# Coursera CARLA Setup for Windows

## Prerequisites

### Hardware

Recommended hardware specifications (from the Unreal Engine 4 Wiki)

- Quad-core Intel or AMD processor, 2.5 GHz or faster
- NVIDIA GeForce 470 GTX or AMD Radeon 6870 HD series card or higher ● 8 GB RAM
- ~10GB of hard drive space for the simulator setup

Note that the above are the **recommended** hardware requirements.

A computer with lower hardware specifications, including systems with integrated graphics, may also be able to run the CARLA simulator with slower performance.

### *Software*

#### Windows

The CARLA loader requires **Windows 7 64-bit or later** to run.

#### Firewall

CARLA requires networking enabled with the firewall allowing access to the CARLA loader, and by default **port 2000, 2001 and 2002** (TCP and UDP) available on the network. When you first run CARLA in server mode, Windows will prompt you to allow the application to access these ports if they are not already accessible on your system.

If your network does not provide access to port 2000, **you may change which ports are used at a later stage of the setup**, just make note of the option here in the FAQ section when trying to run CARLA in server-client mode.

**You can use ports like 5000, 4000 as well**

## Graphics Card Drivers

Update to the latest video card drivers for your system to avoid graphics issues.

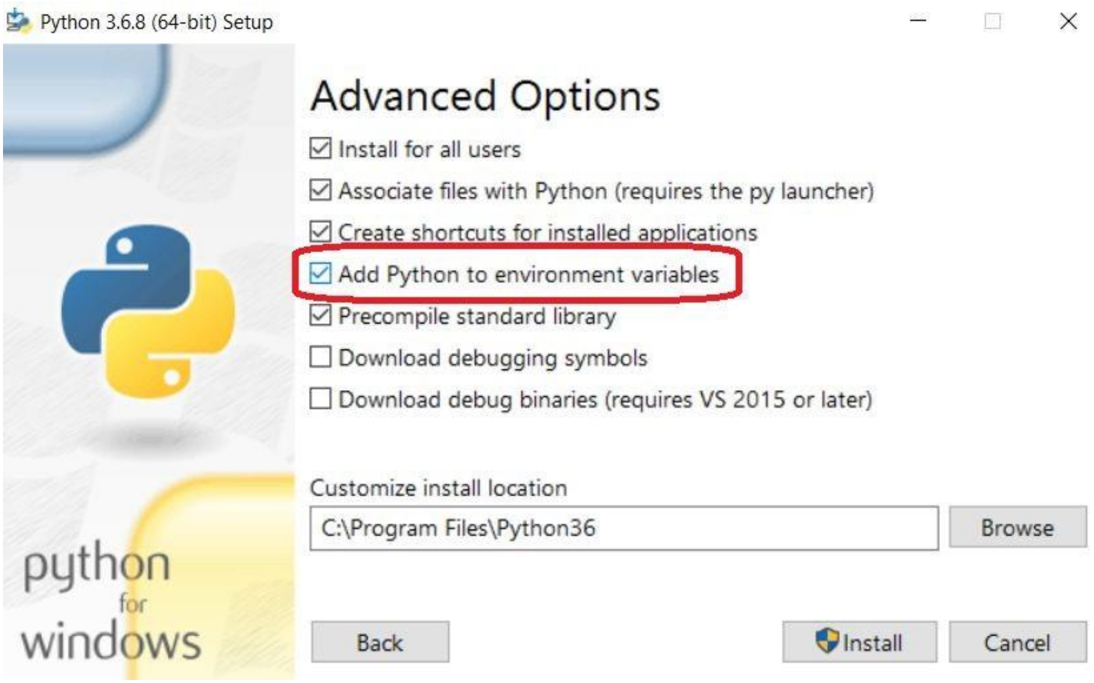
Open GL 3.3 or above and DirectX 10 or above is also required for the CARLA binary to work. Don’t worry about checking these requirements - they are validated during the loading of the CARLA binary.

## Python

The CARLA 0.9 python client runs on Python 3.7.x (x is any number)

Note that it is assumed that **pip** is installed along with the installation of Python. In Windows, it is possible to install multiple versions of Python beside each other.

