Documentation for VANETS in OMNeT++

Installations for Milestone 1+:

- ! *OMNeT++ 5.6.2*
- *INET 4.2.1*
- *VEINS*
- *SUMO 1.8.0*

Installations for Milestone 2: (As of 10/24/2024)

- *VANETsim 1.3*
- *Eclipse MOSAIC 24.1*

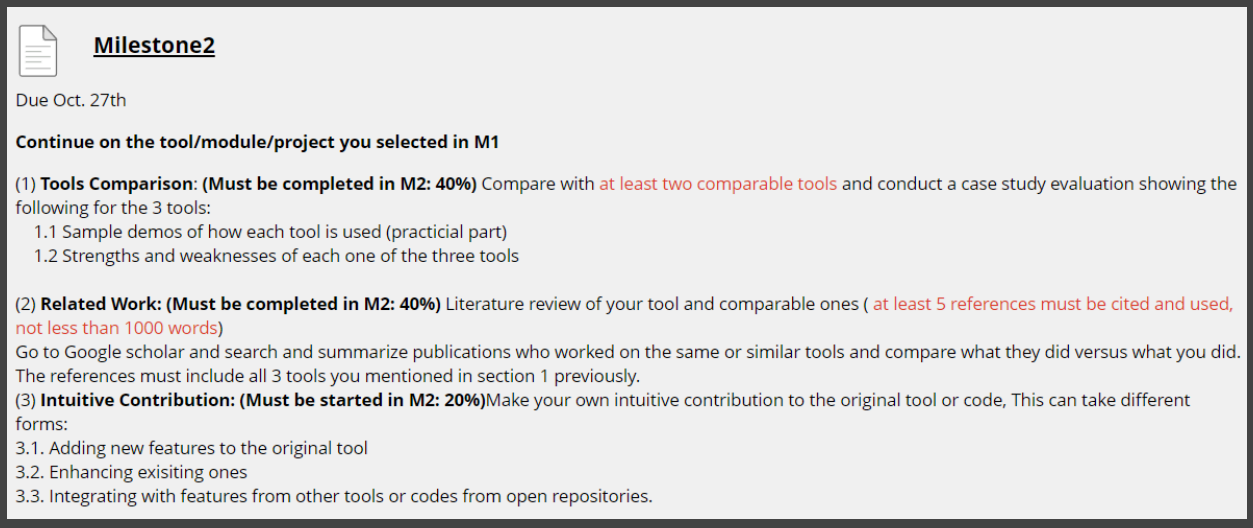
Resources:

- ! *Research Proposal*
- *VANET and OMNET++ Tutorials*
- *OMNeT ++, VEINS & SUMO Tutorial*
- ! *OpenStreetMap*
- *Eclipse MOSAIC Documentation*
- *A Survey on Network Simulators for Vehicular Ad-hoc Networks (VANETS)*
- *Veins - Vehicle in Network Simulation*
- *Bidirectionally Coupled Network and Road Traffic Simulation for Improved IVC Analysis*

Project Milestones:

Milestone 1:

- PROJECT DEMO



Milestone2

Due Oct. 27th

Continue on the tool/module/project you selected in M1

(1) **Tools Comparison**: **(Must be completed in M2: 40%)** Compare with at least two comparable tools and conduct a case study evaluation showing the following for the 3 tools:
1.1 Sample demos of how each tool is used (practicial part)
1.2 Strengths and weaknesses of each one of the three tools

(2) **Related Work: (Must be completed in M2: 40%)** Literature review of your tool and comparable ones (at least 5 references must be cited and used, not less than 1000 words)
Go to Google scholar and search and summarize publications who worked on the same or similar tools and compare what they did versus what you did. The references must include all 3 tools you mentioned in section 1 previously.
(3) **Intuitive Contribution: (Must be started in M2: 20%)**Make your own intuitive contribution to the original tool or code, This can take different forms:
3.1. Adding new features to the original tool
3.2. Enhancing exisiting ones
3.3. Integrating with features from other tools or codes from open repositories.

