Carla 0.9.15 Source Build And Carla ROS2 Bridge Guide

Prerequisites for the Carla Source Build

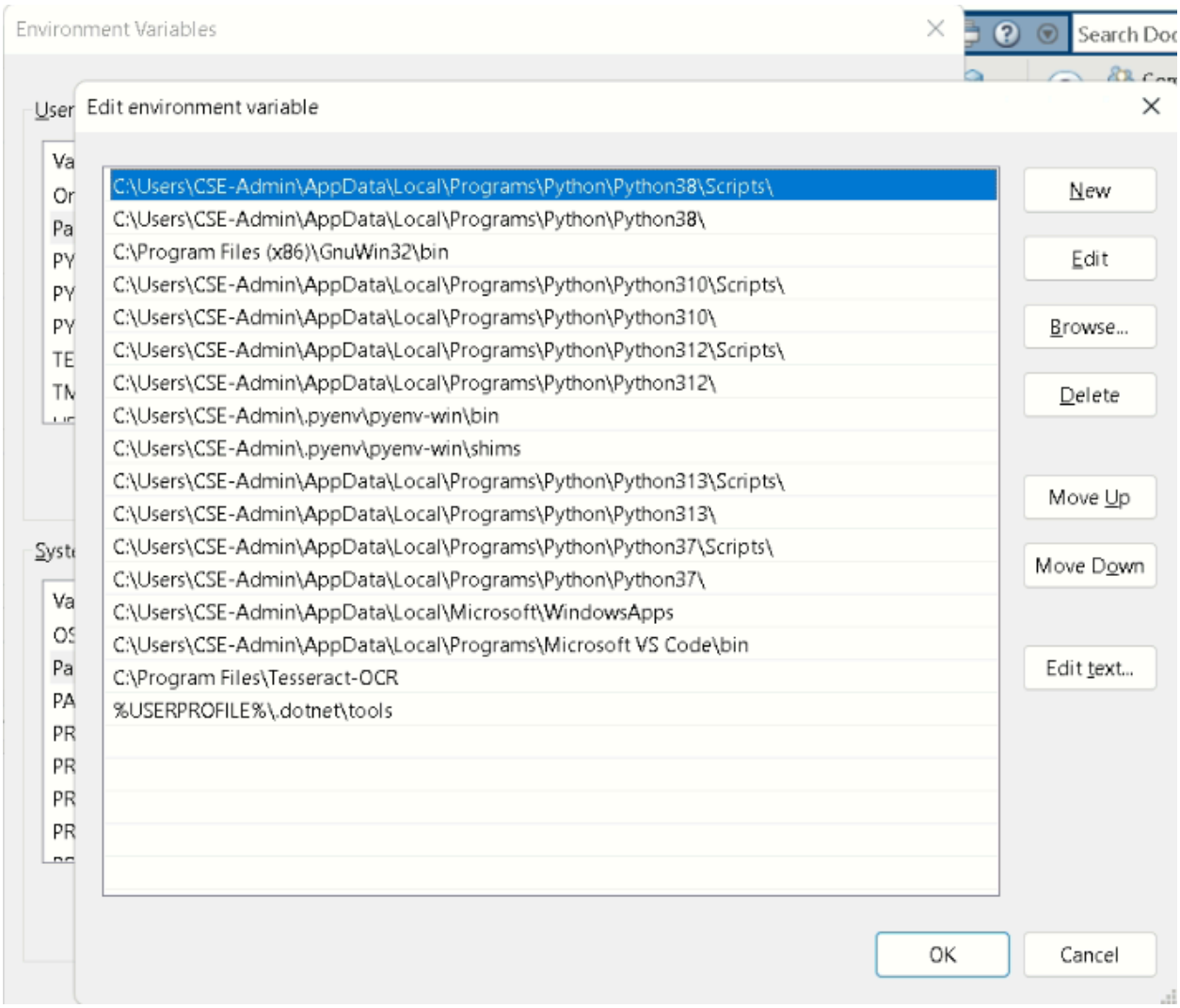
- Python 3.8.x installation. Using any other version of Python 3 (newer or older) will most likely lead to errors during the build process of the client.

Python Release Python 3.8.8

The official home of the Python Programming Language

https://www.python.org/downloads/release/python-388/

If you have any other Python installations, make sure that the Python 3.8 installation is at the top of the PATH list in your Windows environment system variables.



- **CMake**: Install a version later than 3.9 (≥ 3.9)

Download CMake

You can either download binaries or source code archives for the latest stable or previous release or access the current development (aka nightly) distribution through Git. This software may not be exported in violation of any U.S. export laws or regulations. For more information regarding Export

https://cmake.org/download/

- Git

Download GitHub Desktop

Simple collaboration from your desktop

https://desktop.github.com/download/

- 7-zip. Will be used during the build to extract downloaded files.

7-Zip

English
Chinese Simpl.
Chinese Trad.

https://www.7-zip.org/

- Make version 3.81. Make sure it is included in the PATH environment variable as with the Python 3.8 install.