Make sure that the commands a `py`, `python` and `pip` are **properly added to the environment variables**, so they are readily accessible via terminal (command prompt). To check for this run each of those commands individually in the command prompt and see if they work. Note that adding Python to the environment variables is selected as an option during the custom installation of the Python setup process by proceeding through Advanced Options (see below).



Python 3.6.8 (64-bit) Setup

Advanced Options

☑ Install for all users
☑ Associate files with Python (requires the py launcher)
☑ Create shortcuts for installed applications
☑ Add Python to environment variables
☑ Precompile standard library
□ Download debugging symbols
□ Download debug binaries (requires VS 2015 or later)

Customize install location

C:\Program Files\Python36

The setup guide uses the commandv `python` to load all of its Python clients.

To check that `python` points to the correct version, run the following bash command in terminal:

```
\> python --version
```

It should return `Python 3.7.x`

Check whether pip is installed

```
\> python -m pip --version
```

It should return with the pip version, as well as the Python version that it points to (in the brackets). For example: `pip 18.1 from ... (python 3.7)`, or something similar.

When both `python` and `pip` are available, try to install a conventional package for your current user (you will need to be connected to the internet for this to work):

```
\> python -m pip install numpy --user
```

If this command is unable to install numpy, please refer to the Discussion forums for help.

# Preparing the CARLA Simulator

## Download and Extract the CARLA Simulator [1]

1. Download the CARLA simulator found in the reading page. Note that this may take a while as the simulator file is several gigabytes in size.

2. Go to CARLA repository. The installation will create a folder named Carla 0.9.x in the working directory, which hosts the CARLA server and client files required for the projects. Extract contents of the zip file into the working directory, say D.

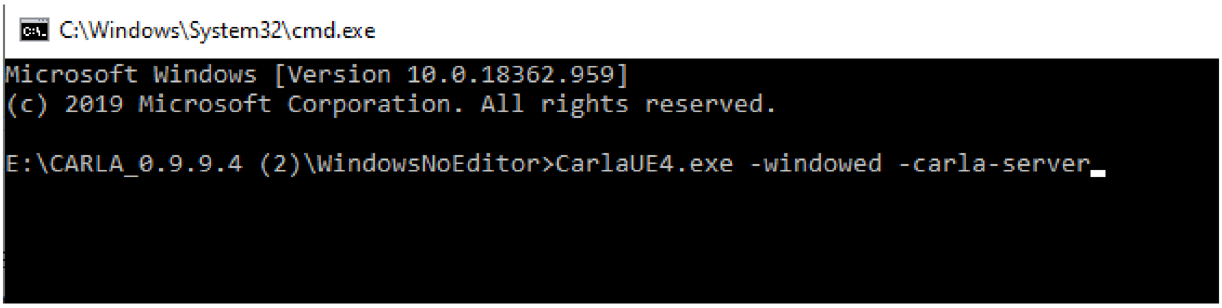
   The guide assumes the simulator is extracted to `E:\` `CARLA_0.9.9.4` If `E:` is unavailable, you may replace `E:` with any other drive (for example `D:`)

# Testing the CARLA Simulator

## Loading the Simulator with the Default Map

Open command prompt in the working directory say,
**E:\CARLA_0.9.9.4 (2)\WindowsNoEditor**

Type following command:

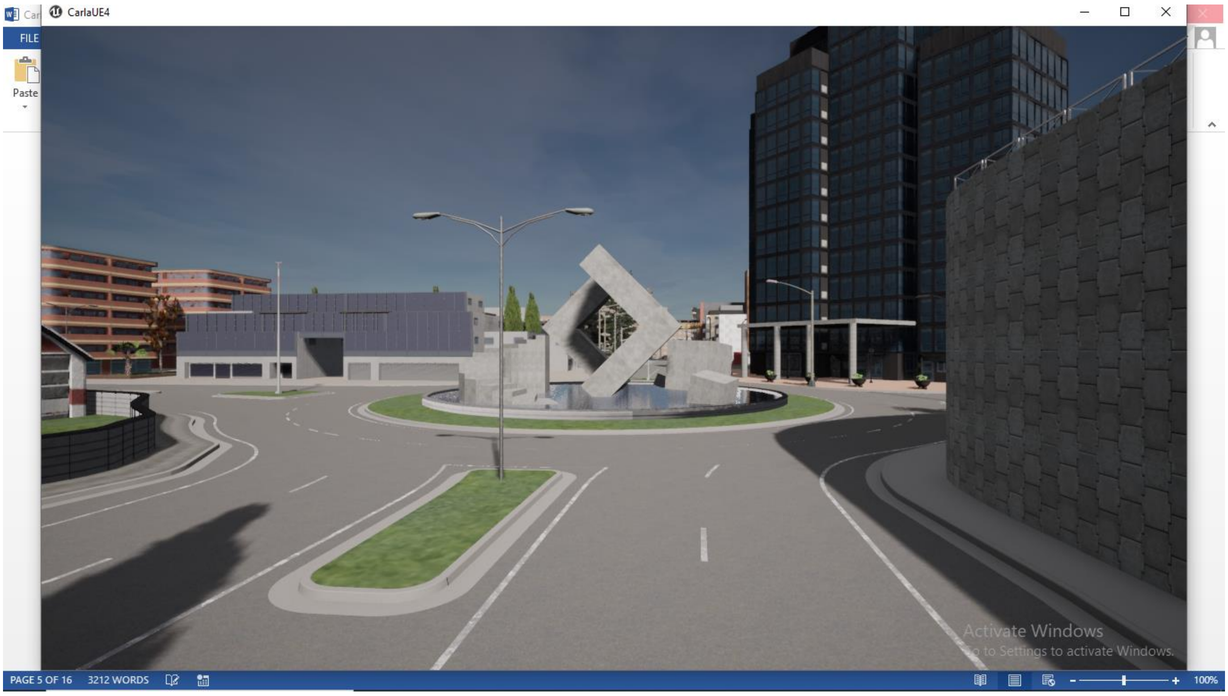


```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.18362.959]
(c) 2019 Microsoft Corporation. All rights reserved.

E:\CARLA_0.9.9.4 (2)\WindowsNoEditor>CarlaUE4.exe -windowed -carla-server
```

If the window is too large, you may also add the arguments `-ResX=<width_size_in_pixels>` and `-ResY=<height_size_in_pixels>` to adjust the window width and height, respectively. For example, add `- ResX=640 -ResY=480` to the above `CarlaUE4.exe` command to resize the window to be 640x480 pixels.

The CARLA window might not be moveable using the mouse cursor, but it can be moved using keyboard arrow keys. To summarize, focus on the CARLA window, then press `Alt-Spacebar` and then press `M` to select the move option. Use the arrow keys to move the window around and press `Enter` to confirm the new window position or `Escape` to jump back to the original window position.

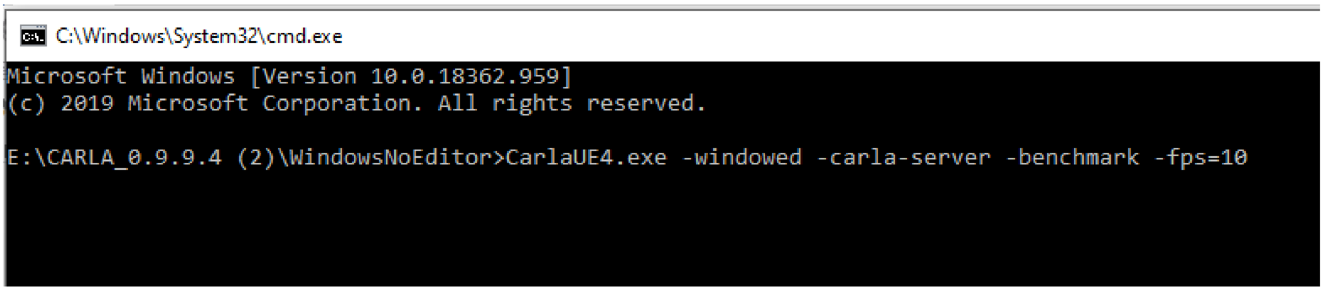
To close the CARLA simulation session, press `Alt-F4` in the simulator or `Ctrl-Alt-Delete` and end the `CARLA UE4` app from the Task Manager.



