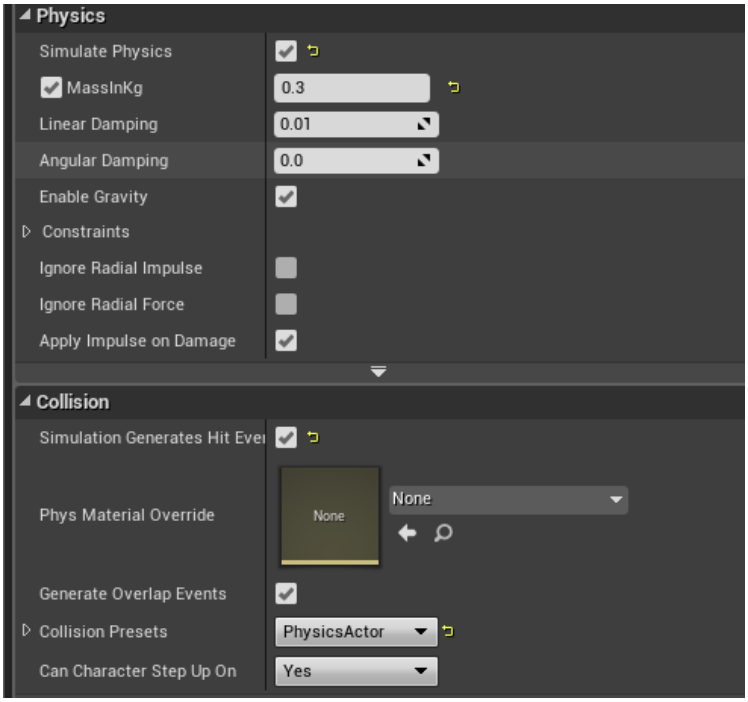
Multiplayer settings:

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



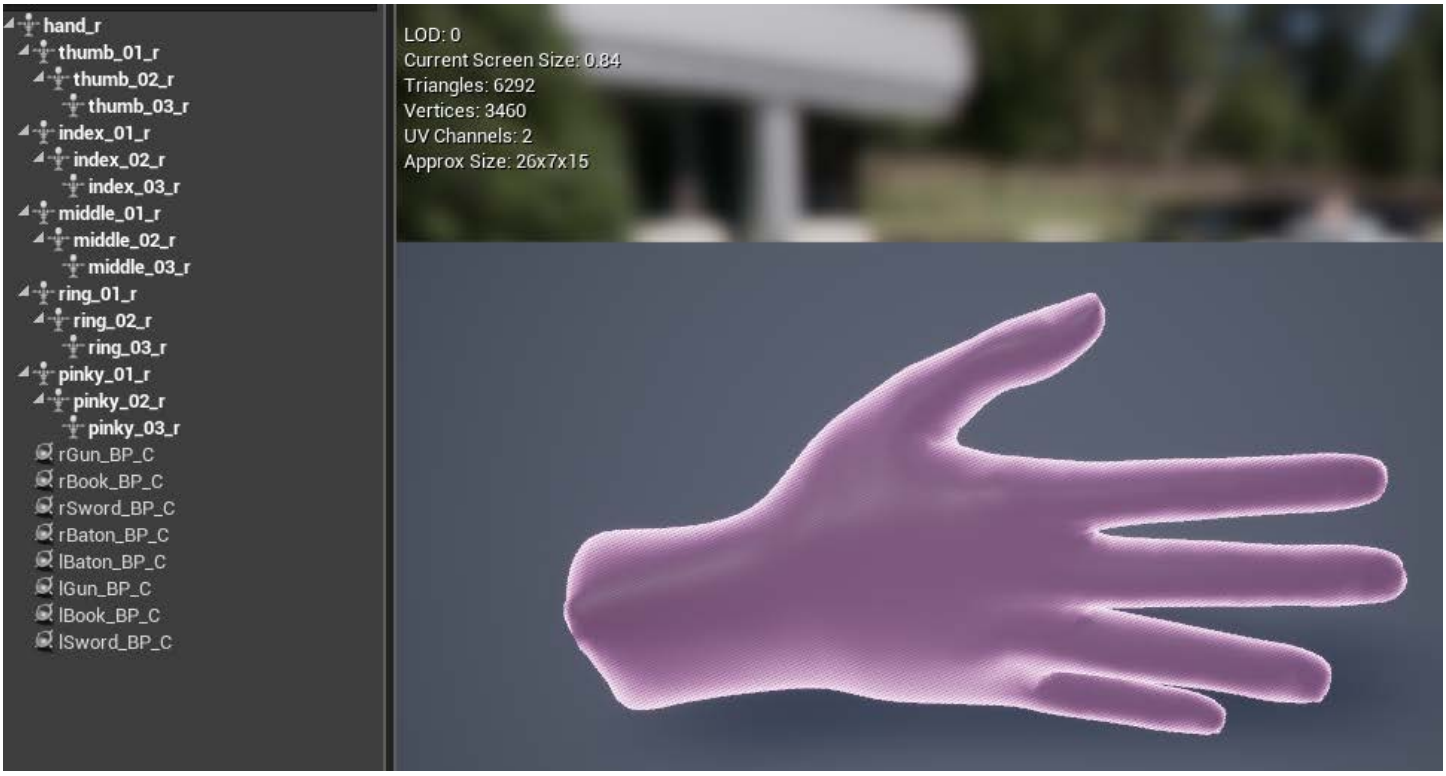
- Implement BI Interactable Actor

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

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.

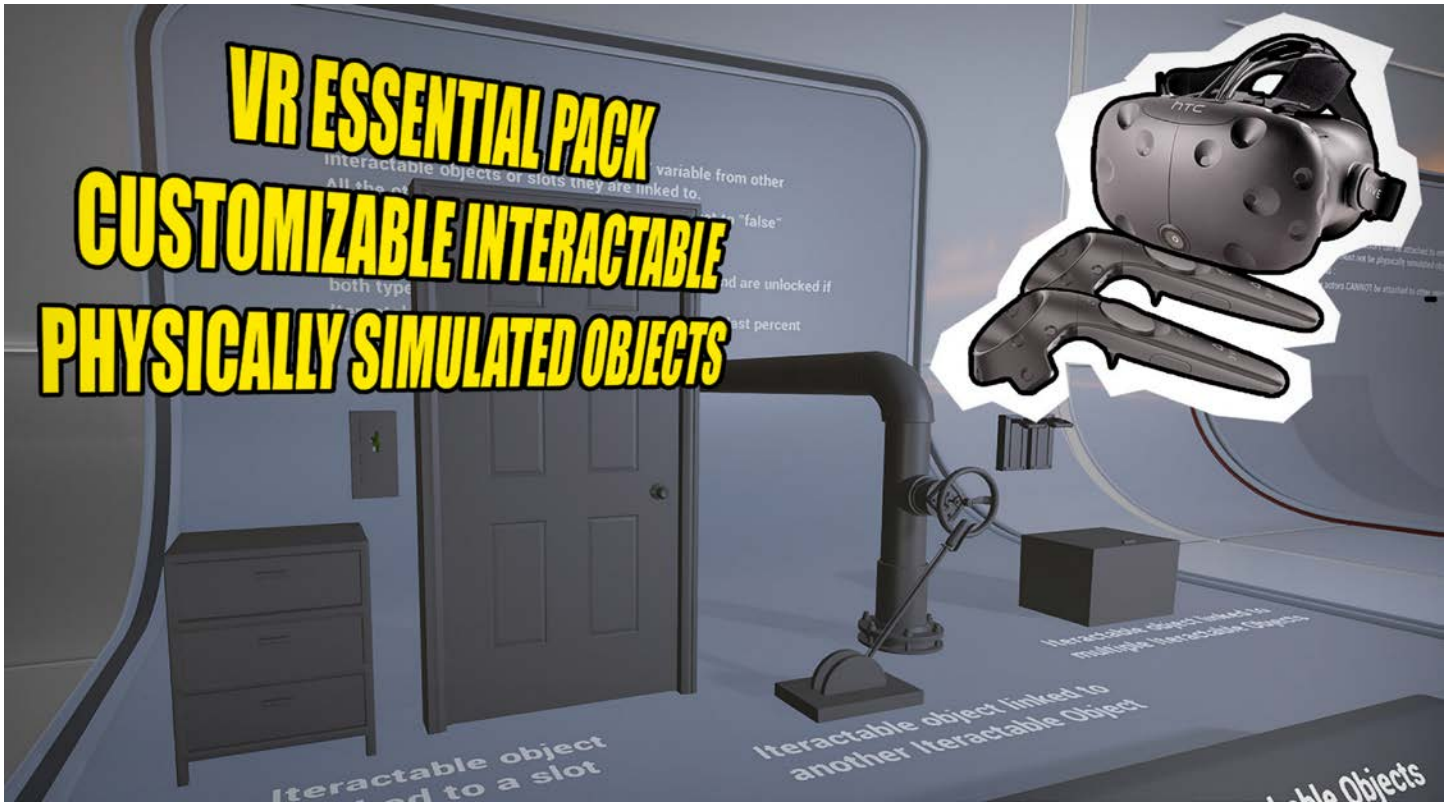
Put "r" or "l" before a socket name to specify a different right or left hand position. If you don't put any socket, the right and left hand will pick up the object by the closest collision mesh surface. An example is found with the cube and the hat.



