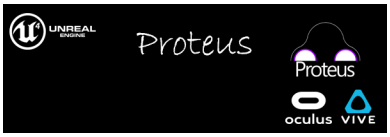


Proteus VR Template

First release: March 2016 (under the name "SteamVR Template"

Latest Version 5.0 (under the name "Proteus VR Template")

Latest release January 25, 2019

What can I do with that, that I cannot do with the "VR Template" in Unreal?

Well, rapidly: It's single or multiplayer (LAN or Oculus Home); It uses Oculus Avatars (or not); It uses voice over IP (VOIP); full of nice features fully using Oculus functions; compatible Go/Quest/Rift; minimum use of C++ (but still some, since some methods not possible only in blueprints); hey, we were the first to propose a template back in 2016!

FOR NOOBS: This is super simple. Even if you think Visual Studio is the name of a VFX/Hollywood startup somewhere around LA with people working in open spaces and flip-flops, it requires few manipulations to set up; I could add few instructions how-to on demand.

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

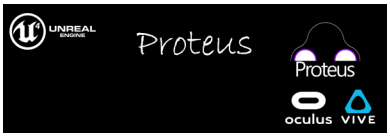
Download it at https://github.com/ProteusVRpublic/ProteusTemplate

Compatible with the following Unreal Engine versions:

Unreal Engine 4.20*, Oculus-branch, latest commit e8c8be1 (Nov 14, 2018), found at https://github.com/Oculus-VR/UnrealEngine/tree/4.20

Unreal Engine 4.21*, Oculus-branch, latest commit 5b6d633 (Dec 20, 2018), found at https://github.com/Oculus-VR/UnrealEngine

* minor changes to the engine possibly / mandatory required

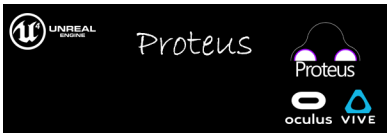


What's new in version 5.0

- **Entirely redesigned**
- **More stable**
- **Use latest Oculus implementations (splash screen, play area limits, smart use of camera fade, etc).**
- **Unreal 4.20 & 4.21**
- **Uses Oculus SDK 1.32 & Oculus Avatar SDK 1.31**
- **Single & Multiplayer Oculus Avatars**
- **Compatible Oculus Rift & Oculus Go, Oculus Quest-ready**

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.



How can I install it in my project?

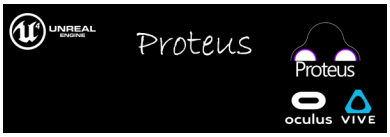
1) Compile correct Unreal Engine version
2) Bring proper modifications to the engine (see page 16), if:
    a. You want to enable Retrieve Oculus ID and Verify Entitlement with the Oculus Go / Quest
    b. You want to nativize assets on the Oculus Go / Quest
    c. You use 4.21 version
3) Compile app and let's go!

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 entryMap 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 entryMap level: PS1
    - In the all other maps: PS1, PS2, PS3, PS4
- In the control panel found in MainMenuPC, select your options



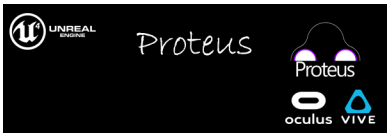
What is the default input mapping for the Oculus Rift / Quest Touch Controllers?

- **Both controllers**
  - Thumbstick directions / Controller orientation: Play area rotation before teleportation
  - Index Trigger: Grab / Release
- **Right Controller**
  - A Button: Teleport
  - B Button: Widget Interaction
  - Thumbstick Button: Spawn Menu on/off
- **Left Controller**
  - X Button: Teleport
  - Y Button: Guardian corners on/off
  - Thumbstick Button: Spectator Mode on/off

What is the default input mapping for the Oculus Go?