**If there are issues with loading the Simulator, please refer the FAQ.**

## Loading the Simulator with a Fixed Time-Step

To run the simulator with a fixed time-step of 10 frames-per-second (fps), use the following command in a terminal:



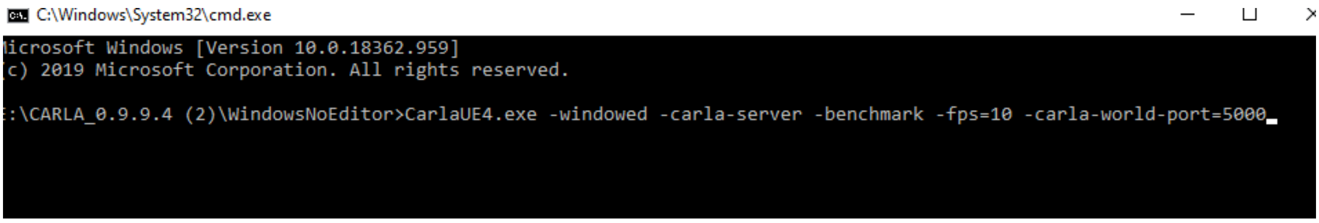
C:\Windows\System32\cmd.exe

```
Microsoft Windows [Version 10.0.18362.959]
(c) 2019 Microsoft Corporation. All rights reserved.

E:\CARLA_0.9.9.4 (2)\WindowsNoEditor>CarlaUE4.exe -windowed -carla-server -benchmark -fps=10
```

The `-` `benchmark -fps=<frames_per_second>` argument is used to fix the simulator to a given frame-per-second rate. Make sure that `-benchmark` always precedes `-fps` and with a space in between the two.

Also note that the simulation flows much slower at this rate, this is because **there is a shorter in-game time interval in between each frame**. By increasing the frames-per-second value (e.x. from `-fps=20` to `-fps=40`) the frames per second is doubled and the simulation should slow down about twice as much.

**If Carla is taking a lot of time to run, try using a different port for the server as shown below**



C:\Windows\System32\cmd.exe

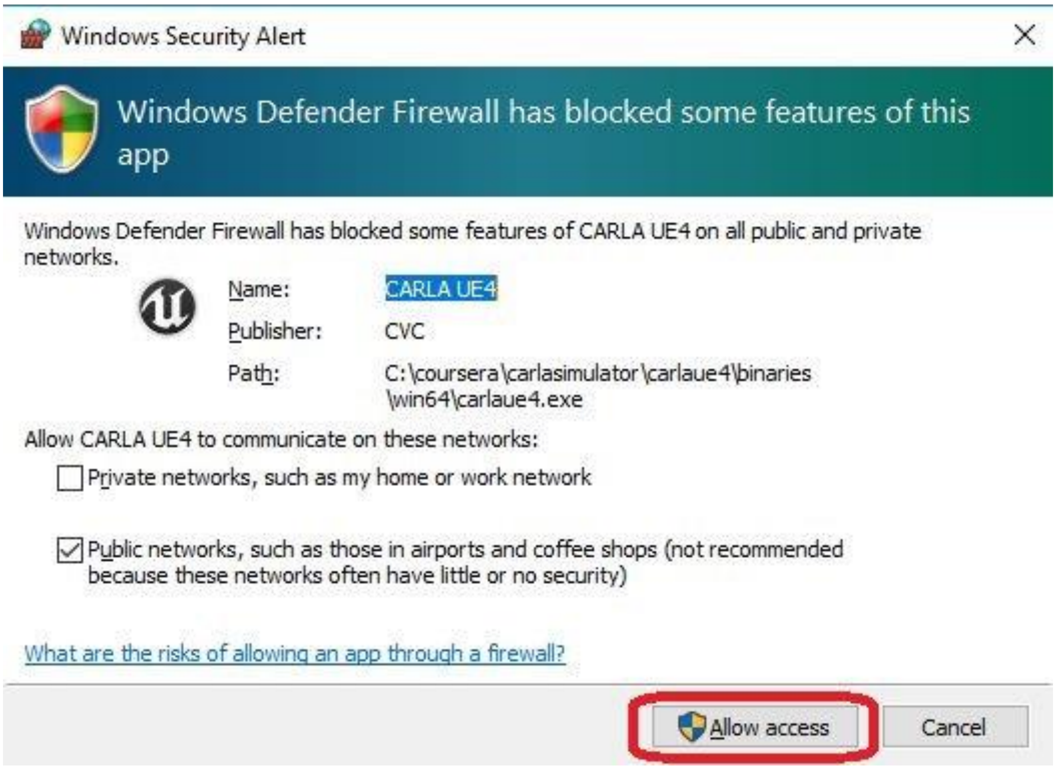
```
icrosoft Windows [Version 10.0.18362.959]
c) 2019 Microsoft Corporation. All rights reserved.

:\CARLA_0.9.9.4 (2)\WindowsNoEditor>CarlaUE4.exe -windowed -carla-server -benchmark -fps=10 -carla-world-port=5000
```