1.1 Sample demos of how each tool is used
1.2 Strengths and weaknesses of each one of these three tools

Literature Review:

- ! *VANETS Literature Review*

Slides Presentation

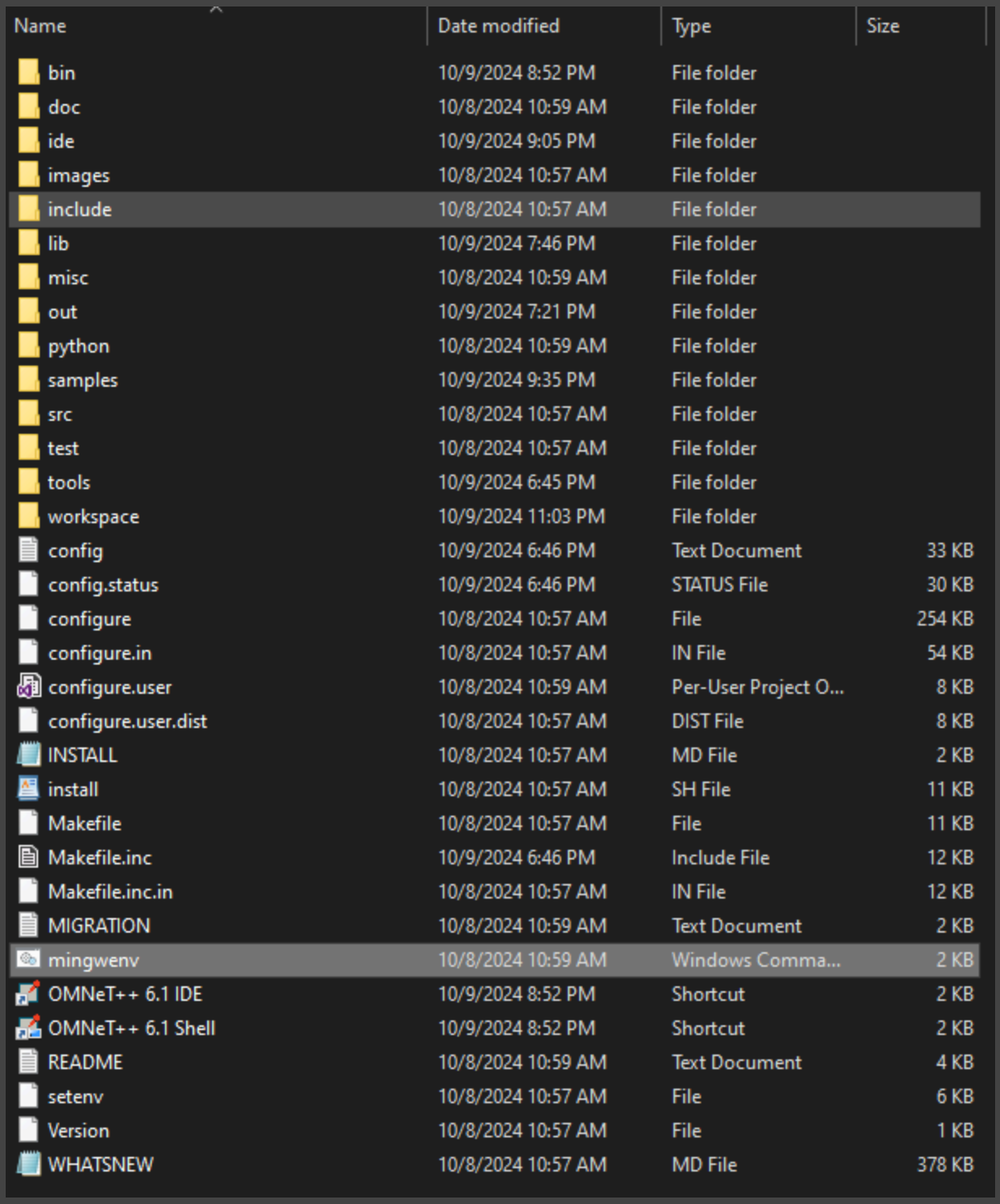
- *VANETs Presentation*

Installing OMNeT++ 5.6.2 and VANET Simulation Frameworks *GUIDE*

The link to OMNeT++ can be found *here*. Make sure to place this into your root directory that way there are no path exceptions (fairly typical of OMNeT++).

Inside the folder open the mingwenv.cmd script and follow the prompts.