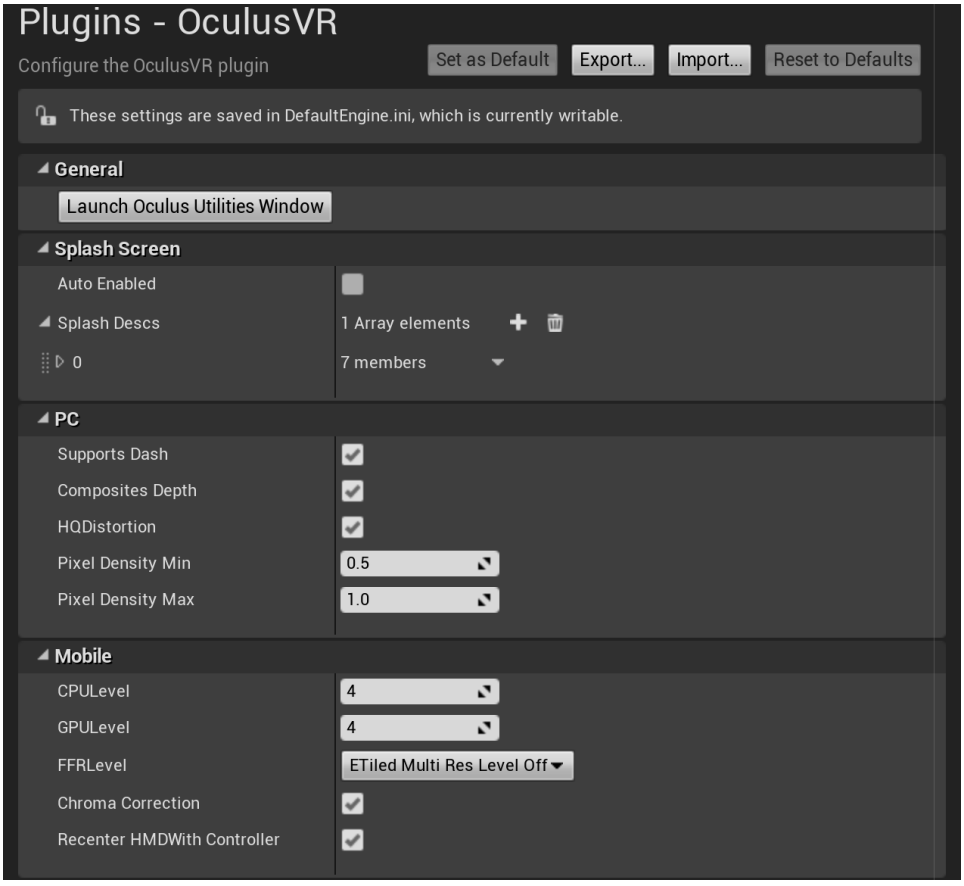
They are not mapped, but they correspond to:

- Oculus Go Home Button: Same as (Right) Touch A Button
- Oculus Go Trackpad (x-y axis): Same as Right Touch Thumbstick x-y axis
- Oculus Go Trackpad Button: Same as Right Touch Thumbstick Button
- Oculus Go Trigger: Same as Right Touch Trigger
- Oculus Go Back Button: Reserved