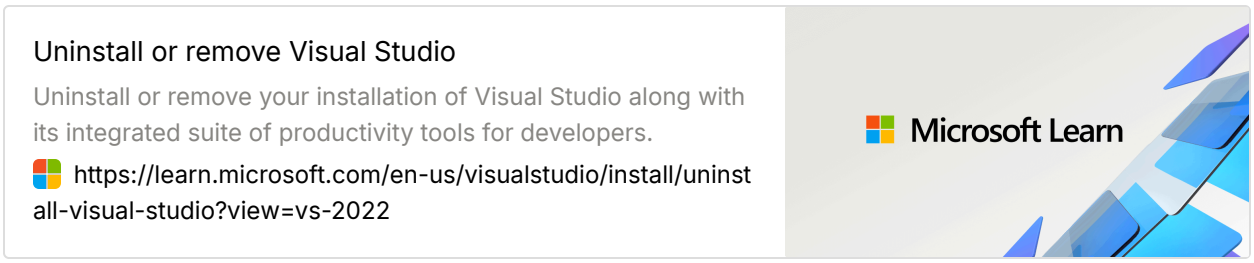
make for Windows

make {whatisit}

https://gnuwin32.sourceforge.net/packages/make.htm

Visual Studio 2019 Community Installation

Before proceeding to install this version of VS, make sure you have completely uninstalled any other installed versions of VS (except for VS Code). The steps for the full VS uninstallation are available in the "Remove all with InstallCleanup.exe" section at the link below. While some Carla Build guides suggested that building Unreal and Carla from source was possible using VS Community 2022, in our findings, we faced many problems configuring Carla dependencies for VS Community 2022. Thus, we do not recommend using this version to build Carla or Unreal if your aim is to get the Carla build running worry-free and as soon as possible.

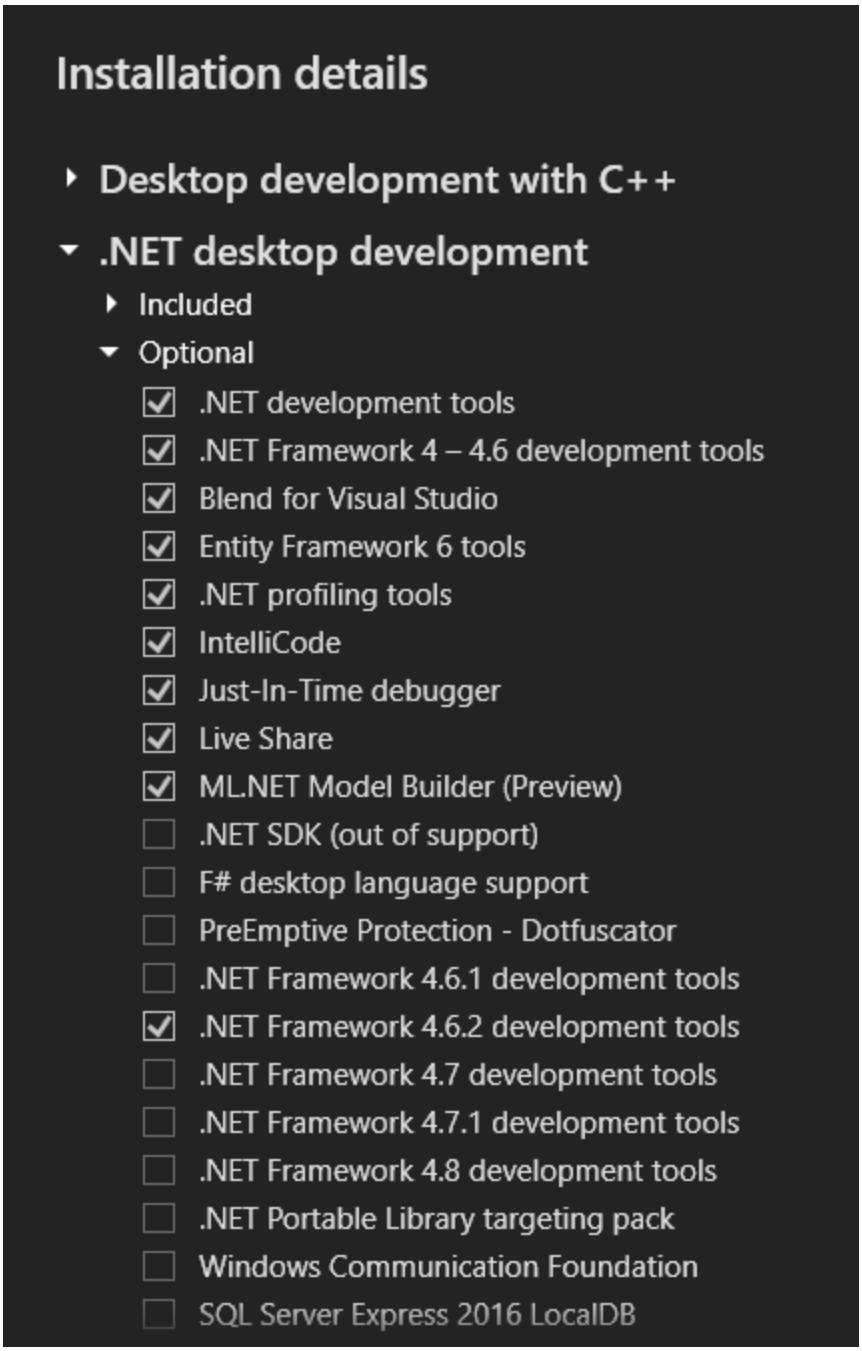


- This version of VS is not currently available on Microsoft's website, so please install it using the installer found in this link:

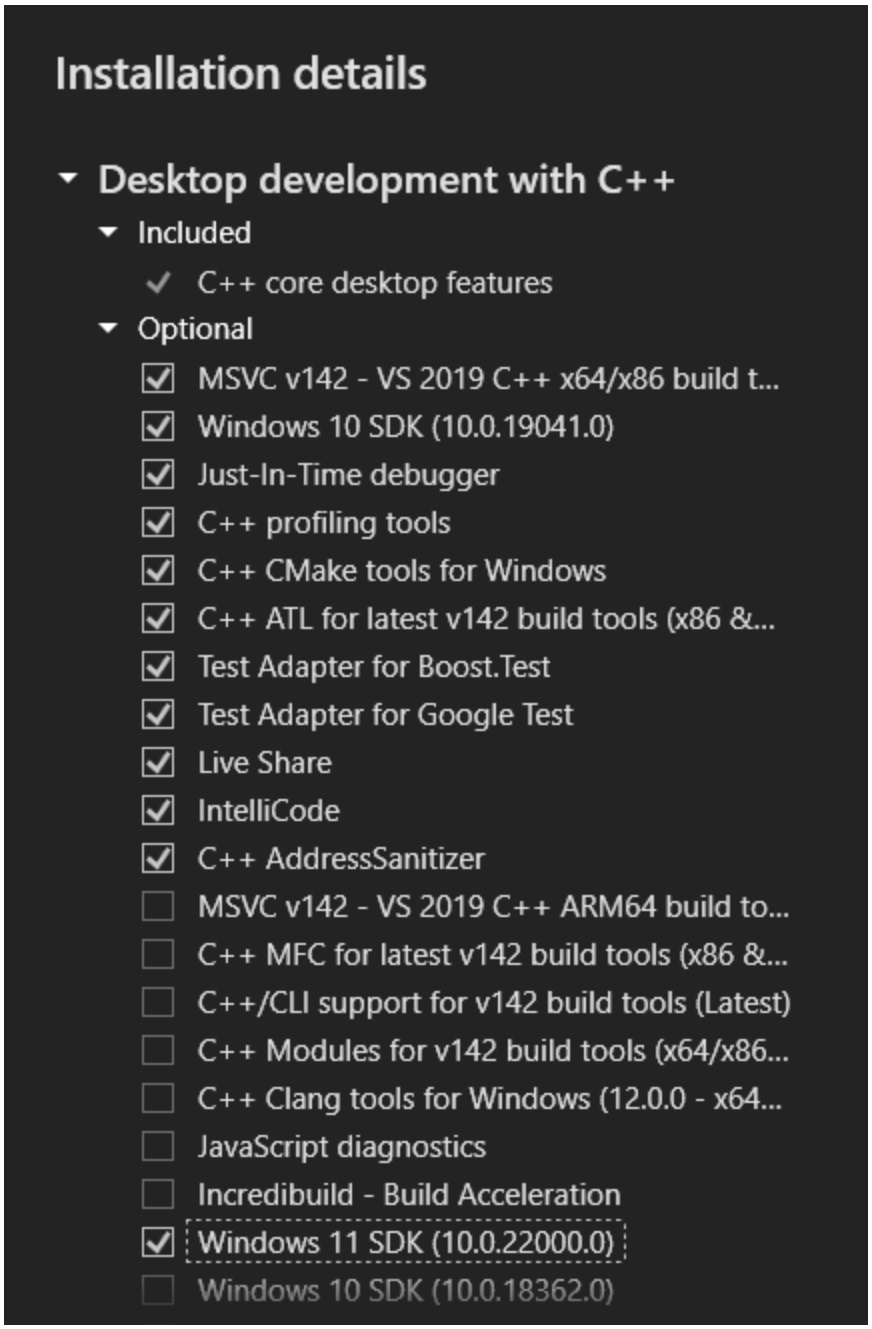
https://drive.google.com/file/d/1zV-udnvdFQTtVoVvqju58e24NgnhMUl7/view?usp=sharing

When running the installer, make sure you choose the following:

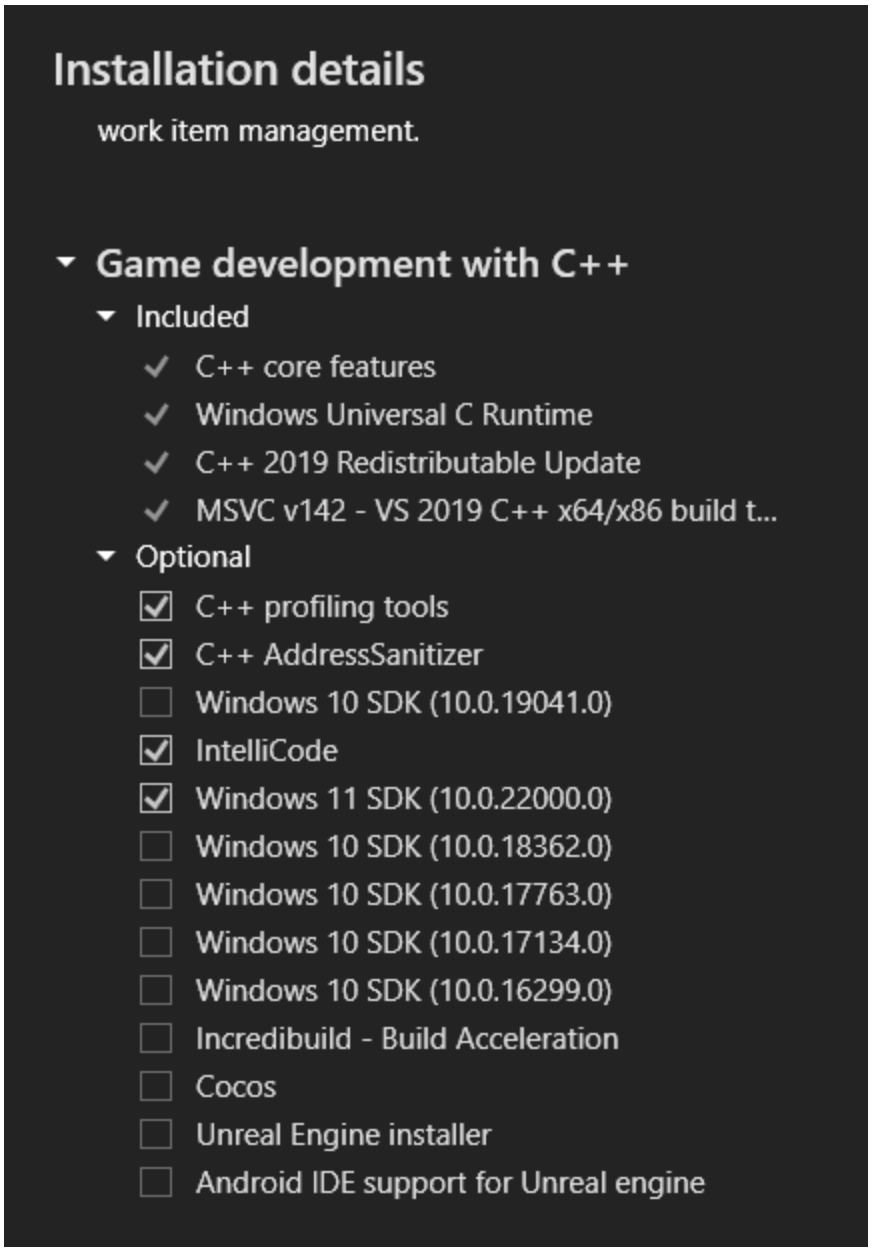
- .NET Desktop Development as a **workload. Make sure that** .NET Framework 4.6.2 Development Tools is also selected from the installer's Installation details drop-down menu on the right.