File Path: C:\omnetpp-5.6.2\mingwenv.cmd



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test	10/8/2024 10:57 AM	File folder	
tools	10/9/2024 6:45 PM	File folder	
workspace	10/9/2024 11:03 PM	File folder	
config	10/9/2024 6:46 PM	Text Document	33 KB
config.status	10/9/2024 6:46 PM	STATUS File	30 KB
configure	10/8/2024 10:57 AM	File	254 KB
configure.in	10/8/2024 10:57 AM	IN File	54 KB
configure.user	10/8/2024 10:59 AM	Per-User Project O...	8 KB
configure.user.dist	10/8/2024 10:57 AM	DIST File	8 KB
INSTALL	10/8/2024 10:57 AM	MD File	2 KB
install	10/8/2024 10:57 AM	SH File	11 KB
Makefile	10/8/2024 10:57 AM	File	11 KB
Makefile.inc	10/9/2024 6:46 PM	Include File	12 KB
Makefile.inc.in	10/8/2024 10:57 AM	IN File	12 KB
MIGRATION	10/8/2024 10:59 AM	Text Document	2 KB
mingwenv	10/8/2024 10:59 AM	Windows Comma...	2 KB
OMNeT++ 6.1 IDE	10/9/2024 8:52 PM	Shortcut	2 KB
OMNeT++ 6.1 Shell	10/9/2024 8:52 PM	Shortcut	2 KB
README	10/8/2024 10:59 AM	Text Document	4 KB
setenv	10/8/2024 10:57 AM	File	6 KB
Version	10/8/2024 10:57 AM	File	1 KB
WHATSNEW	10/8/2024 10:57 AM	MD File	378 KB

You can then open this IDE from the mingwenv.cmd file using the command “omnetpp”. Once you start this you can select a workspace directory. Ours will be \workspace before you do this make sure you clear the \sample directory.

File Path: C:\omnetpp-5.6.2\workspace

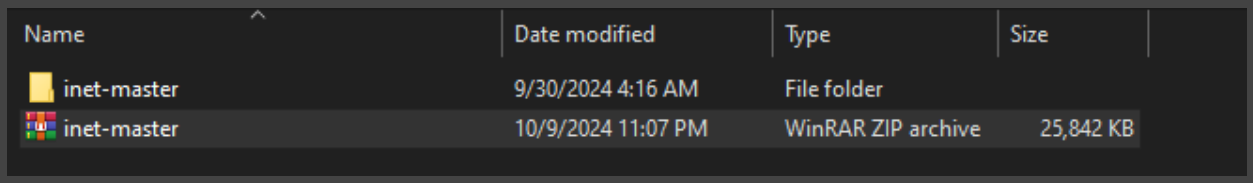
This will then boot you into the IDE. The IDE can also be accessed through the IDE folder if you choose to do so.

We will then create a separate folder in our root directory for any frameworks we use. OMNeT++ tends to corrupt files over time so it's a good idea to have them stored outside of your workspace file. In our case, we will be doing this.