## Testing CARLA in Server-Client Mode .

**Note: Enabling the server mode forces the simulator to wait for a Python client to connect before the simulator starts. This means that nothing will appear on the window or the simulator will appear frozen, which is expected until the Python client connects. Make sure to press `Alt-Tab` to defocus from the simulator (as it is still idling until a client connects), so you can run the Python client in a separate terminal.**

First, lets enable server mode for the CARLA simulator by running the following command in a terminal (**Make sure to allow CARLA UE4 to access the network through the Windows Firewall)**:

**Allow CarlaUE4 to access through the Windows firewall if prompted to do so. You can select Private or Public networks based on your network preference. (see below).**



Windows Defender Firewall has blocked some features of this app

Windows Defender Firewall has blocked some features of CARLA UE4 on all public and private networks.

Name: CARLA UE4

Publisher: CVC

Path: C:\coursera\carlasimulator\carlaue4\binaries \win64\carlaue4.exe

Allow CARLA UE4 to communicate on these networks:

□ Private networks, such as my home or work network

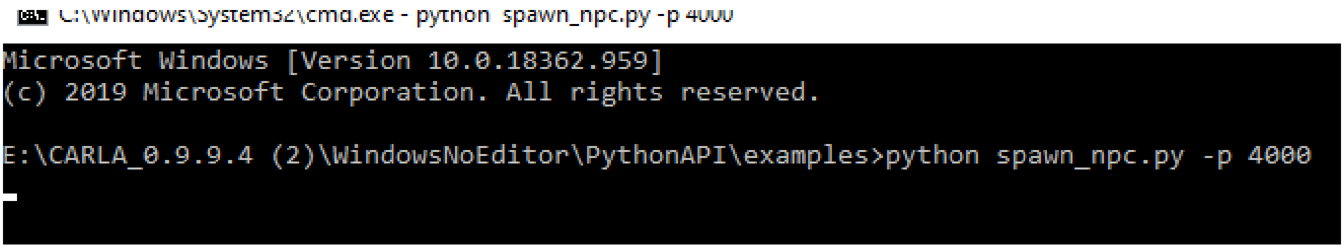
☑ Public networks, such as those in airports and coffee shops (not recommended because these networks often have little or no security)

What are the risks of allowing an app through a firewall?

Figure: Windows Defender Firewall access prompt for Windows 10

Use any other arguments if desired (for example, `-ResX` and `-ResY` to resize the window). Since there is no client that is running yet, the CARLA UE4 app will continue idling until a client connects.

**Go to the following address as shown in the command prompt and run the command shown**



```
Microsoft Windows [Version 10.0.18362.959]
(c) 2019 Microsoft Corporation. All rights reserved.

E:\CARLA_0.9.9.4 (2)\WindowsNoEditor\PythonAPI\examples>python spawn_npc.py -p 4000
```

**Note that here the Carla server was run on port = 4000, hence the client should also connect to the same port which is done by adding the *-p 4000* at the end of the ecommand**

# Frequently Asked Questions (FAQ)

## Can I run the simulator in a virtual machine (VM)?

The simulator will not run on a VM using VirtualBox as VirtualBox only supports OpenGL 2, whereas CARLA requires Open GL 3.3 or above. Other issues for VMs might be due to the lack of the necessary hardware virtualizations required to run the Unreal Engine. We have not tested the simulator with a different virtual machine platform.