- Desktop development using C++ as a **workload.** Make sure that MSVC v142 - VS 2019 C++ x64/86 build... and the latest Windows 10 SDK are selected from the installer's Installation details drop-down menu on the right.



- Game Development Using C++ as a workload.



Unreal Engine 4 Source Build

Before cloning the Unreal Engine Carla fork, the GitHub account used on the PC where Carla is being built needs to be linked with an Epic Games account as stated in the following guide.

Unreal Engine on GitHub

Find out how to access Unreal Engine source code on GitHub

https://www.unrealengine.com/en-US/ue-on-github

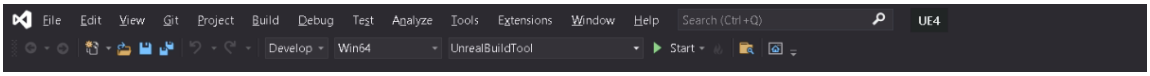
In a cmd prompt, run the following command to clone the Unreal Engine source fork for Carla. It is best to clone the fork as close to the C:\ directory as possible.

```
git clone --depth 1 -b carla https://github.com/CarlaUnreal/UnrealEngine.git .
```

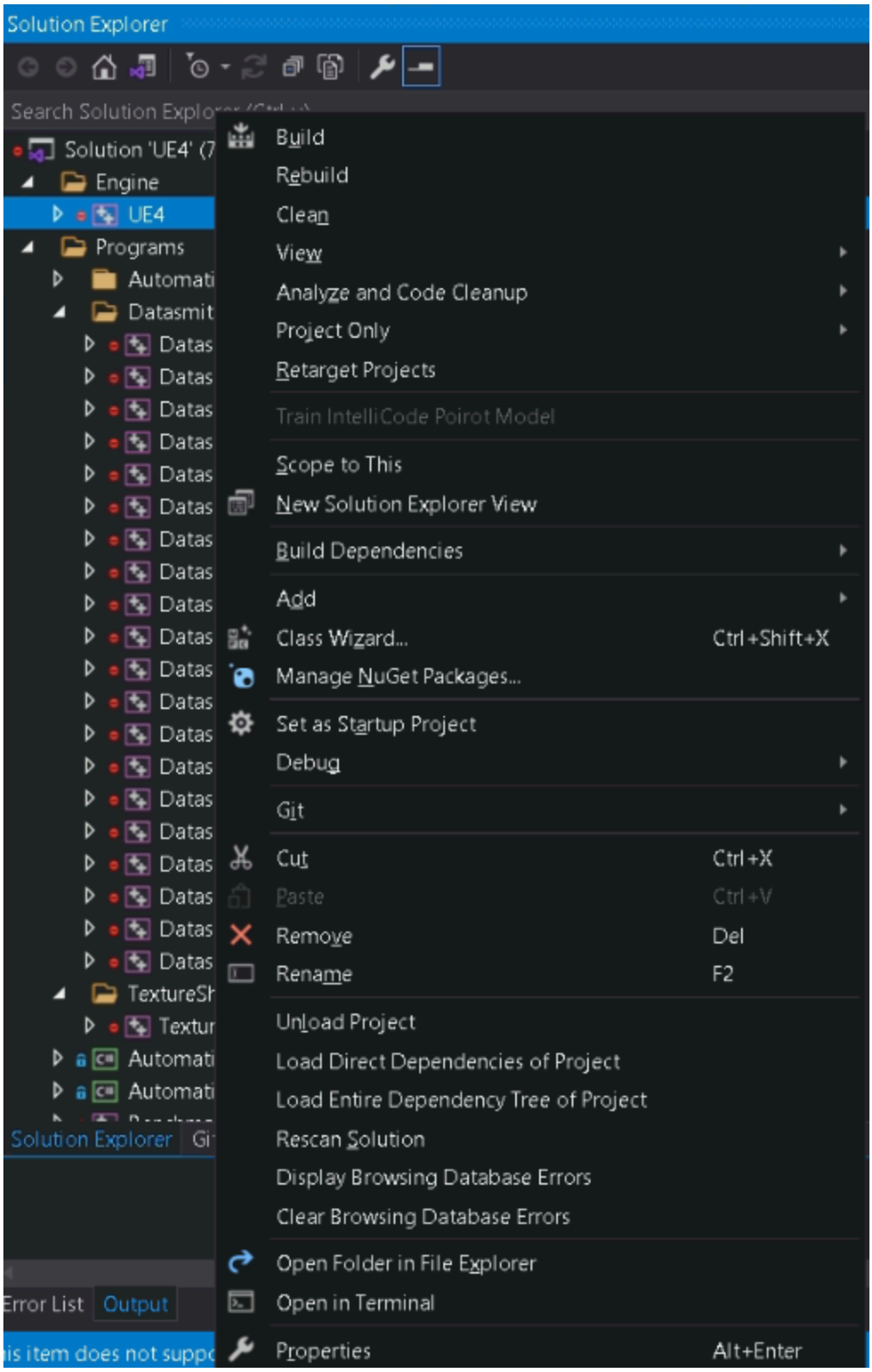
Following this step, run the following commands:

```
Setup.bat
GenerateProjectFiles.bat
```