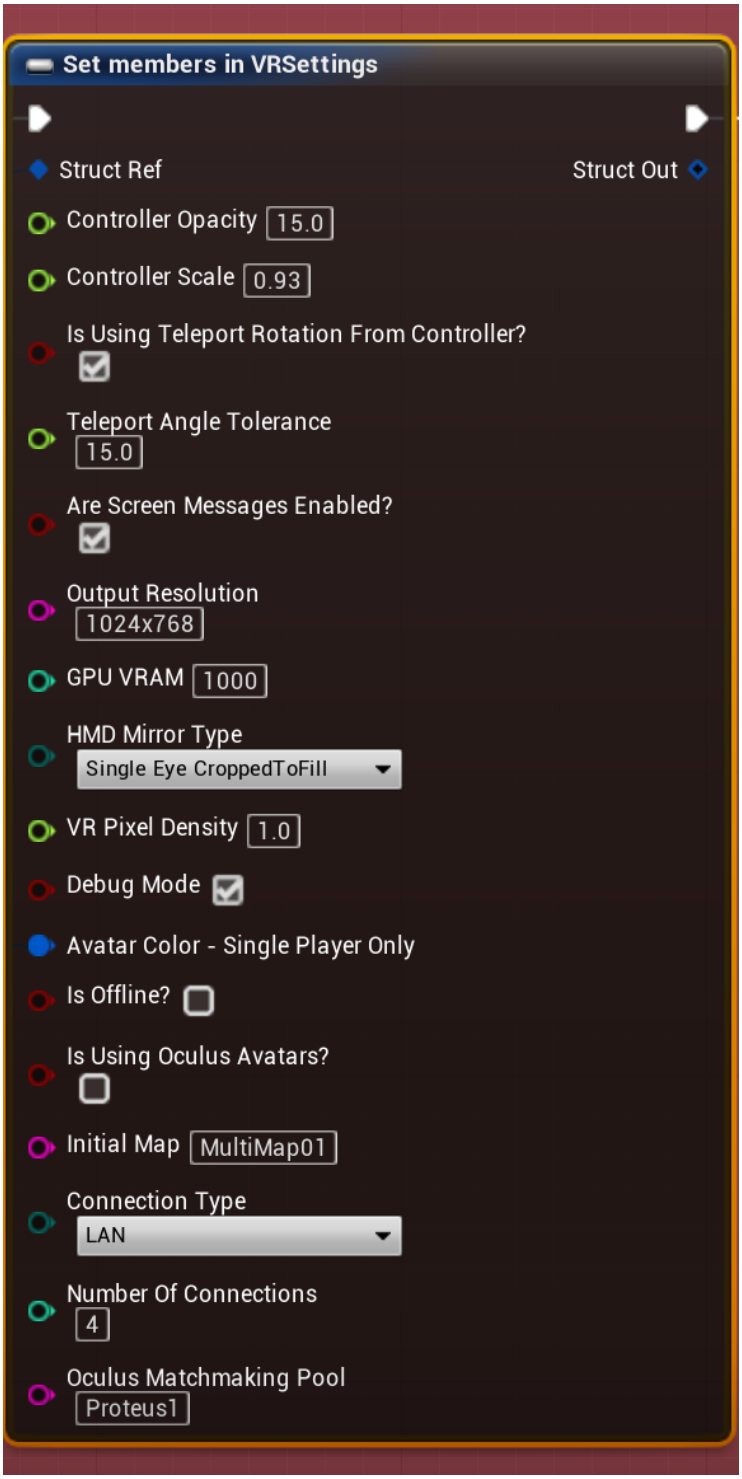


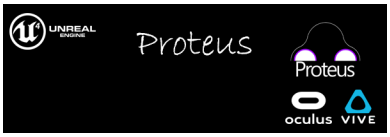
What are the best Project Settings for VR?

- **You will find the best settings for Rift/Go already set in ProjectSettings**
- Go / Quest
  - works both in OpenGL ES2 and ES 3.1, use Android SDK 21
  - Oculus Go is a 32-bits device, so use armeabi-v7a
  - Use Mobile Multi-View, Mobile Multi-View Direct, Mask-base Foveated-Rendering
  - Avoid Monoscopic Far Field (crash – BUG)
  - Mobile HDR off
  - Occlusion Culling off (bug)
- Don't forget the settings in Project Settings:



The Control Panel

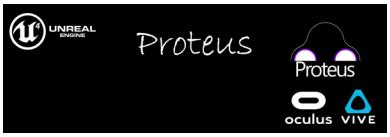




Setting	
Controller Opacity	0 up to whatever, 1 is not entirely opaque, just 15 should be fine
Controller Scale	For the hands, the scale is 1:1 with Epic VR template. Reduce scale to approx. 0.75 to come close to real-life for the hands, 0.93 to Oculus Avatar Hands
Teleport Rotation from Controller	If unselected, rotation is from thumbstick / trackpad
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 (in development and editor mode)
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
Debug Mode	Enable debug mode (no VR – see below)
Avatar Color	Avatar color when not using the Oculus Avatars
Is Offline?	You will be logged in but will not accept any connections
Is Using Oculus Avatars?	Use in-house hands+head or Oculus Avatars system
Initial Map	The map you'll load into following entryMap
ConnectionType	LAN / Oculus Home. You need to be connected to Oculus Home to use the Oculus Avatars
Oculus Matchmaking Pool	Oculus Matchmaking Pool, as set in Developer Dashboard

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.