## The simulator freezes or crashes as soon as I start it! What do I do?

### Make sure you have all of the prerequisites prepared!

First, make sure that you have the proper hardware and software requirements for the simulator to work, and also followed the simulator setup instructions. In particular, make sure you are using a **most recent driver for your video card and have OpenGL 3.3 or above installed**.

### Try to run CARLA without server mode enabled

Once the above prerequisites are completed, and run the simulator with this command:

```
\> C:
\> cd \E\Carla 0.9.x
\> CarlaUE4.exe -carla-no-networking
```

If you are able to run the CARLA without server mode enabled, then proceed to the next section.

If you are experienced with the Unreal Engine, you may be able to debug the simulator yourself; however, most people should refer or post to the Discussion Forums at this stage so that the course team can help you.

Make sure you include the following in the forum post:

- `CarlaUE4.log` file (`C:\Coursera\CarlaSimulator\CarlaUE4\Saved\Logs`)
- Hardware Specifications
- Operating System

### It freezes when I am trying the run CARLA in server mode!

Be sure you are able to run CARLA without server mode first .

As mentioned in the Testing CARLA in server-client mode section, running the simulator with the argument `-carla-server` will keep the CARLA simulator idle (frozen) until a client connects to it. If you run CARLA in server mode and things seem to be stuck on screen, make sure to press `Alt-Tab` and defocus from the idling CARLA simulator window to gain access to the mouse cursor. Load the Python Client from another window to connect to the CARLA server and the simulation should commence.

Basic server-client mode test:

Server terminal command:

```
\> C:
\> cd \E:\CARLA_0.9.9.4 (2)\WindowsNoEditor
\> CarlaUE4.exe -windowed -carla-server
```

Client terminal command:

```
\> C:
\> cd \E:\CARLA_0.9.9.4 (2)\WindowsNoEditor\PythonAPI\examples
\> python spawn_npc.py —p xxxx
```

If the Carla simulator remains frozen as soon as you enable server mode and try to connect a client to it, then maybe your issue can be resolved by using another port in your network or ensuring that CARLA is allowed access through the firewall.

## How do I use another port for the server-client mode.

To use another port (besides the default port of 2000), use the argument `-carla-world-port=N` for the CARLA Simulator script and `--port=N` for the Python client.

Make sure to set the port number `N` to be the same for both the server and client.

Example:

Server side:

```
\> C:
\> cd \E:\CARLA_0.9.9.4 (2)\WindowsNoEditor
\> CarlaUE4.exe -carla-server -carla-world-port=4000
```

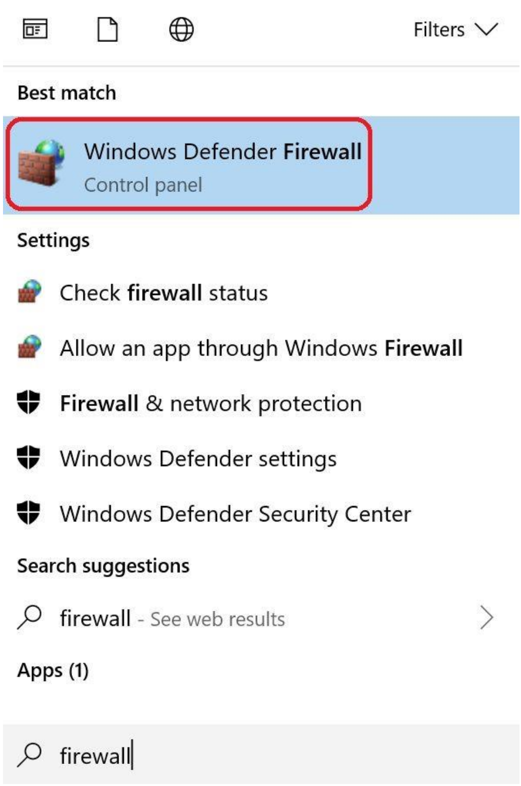
Client side:

```
\> C:
\> cd \E:\CARLA_0.9.9.4 (2)\WindowsNoEditor\PythonAPI\examples
\> python spawn_npc.py -p 4000
```