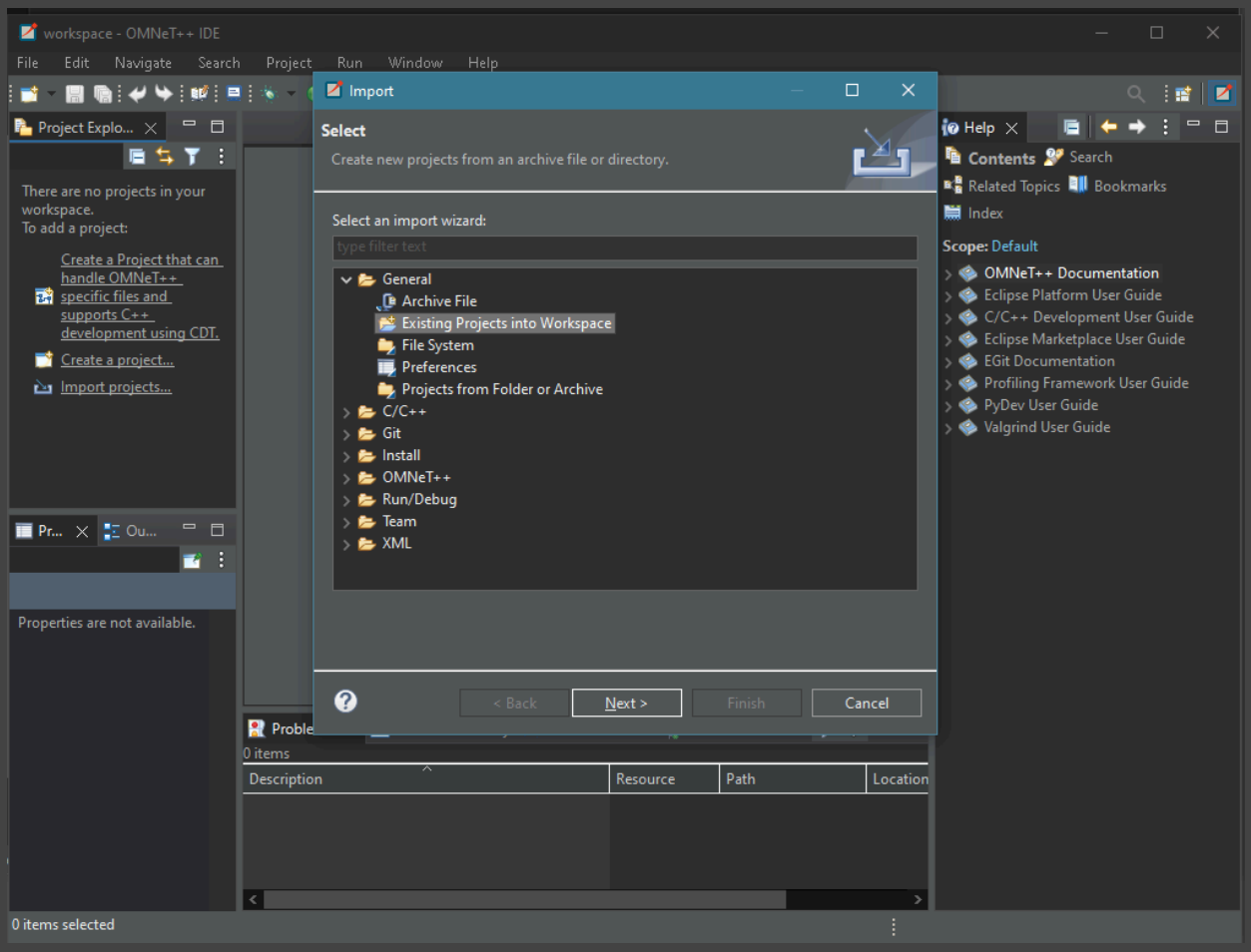
File Path: C:\NetworksProject

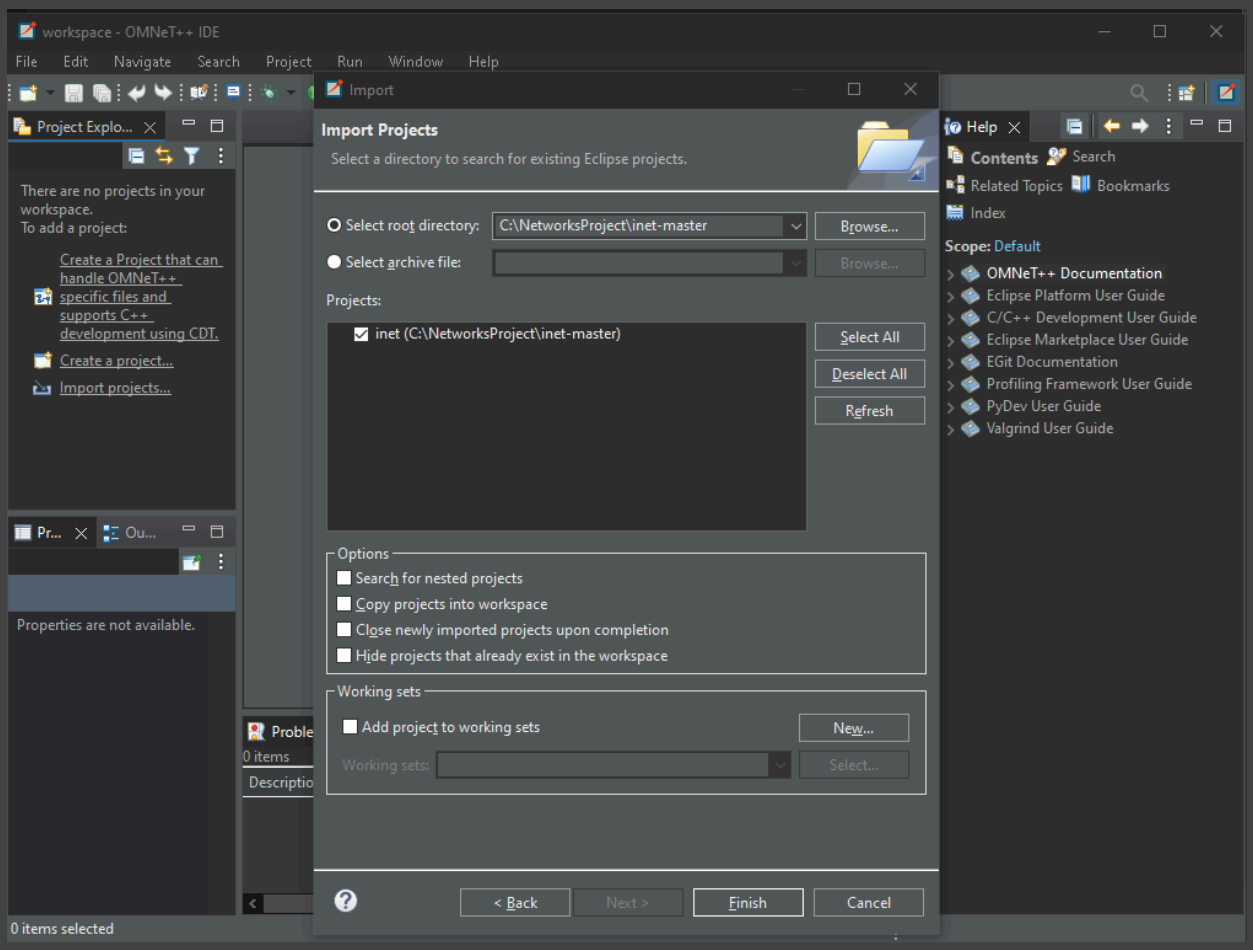
Installing INET 4.2.1

Our first framework is going to be INET which can be found *here*. Place this into the NetworksProject directory and extract the file.