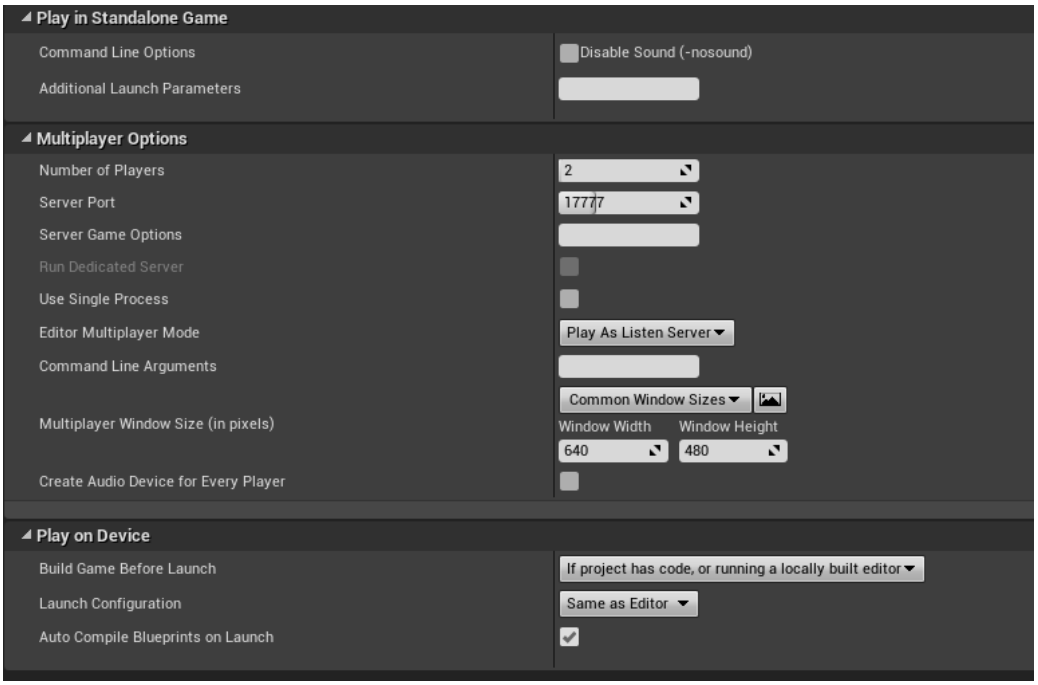


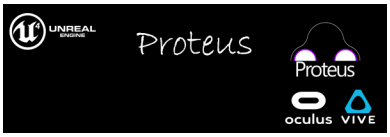
What is the "Debug Mode"

In debug mode, you can control the pawn with the keyboard, without HMD. You can also test multiplayers with a single computer (see below). Controls are

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

To simulate multiplayer on a single computer, use debug mode with LAN, launch it in Stand-Alone Game mode with:





MULTIPLAYER MODE

IMPORTANT

- Select ProjectSettings/NavigationSystem/Allow Client Side Navigation
- Don’t't forget to put

  [/Script/Engine.GameSession]

  bRequiresPushToTalk=false

  in DefaultGame.ini
- LAN MODE:
  - Use the DefaultEngine.ini found in /Config/LAN
  - Specific configuration for LAN is:

    [OnlineSubsystem]

    DefaultPlatformService=NULL

    bHasVoiceEnabled=true

    PollingIntervalInMs=20

    VoiceNotificationDelta=0.2

    AllowPeerConnections=True

    AllowPeerVoice=True

    [/Script/Engine.GameEngine]

    !NetDriverDefinitions=ClearArray

    +NetDriverDefinitions=(DefName="GameNetDriver",DriverClassName="/Script/OnlineSubsystemUtils.IpNetDriver",DriverClassNameFallback="/Script/OnlineSubsystemUtils.IpNetDriver")
  - Oculus Home can be logged in or out
- OCULUS HOME MODE
  - Use the DefaultEngine.ini found in /Config/Oculus
  - Specific configuration for OCULUS HOME is:

    [OnlineSubsystem]

    DefaultPlatformService=Oculus

    bHasVoiceEnabled=true

PollingIntervalInMs=20

[OnlineSubsystemOculus]

bEnabled=true

RiftAppId=YOUR RIFT APP ID

GearVRAppId= YOUR GEAR VR / GO APP ID

[/Script/OnlineSubsystemOculus.OculusNetDriver]

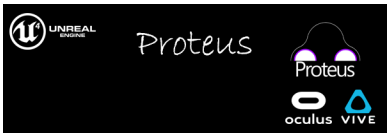
NetConnectionClassName=OnlineSubsystemOculus.OculusNetConnection

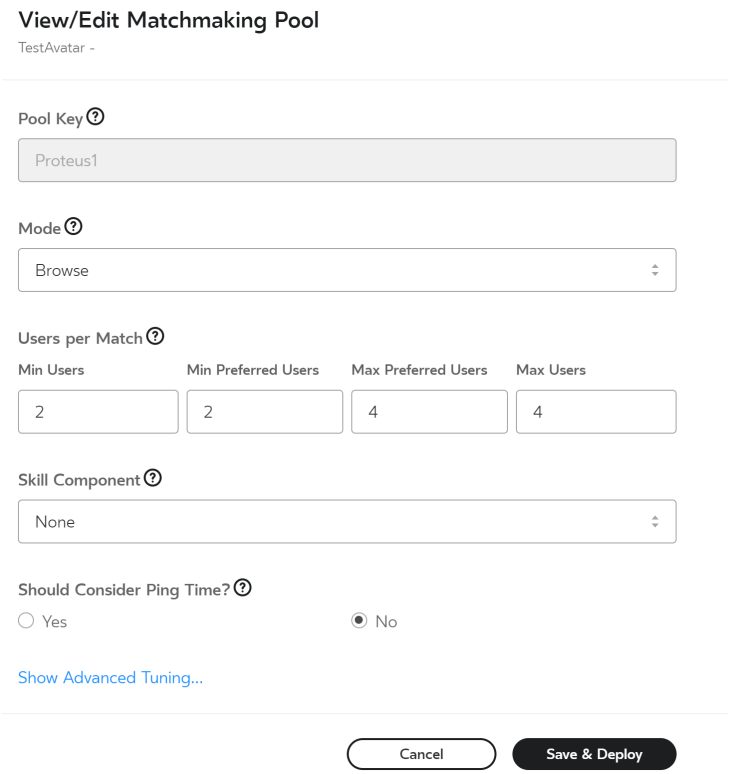
[/Script/Engine.GameEngine]