- **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

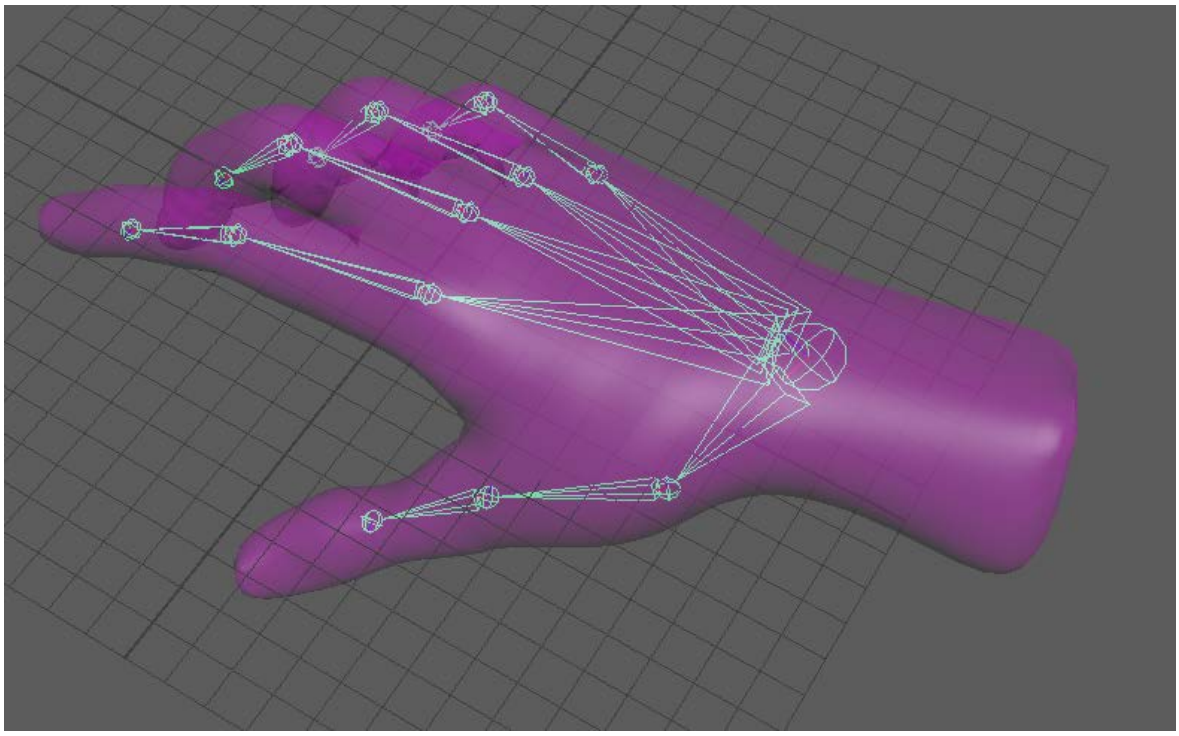


- **Note that the VR Essential Kit is a project made by @jamis. All questions concerning this project should be directed to him.**

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

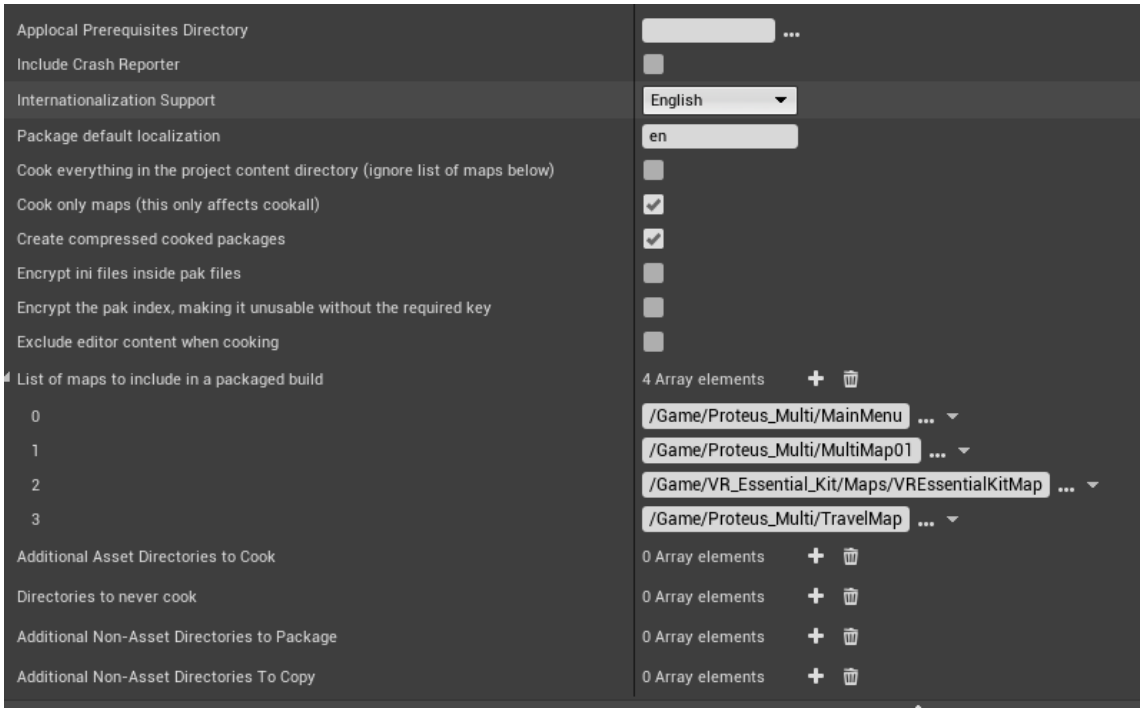
IMPORTANT: Enable Project Settings / Engine / Navigation System / Allow Client Side Navigation for multiplayer teleportation; if not selected, clients won't be able to detect the Navigation Mesh.

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/

Questions?

Don’t hesitate to contact me mathieu.beaulieu@proteus-vr.com .

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