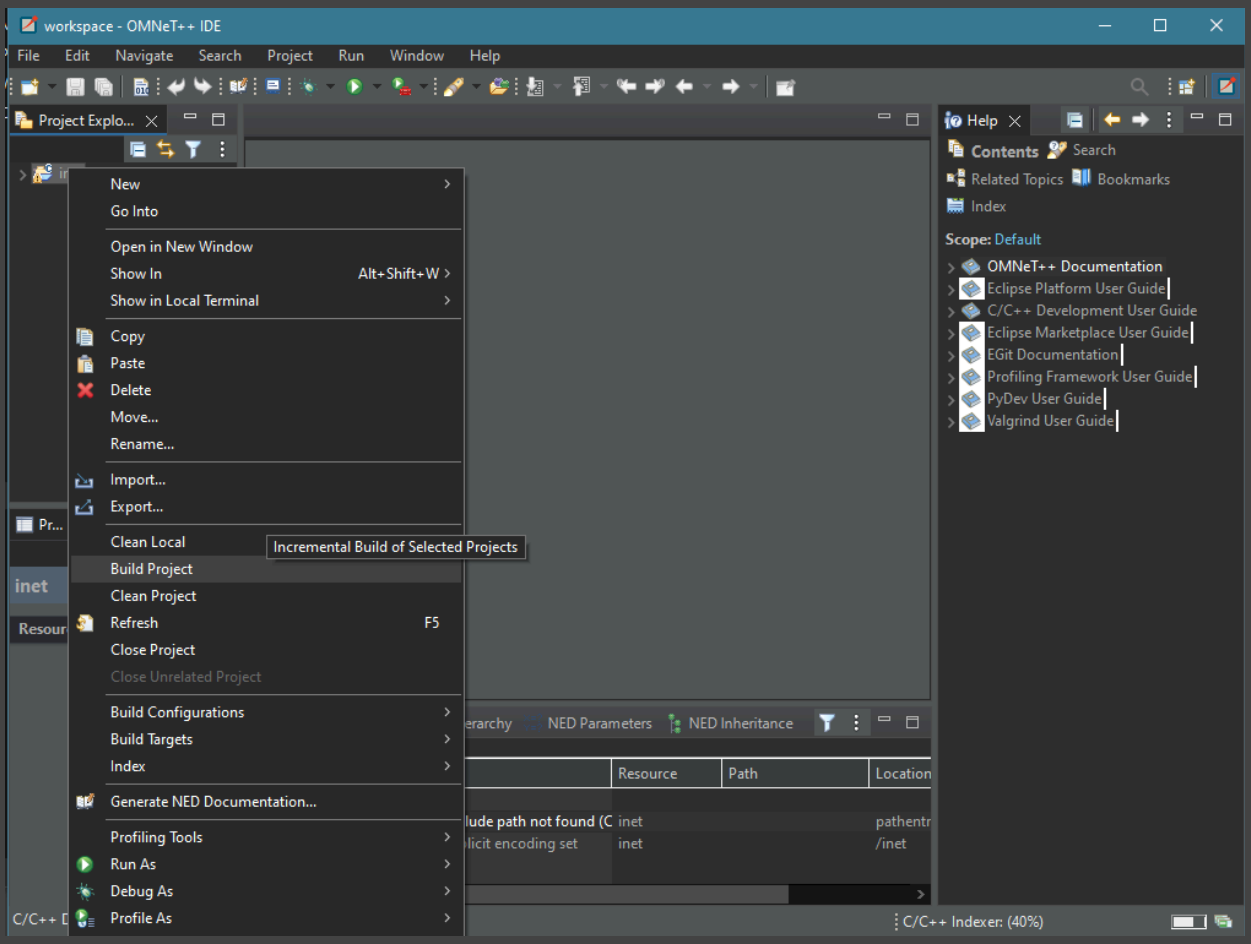


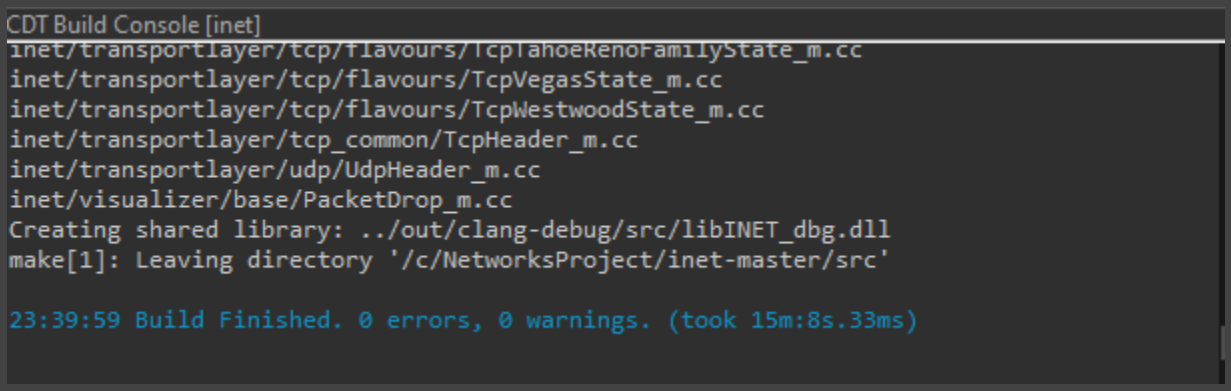
We'll then go back to our workspace in OMNeT++. You are going to "Import project" and select *General* > *Existing Projects* into \workspace.


workspace - OMNeT++ IDE
File Edit Navigate Search Project Run Window Help
Import
Select
Create new projects from an archive file or directory.
Select an import wizard:
type filter text
General
Archive File
Existing Projects into Workspace
File System
Preferences
Projects from Folder or Archive
C/C++
Git
Install
OMNeT++
Run/Debug
Team
XML
< Back
Next >
Finish
Cancel
Project Explo...
There are no projects in your workspace.
To add a project:
Create a Project that can handle OMNeT++ specific files and supports C++ development using CDT.
Create a project...
Import projects...
Properties are not available.
Help
Contents
Search
Related Topics
Bookmarks
Index
Scope: Default
OMNeT++ Documentation
Eclipse Platform User Guide
C/C++ Development User Guide
Eclipse Marketplace User Guide
EGit Documentation
Profiling Framework User Guide
PyDev User Guide
Valgrind User Guide
0 items
Description
Resource
Path
Location
0 items selected