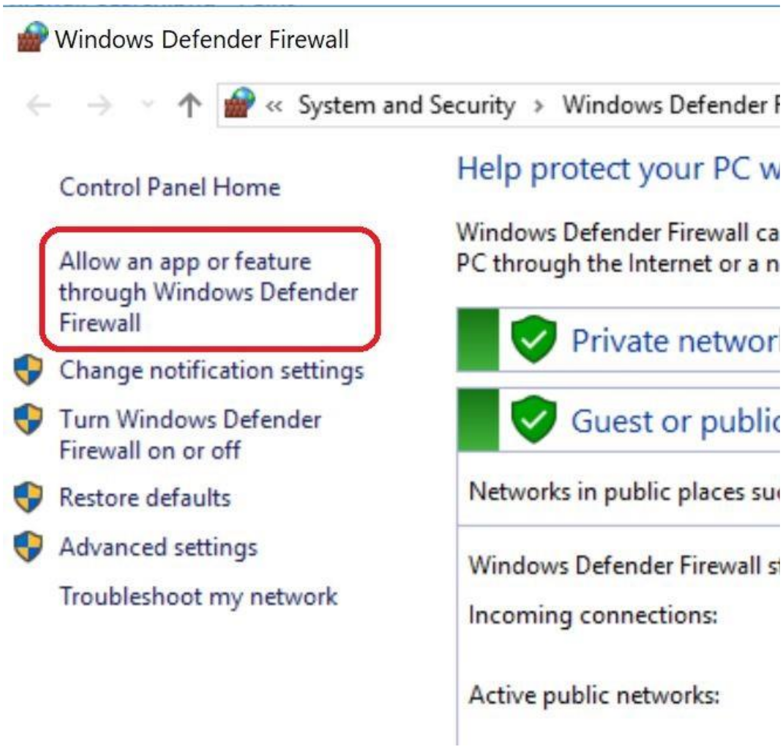
# How do I check if CARLA was allowed access through the Firewall? (Windows 10)

**Note: while these instructions are for Windows 10 users, the procedures should be similar for Windows 7 users as well.**

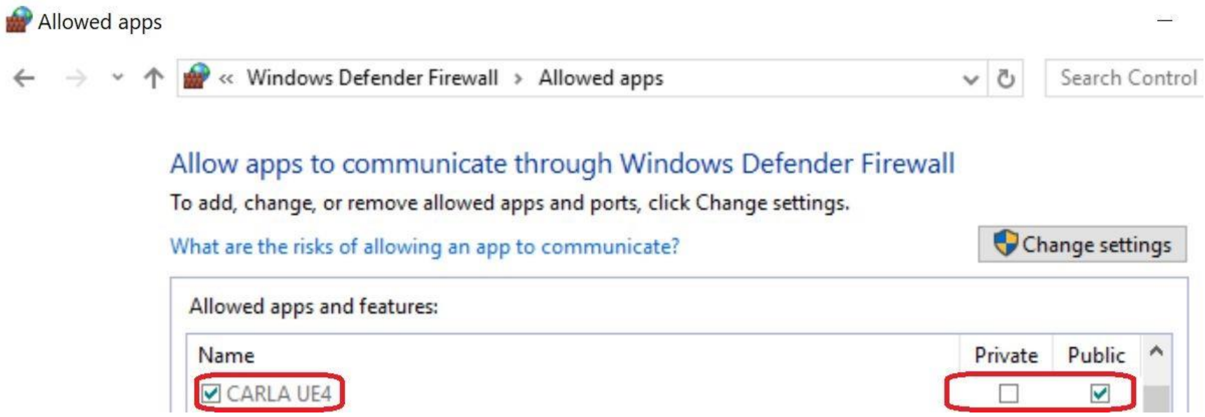
- Search "firewall" on the Cortana search bar (located on the Windows taskbar) ● Select "Windows Defender Firewall" (see below)