Afterwards, open VS Community 2019 and open the file **UE4.sln** found in the directory where UE4 is placed. In the build bar, ensure that you have selected 'Development Editor', 'Win64', and 'UnrealBuildTool' options.



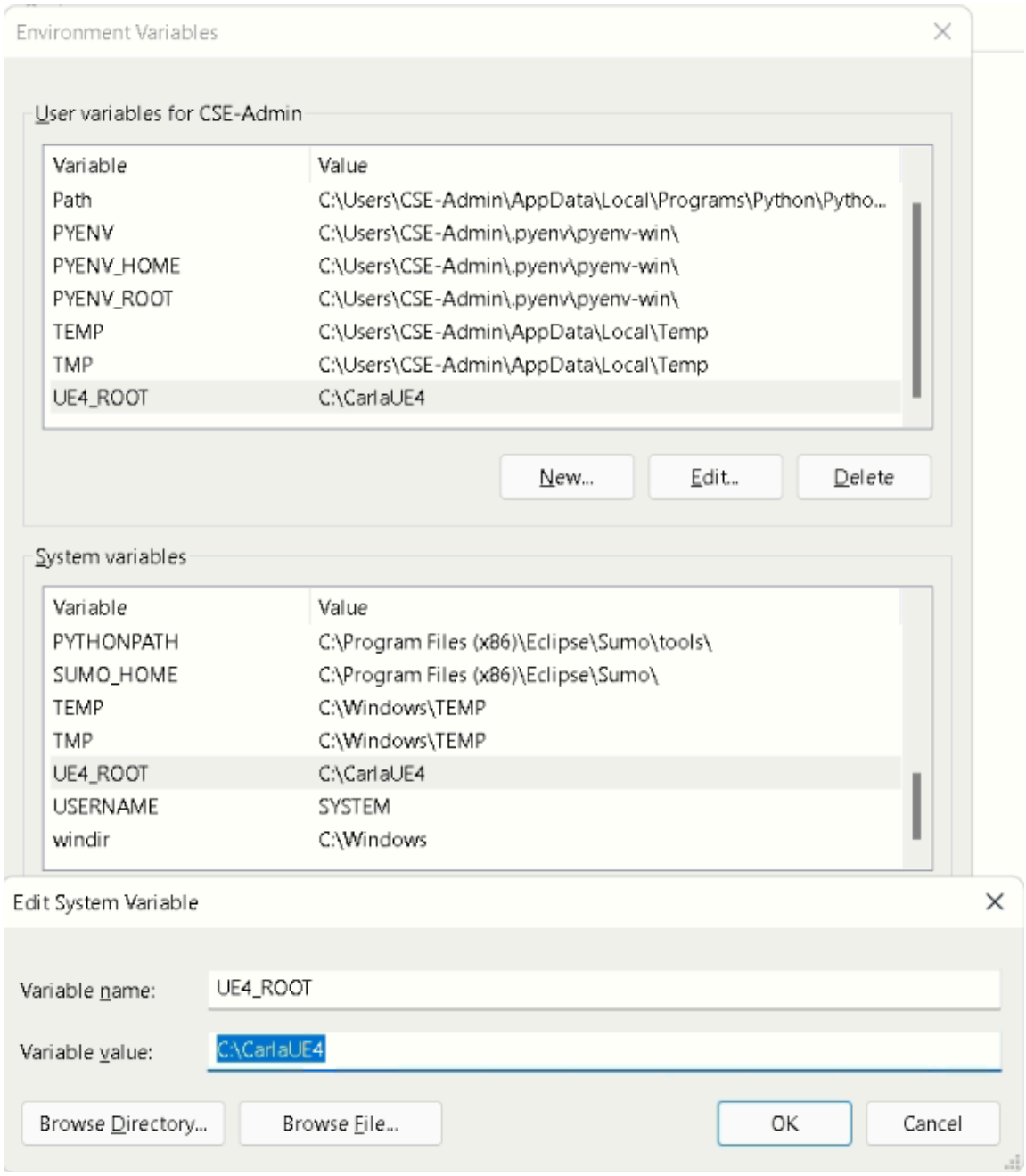
In the solution explorer on the right, right-click UE4 and select Build.
Unreal 4 build. This process TAKES TIME, so please exercise patience.