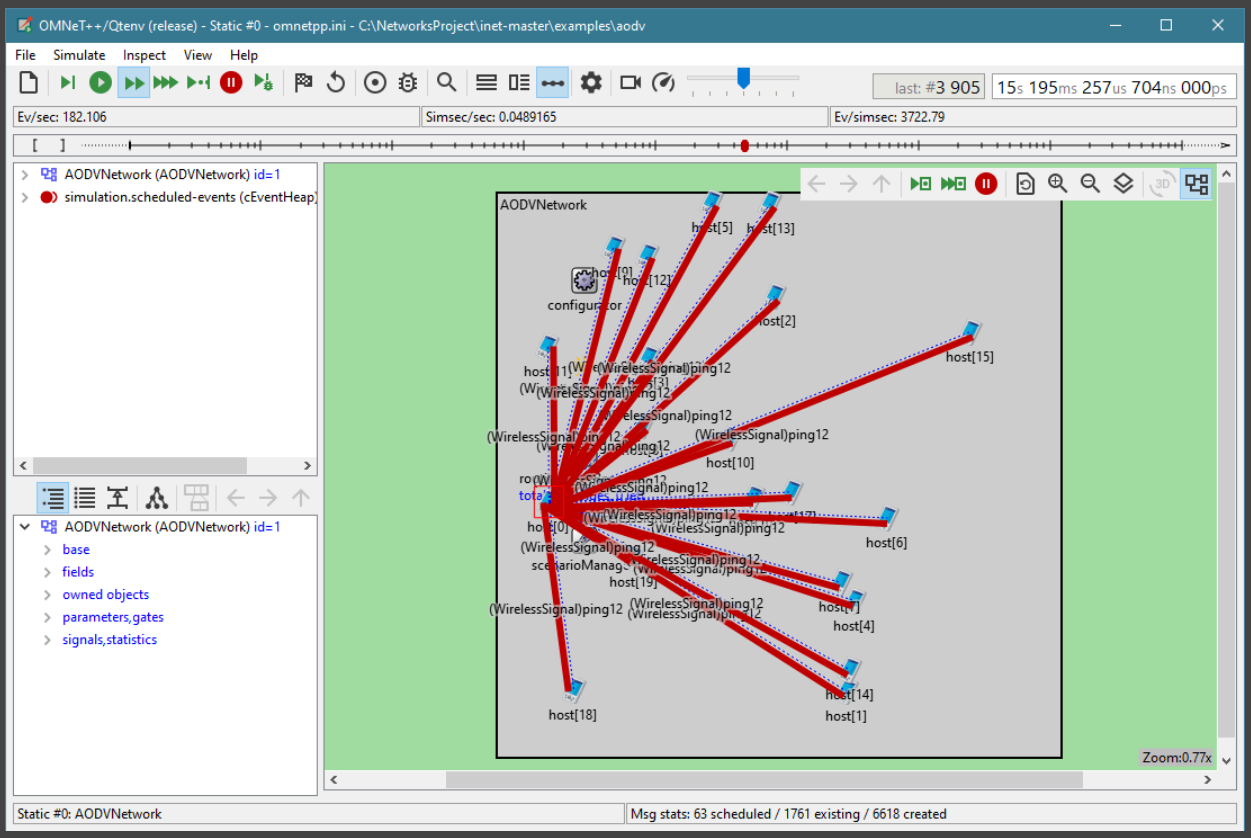


Once this is done you should have the file in your workspace. Right-click on this file and select “Build Project”. This can take a significant amount of time. For me, this took about 15 minutes.





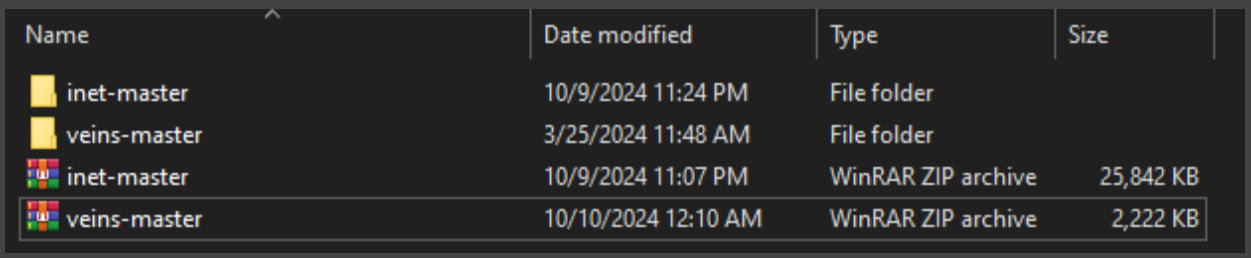
Sam - 10/09/2024: It's 11:41 PM. I'm letting one of the example projects run just to make sure INET is working. There are a few warnings in some of the directories but I don't think this is a huge deal. It takes a very long time for some of these projects to run like, a very long time. Oh well. It's working 🙂