Filters
Best match
Windows Defender Firewall
Control panel
Settings
Check firewall status
Allow an app through Windows Firewall
Firewall & network protection
Windows Defender settings
Windows Defender Security Center
Search suggestions
firewall - See web results
Apps (1)
firewall

- Once the Windows Defender Firewall options window pops up, select "Allow an app or feature through Windows Defender Firewall" on the left tab (see below)


Windows Defender Firewall
« System and Security › Windows Defender F
Control Panel Home
Allow an app or feature through Windows Defender Firewall
Change notification settings
Turn Windows Defender Firewall on or off
Restore defaults
Advanced settings
Troubleshoot my network
Help protect your PC w
Windows Defender Firewall ca
PC through the Internet or a n
Private networ
Guest or public
Networks in public places su
Windows Defender Firewall s
Incoming connections:
Active public networks:

- Double check that **CARLA UE4** is in the allowed apps and that either **Private** or **Public** boxes has a check mark. This means that CARLA UE4 is allowed access through the Windows 10 Firewall.



Allow apps to communicate through Windows Defender Firewall

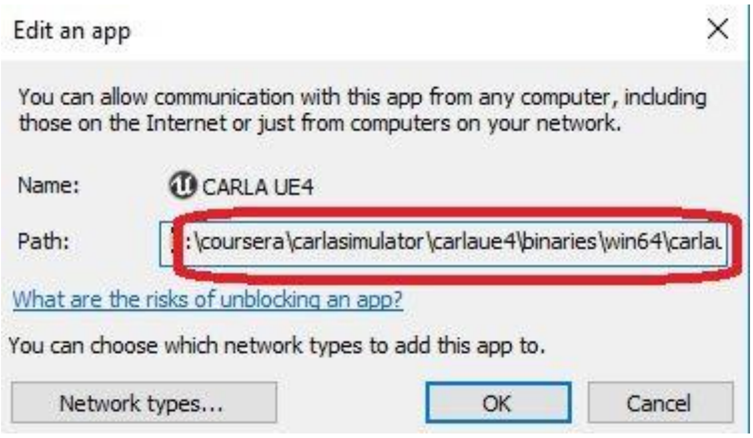
To add, change, or remove allowed apps and ports, click Change settings.

What are the risks of allowing an app to communicate?

Allowed apps and features:

| Name | Private | Public |
|---|---|---|
| ☑ CARLA UE4 | □ | ☑ |

- Lastly, click on "Change settings" and double click on **CARLA UE4** from the list to get more details on the firewall access. In particular, make sure that the Path is set to your CARLA Simulator path with `carlaue4\binaries\win64\carlaue4.exe` appended to it.



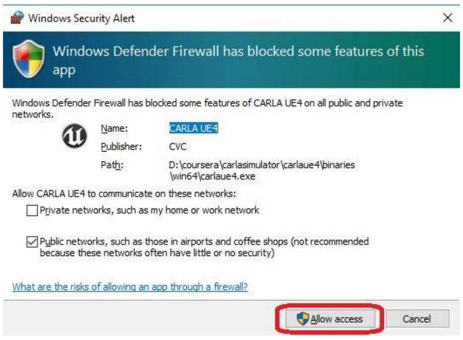
You can allow communication with this app from any computer, including those on the Internet or just from computers on your network.

Name: CARLA UE4

Path: :\coursera\carlasimulator\carlaue4\binaries\win64\carlau

What are the risks of unblocking an app?

You can choose which network types to add this app to.



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Name: CARLA UE4

Publisher: CVC

Path: D:\coursera\carlasimulator\carlaue4\binaries\win64\carlaue4.exe

Allow CARLA UE4 to communicate on these networks:

□ Private networks, such as my home or work network

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What are the risks of allowing an app through a firewall?

## The `python` command did not give the correct version, what should I do?

This issue is likely due to the Python version installed in your computer is an older one (3.5, 3.6). First ensure that Python 3.7 is installed to your Windows computer. Make sure to check the option "Add Python to environment variables" during the custom installation process.