Solution Explorer
Search Solution Explorer
Solution 'UE4'
Engine
UE4
Programs
Build
Rebuild
Clean
View
Analyze and Code Cleanup
Project Only
Retarget Projects
Train IntelliCode Poirot Model
Scope to This
New Solution Explorer View
Build Dependencies
Add
Class Wizard... Ctrl+Shift+X
Manage NuGet Packages...
Set as Startup Project
Debug
Git
Cut Ctrl+X
Paste Ctrl+V
Remove Del
Rename F2
Unload Project
Load Direct Dependencies of Project
Load Entire Dependency Tree of Project
Rescan Solution
Display Browsing Database Errors
Clear Browsing Database Errors
Open Folder in File Explorer
Open in Terminal
Properties Alt+Enter
Solution Explorer
Error List
Output

To launch the UE4 Editor, run the engine by executing the following command in a command prompt:

```
path_to\CarlaUE4\Engine\Binaries\Win64\UE4Editor.exe
```

After the installation is complete, ensure that the root directory of the UE4 source build is added to the PATH environment variable in a similar manner to the figure below:



Carla Source Build

Important Notes

Having built Unreal Engine, all that remains is building Carla's PYTHONAPI and Server. This is a tedious process, and you will likely face many errors during the

build. In case you face any errors not included in this guide, search around the Carla official GitHub repository and the official Discord Server.

https://github.com/carla-simulator/carla

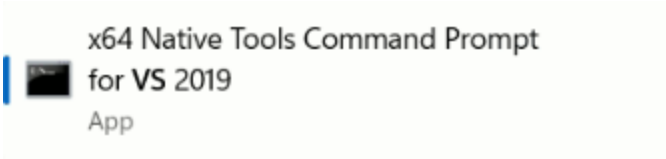
Join the carlasim Discord Server!

Check out the carlasim community on Discord - hang out with 5517 other members and enjoy free voice and text chat.

https://discord.com/invite/8kqACuC

Carla Build Process

**** All the following commands should run in the Carla root folder and using the x64 Native Tools Command Prompt for VS 2019. Expect this build process to take A LOT OF TIME as your mileage may vary with the build errors. Further errors were faced when attempting the build with VS 2022 thus will not be mentioned in this guide. ****



The first step of the build process is to clone the Carla UE4 GitHub Repository.

```
git clone https://github.com/carla-simulator/carla
```

After the git clone is done, run the following command to install the latest Carla assets:

```
Update.bat
```

After the assets are done downloading, run the following command to compile the Carla Client:

```
make PythonAPI
```

OSM2ODR.h Error

The following error is typically faced when running the PYTHONAPI. It arises near the end of the build:

```
C:\carla\PythonAPI\carla\source\libcarla\OSM2ODR.cpp(7): fatal error C1083: Ca
```

osm2odr is a tool that allows the user to generate maps with OpenStreetMap. It converts the generated maps from the .osm format to .xodr, which is used by Carla.

To fix this, first remove the following 2 directories:

```
c:\carla\Build\osm2odr-visualstudio
c:\carla\Build\osm2odr-source
```

Download the .lib file below and paste it in this folder:

```
C:\carla\Unreal\CarlaUE4\Plugins\Carla\CarlaDependencies\lib
```

Then download the header file below and paste it in this folder:

```
C:\carla\Unreal\CarlaUE4\Plugins\Carla\CarlaDependencies\include
```

Download the osm2odr-source zip file and extract it inside the Build directory:

```
C:\carla\Build
```

You will also need to install **xerces-c**, which is an XML parser written in C++. This parser is available to download and install using Anaconda and its lightweight version Miniconda. It is recommended to use Miniconda as it is more suitable for this purpose given we don't need the entire Anaconda installation.

Download the Miniconda Python 3.8 installer

repo.anaconda.com

https://repo.anaconda.com/miniconda/Miniconda3-py38_23.11.0-2-Windows-x86_64.exe

Install Xerces by running

```
conda install -c anaconda xerces-c
```

Navigate to this directory

```
Path_To_miniconda3\pkgs\xerces-c-3.2.3-ha925a31_0\Library
```

Copy all the folders in this directory into the following folder (if the folder is not found in the build folder create it and paste the copied folders inside it)

```
c:\carla\Build\xerces-c-3.2.3-install
```

Copy the following file

```
c:\carla\Build\xerces-c-3.2.3-install\lib\xerces-c_3.lib
```

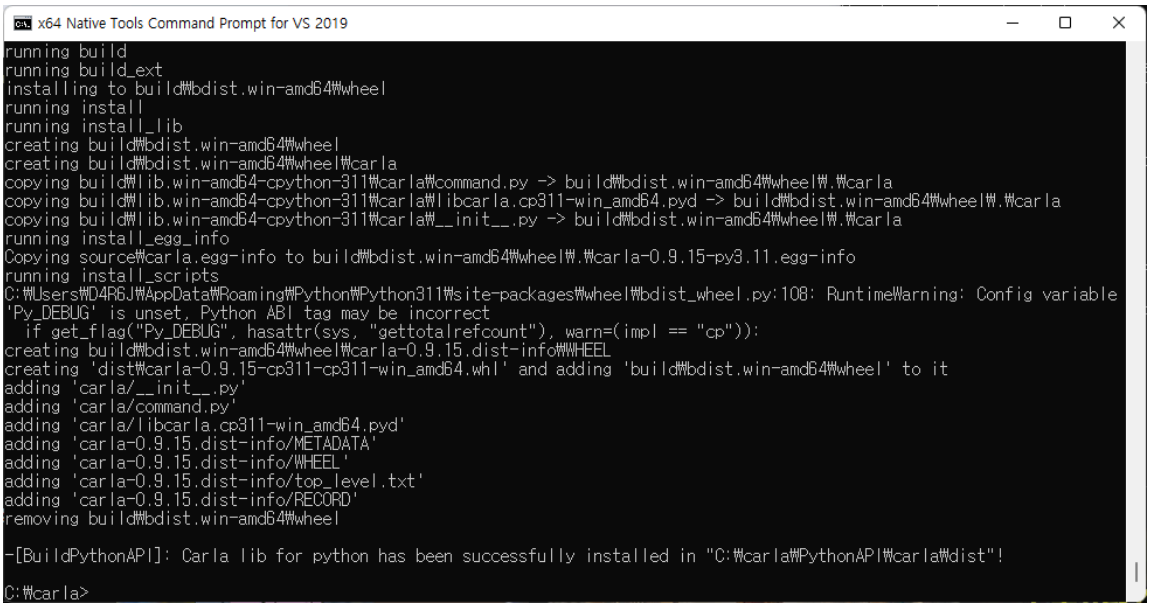
Paste the lib file here

```
c:\carla\PythonAPI\carla\dependencies\lib
```