!NetDriverDefinitions=ClearArray

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

- Login to Oculus Home
- The Oculus Rift will use the RiftAppId found in Developer Dashboard FOR RIFT
- The Oculus Go will use GearVRAppID found in the Developer Dashboard FOR MOBILE
- Set the Matchmaking Mode in the Developer Dashboard to:





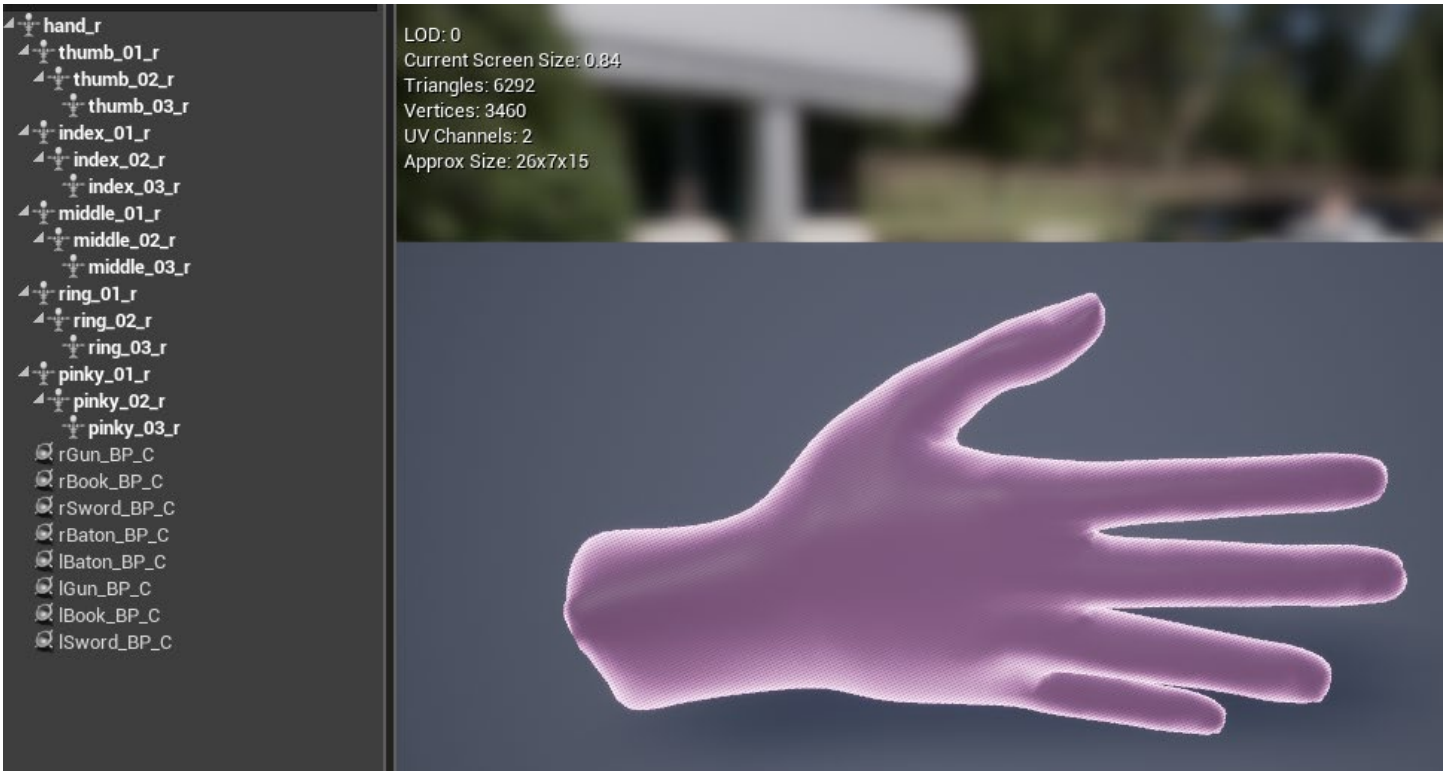
JOINING A GAME

Spawn the Menu, refresh, select game.

Using Sockets (no Oculus Avatars yet)

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.