Navigate back to the root Carla Folder and re-compile the PYTHONAPI

```
cd c:\carla
make PYTHONAPI
```

If the compilation was successful you should be abel to see the following at the end of it



CARLA Server Build

To compile the server after building the PYTHONAPI simply run this command

```
make launch
```

This will compile the carla server and launch the environment in the Unreal Engine 4 Editor. The first run the process will take a lot of time (several hours) as the PC's GPU renders the shaders found in all the Carla assets available at the build folder.

If you want to run the compiled binary version instead of running Carla through the editor, you can launch the following .exe file

```
C:\carla\Unreal\CarlaUE4\Binaries\Win64\CarlaUE4.exe
```

Carla ROS2 Bridge Container

The carla-ros-bridge is the component that facilitates the powerful combination of CARLA and ROS. It retrieves data from the simulation to publish it on ROS topics while simultaneously listening on different topics for requested actions, which are translated to commands to be executed in CARLA. It communicates via DDS to interact with ROS, and via RPC to interact with the CARLA Python API.

1. Prerequisites

1. **Windows Features**
    - **WSL 2** and **Virtual Machine Platform** enabled
        - Open PowerShell as Administrator and run:

          ```
          dism.exe /online /enable-feature /featurename:Microsoft-Windows-Subsystem-Linux /all /norestart
          dism.exe /online /enable-feature /featurename:VirtualMachinePlatform /all /norestart
          ```

        - Reboot, then install Ubuntu 22.04 from the Microsoft Store.
2. **Docker Desktop**
    - Download & install from https://www.docker.com/products/docker-desktop
    - In Settings → **General** enable “Use the WSL 2 based engine”
    - In Settings → **Resources → WSL Integration**, turn on integration for the Ubuntu distro.

- In Settings → **Resources → File Sharing**, ensure the `C:` drive (or whatever drive hosts the
- bag folder) is shared.

3. **X Server for Windows** (to forward any GUI from the container)
   - Install **VcXsrv** (https://sourceforge.net/projects/vcxsrv/) or **Xming**.
   - Launch it (e.g. with “Disable access control”), so that the container can connect to `host.docker.internal:0.0`.
4. **Local bags folder**
   - Create a folder on the C: drive for recordings, e.g. `C:\rosbags`.
5. Pulled Docker Image for the ROS2 CARLA Bridge

   hub.docker.com

   https://hub.docker.com/r/rwthika/carla-ros-bridge?uuid=EC25BB51-7DE8-4BA0-9843-072BF2A202AB

   ```
   docker pull rwthika/carla-ros-bridge
   ```

2. Configure PowerShell Environment

1. **Open a plain PowerShell** (not WSL) as the regular user.
2. **Set the DISPLAY variable** so that Linux GUI apps know where to forward:

   ```
   # point at the X server you launched
   $env:DISPLAY = "host.docker.internal:0.0"
   ```

3. **Enable Docker CLI to see the WSL folders**

   Docker Desktop will map `C:\rosbags` automatically.

3. Launch the CARLA Simulator

1. In a separate window, navigate to the CARLA folder, and run:

```
cd C:\carla\Unreal\CarlaUE4\Binaries\Win64\CarlaUE4.exe

.\CarlaUE4.exe
```

2. Wait until the server starts and you see the viewport.

4. Run the ROS 2–CARLA Bridge Container

In a WSL PowerShell session (with `$env:DISPLAY` set) run the following:

```
docker run --rm -it --name carla_bridge \
  -e CARLA_HOST=host.docker.internal \
  -e CARLA_TIMEOUT=60 \
  -e RMW_IMPLEMENTATION=rmw_fastrtps_cpp \
  -e DISPLAY=$env:DISPLAY \
  -e QT_X11_NO_MITSHM=1 \
  -e LIBGL_ALWAYS_SOFTWARE=1 \
  -v C:\rosbags:/bags \
  -p 2000:2000/tcp -p 2000:2000/udp \
  -p 11811:11811/udp \
  -p 7400:7400/udp -p 7410:7410/udp \
  rwthika/carla-ros-bridge:ros2 bash
```

> Notes:
>
> - This mounts the Windows path `C:\rosbags` to `/bags` inside the container.
> - Ports **2000**, **11811**, **7400**/7410 (DDS) are forwarded so that CARLA ↔ ROS 2 can communicate.

5. Inside the Container: Launching ROS 2 Nodes

Open a **WSL** terminal to start running nodes on the container

1. **Start the core bridge in the first opened container terminal**

   ```
   ros2 launch carla_ros_bridge carla_ros_bridge.launch.py host:=${CARLA_HOST} port:=2000 timeout:=${CARLA_TIMEOUT} town:=Town02 spawn_sensors:=True
   ```

2. Run the ros2 node to spawn an ego vehicle

   ```
   docker exec -it carla_bridge bash
   ros2 launch carla_spawn_objects carla_spawn_objects.launch.py
   ```

3. Run this script to give throttle command to the ego vehicle

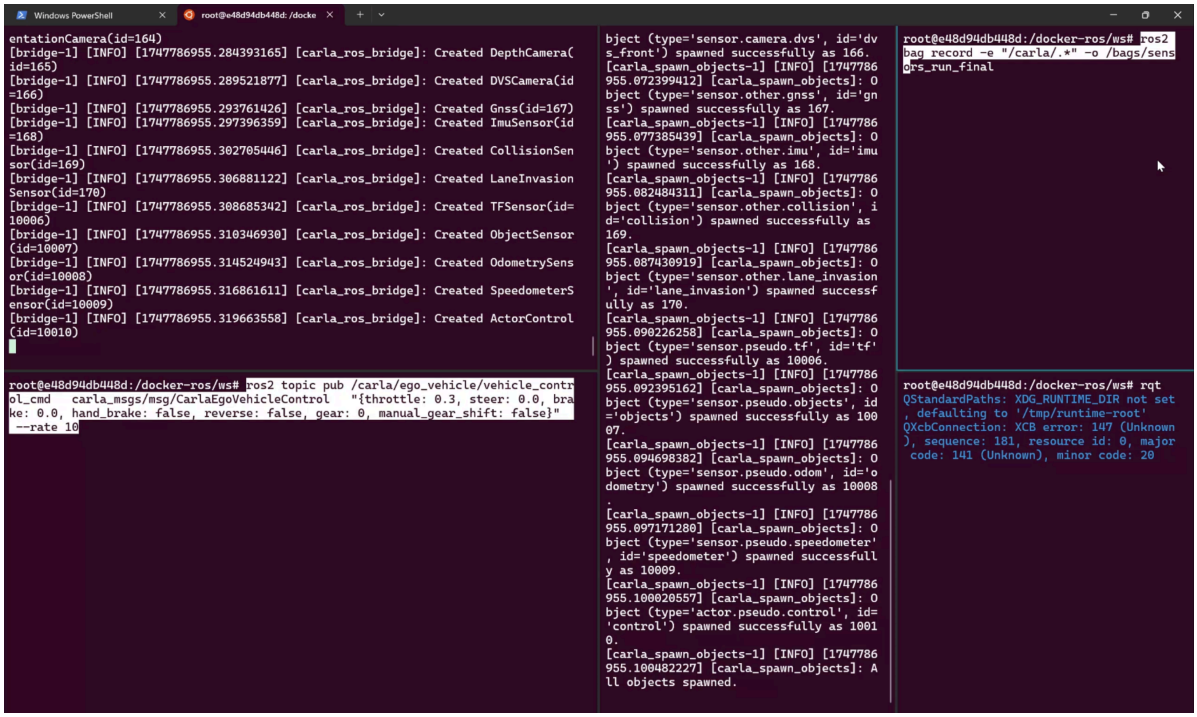
   ```
   docker exec -it carla_bridge bash
   ros2 topic pub /carla/ego_vehicle/vehicle_control_cmd carla_msgs/msg/CarlaEgoVehicleControl "{throttle: 0.3, steer: 0.0, brake: 0.0, hand_brake: false, reverse: false, gear: 0, manual_gear_shift: false}" --rate 10
   ```

4. list the topics in the environment

   ```
   docker exec -it carla_bridge bash
   ros2 topic list
   ```

5. Log the simulation in a ros2 bag to rerun the simulation later

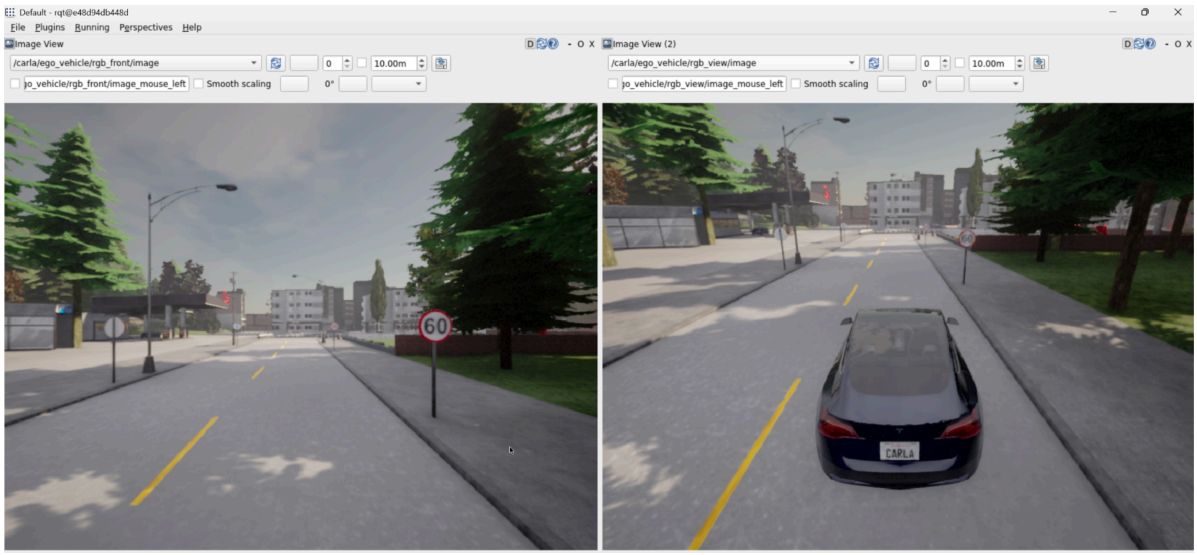
   ```
   docker exec -it carla_bridge bash
   ros2 bag record -e "/carla/.*" -o /bags/sensors_run
   ```



The terminal shell view of the opened shells

6. Run RQT to view the camera view of the vehicle

```
docker exec -it carla_bridge bash
rqt
```



Camera views of the ego vehicle spawned in the carla simulator