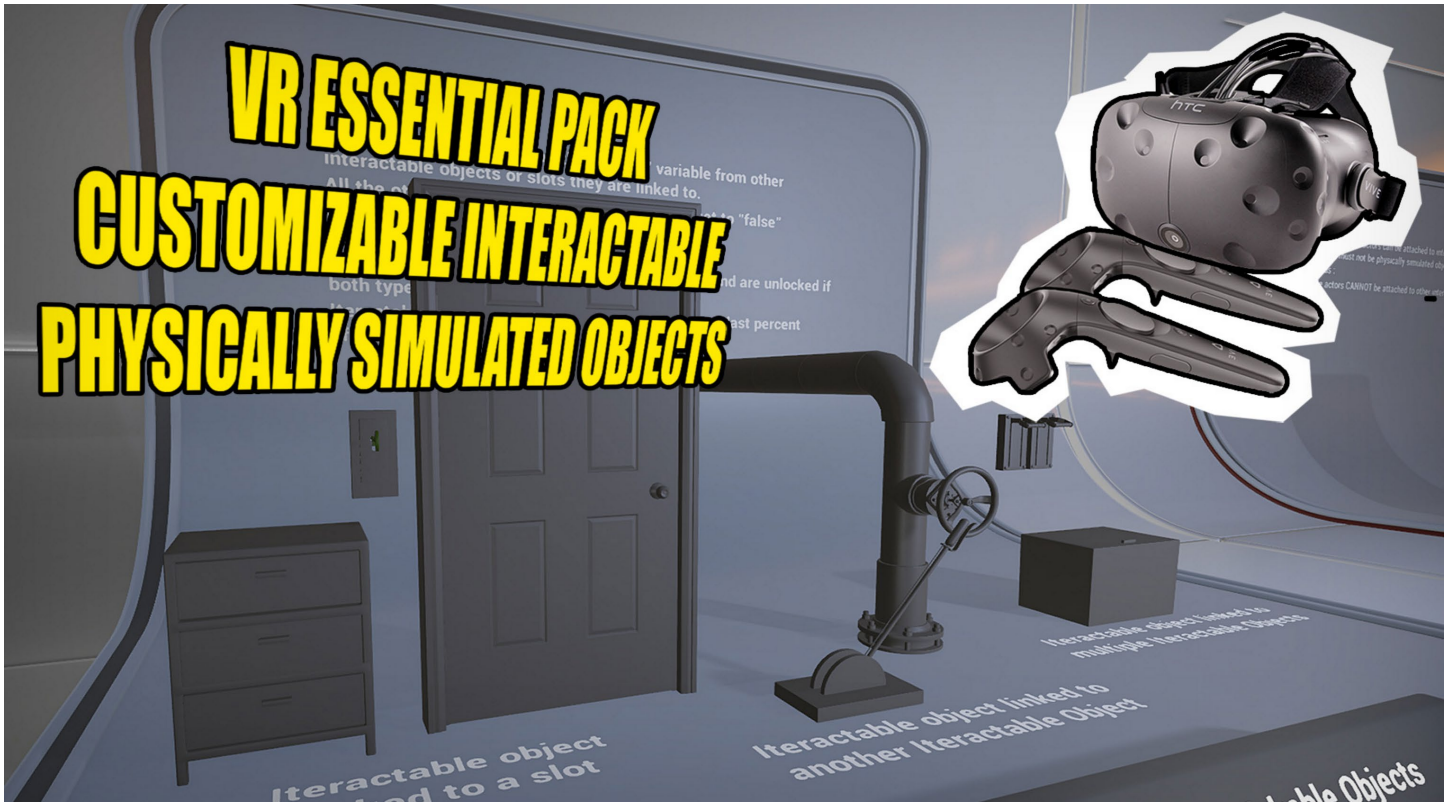
Put "r" or "l" before a socket name to specify a different right or left hand position. If you don't put any socket, the right and left hand will pick up the object by the closest collision mesh surface. An example is found with the cube and the hat.



- **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

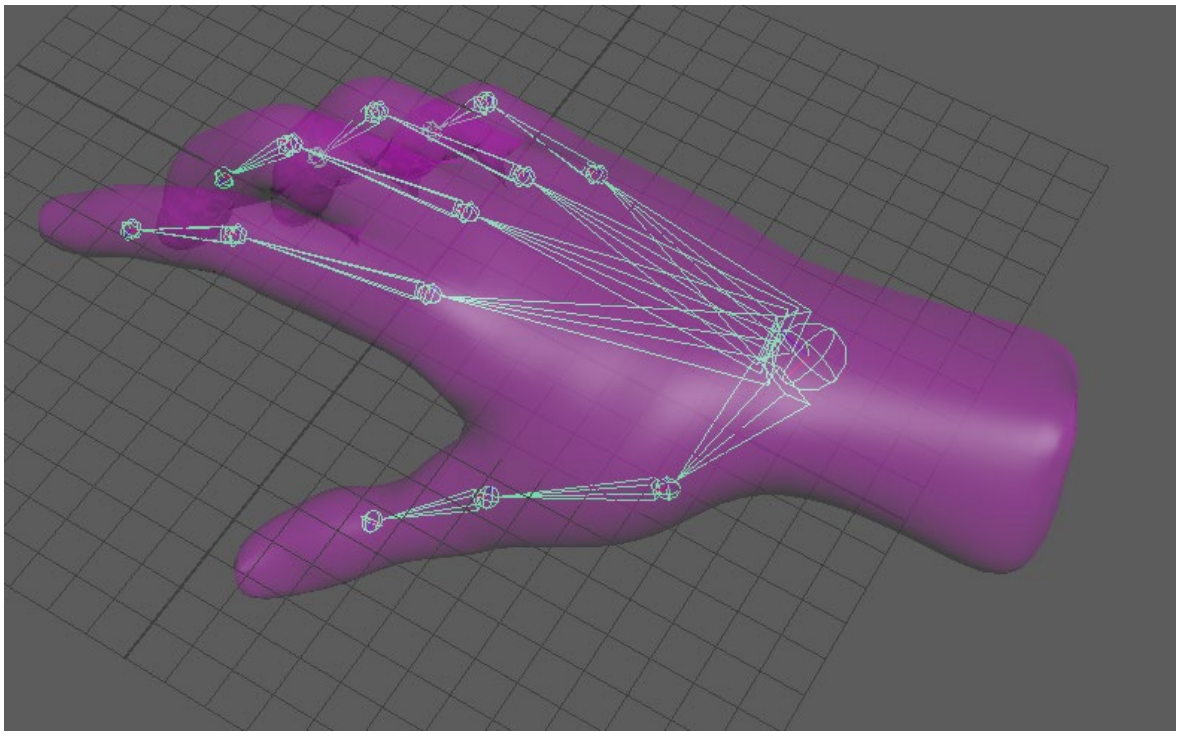


- **Note that the VR Essential Kit is a project made by @jamis. All questions concerning this project should be directed to him.**

Fingers / Controllers Poses

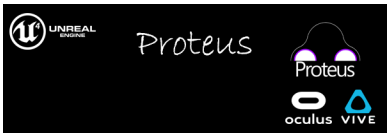
The hand model (.fbx and ASCII Maya) can be found on OneDrive at the same place as the template:

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**

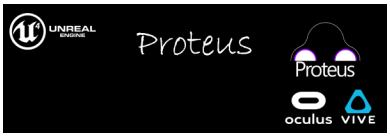


Teleporting

Pawns 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.



What are the modifications to bring to the engine? Why on earth?

Modification #1 (Unreal 4.20 AND 4.21)

To be enable to retrieve Oculus ID and verify Entitlement with the Oculus Go and Quest (Rift is OK)

change

\Engine\Plugins\Online\OnlineSubsystemOculus\Source\Private\OculusIdentityCallbackProxy.cpp

Line 26

from:

DelegateHandle = Online::GetIdentityInterface()->AddOnLoginCompleteDelegate_Handle(

to:

DelegateHandle = OculusIdentityInterface->AddOnLoginCompleteDelegate_Handle(

Reference: https://github.com/Oculus-VR/UnrealEngine/pull/26

Modification #2 (Unreal 4.20)

To be enable to Nativize assets on the Oculus Go and Quest

change

\Engine\Source\Runtime\Engine\Classes\GameFramework\PlayerController.h

line 1053 private to public, because 'PlayDynamicForceFeedback' is a private member of 'APlayerController', for reasons unknown

Reference: https://answers.unrealengine.com/questions/831405/playdynamicforcefeedback-node-in-420-fails-to-cook.html

Modification #3 (Unreal 4.21)

Mandatory Modification to use the Proteus Avatar Plugin

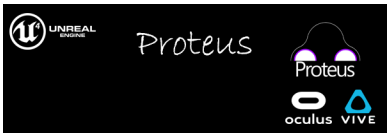
change

\Engine\Source\Runtime\Engine\Classes\Components\PoseableMeshComponent.h

Line 70 remove private

```
private:
	void MarkRefreshTransformDirty();
	// this is marked if transform has to be updated
	bool bNeedsRefreshTransform;
```

reference: https://github.com/EpicGames/UnrealEngine/commit/2a9dbb5bdc8ee855a1a0fdb752966f4e3821895a



Modifications to bring to the plugin (Unreal 4.21 only)

Mandatory Modification to use the Proteus Avatar Plugin

Uncomment the 3 following lines in

\ProteusAvatars\Public\ProteusOvrAvatar.cpp

Line 569

```
////////////////////////////// ONLY FOR UNREAL 4.21 depthMesh->MarkRefreshTransformDirty();
```

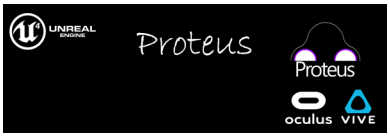
Line 633

```
////////////////////////////// ONLY FOR UNREAL 4.21 depthMesh->MarkRefreshTransformDirty();
```

Line 809

```
////////////////////////////// ONLY FOR UNREAL 4.21 mesh.MarkRefreshTransformDirty();
```

reference: https://github.com/EpicGames/UnrealEngine/commit/2a9dbb5bdc8ee855a1a0fdb752966f4e3821895a



As the world is not perfect, there's still bugs!!! They are:

Oculus Rift: There is no voice vizualisation with the Avatars!

- No Voice vizualisation for Oculus Avatars; should be updated soon by Oculus (FUTURE FEATURE)

Oculus Rift, Go, Quest : You don't use Stereo Layers?

- We are not using Stereo Layers, because they cannot be destroyed !!! (BUG)

Oculus Go / Quest

- Occlusion culling doesn't work!!!!!
  - Yes (BUG)
- Be gentle on the tick events, as you can easily crash the device
- Oculus Go cannot use Render Targets (i.e. the mirror)
  - That's life.
- Oculus Avatars
  - FOR NOW, ONLY THE BLANK AVATAR IS LOADED
    - Yes (FUTURE FEATURE)
  - INPUTS NOT REGISTERED WITH THE GO REMOTE
    - Yes (FUTURE FEATURE)
  - USE OPENGL ES3.1 TO COMPILE MOBILE AVATAR MATERIALS

What's coming next in the next version:

Oculus Avatars (Rift + Go): Set Custom hand poses / use hand sockets

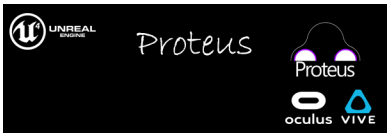
Oculus Avatars (Rift): See Avatar head in mirror

Oculus Avatars (Go/Quest): Load correct mesh

And after that…

Oculus Avatars: Compatibility with SteamVR, Vive Controllers and Vive Knuckles

General template: Blueprints for Mixed-Reality & Oculus 3D Sound



Q&A

Why did you not use the launcher version of UE4?

1) Because the launcher version is always behind the Oculus branch for using latest Oculus SDK implementations;
2) Because it's always better to use UE4 source-based, to be able to make some changes to the engine;
3) Because the Oculus-branch version has some nice features, i.e. the Project Settings Menus

Where are the Windows MR / SteamVR functions?

They will be back, but we targeted Oculus Go / Rift / Quest for this release.

You don't use the integrated Oculus Avatar plugin?

You are such a detective. No. Because the official one is only single player, and we brought all sort of improvement to it, including multiplayer. So we packaged the improved/modified one under "ProteusAvatar plugin". We take the engagement to keep it updated following Unreal versions and Oculus SDKs.

I would like to log my users through Oculus Home, but I don't want to use Browse Matchmaking!

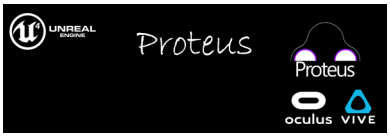
Browse matchmaking is the only way to match players while using blueprints, as of Unreal 4.21. We'll bring more ways soon through code (alternatively, there are C++ methods posted in the forums doing that).

My project doesn't work / crashes / doesn't compile! Your template is crap!

There can be a zillion reasons why your project doesn't compile / crashes. Are you using the latest version of Visual Studio? Correct UE4 version? Windows 10, updated? Is it cold outside? etc. We just want to be sure it's not our template that is crashing your game. Passed that, we're of limited help since, as I said, there could be a zillion reasons why your game does not work.

Other settings

- Follow latest guidelines for Rift / Go / Quest published on both Unreal and Oculus websites
- Yes, products are updated and something that was not possible before, works now (i.e. OpenGL ES 3.1 on the Go)
- 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

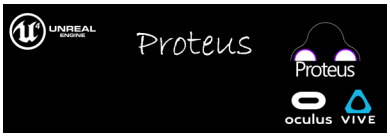


Supplemental resources

- 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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