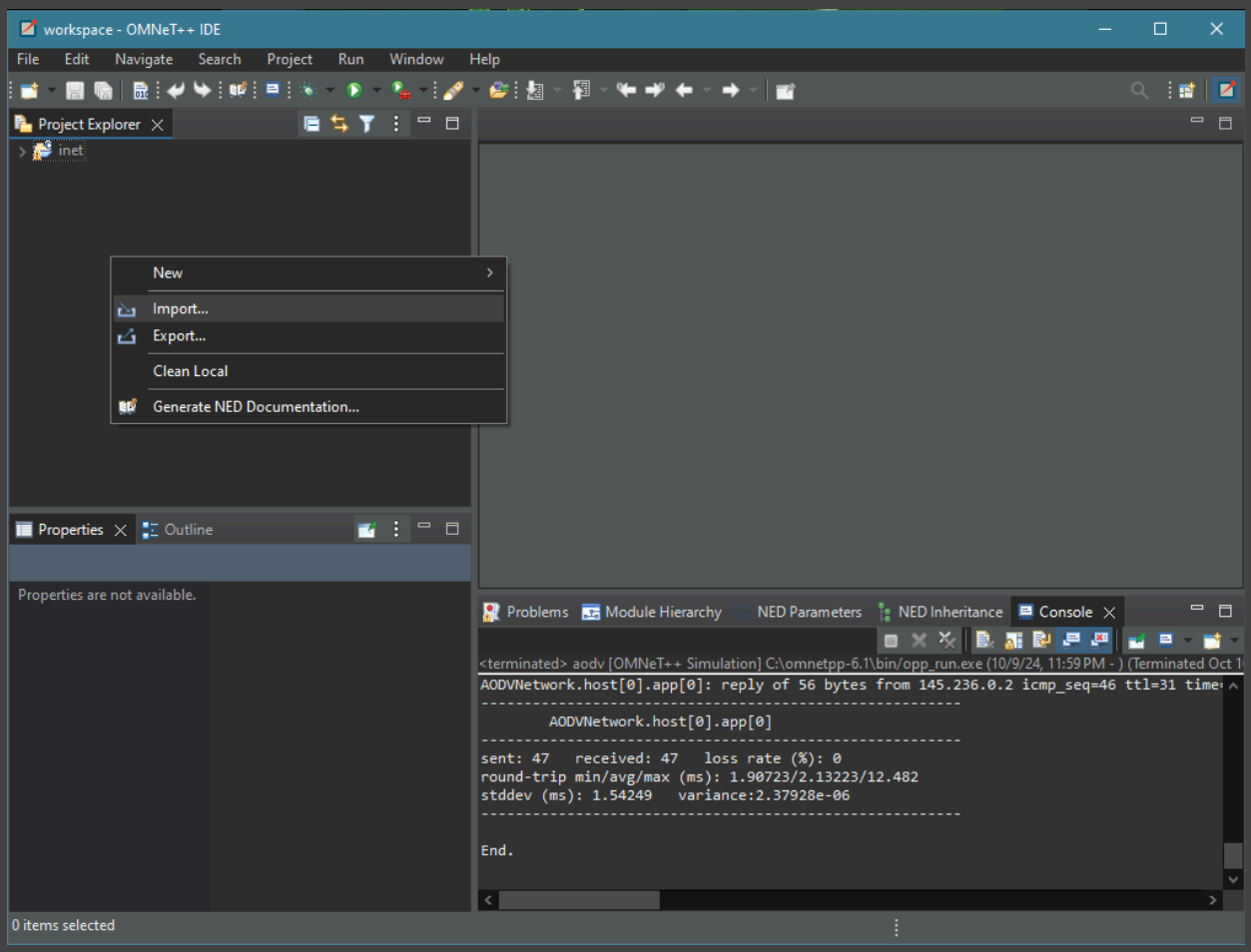
Installing Veins 5.2

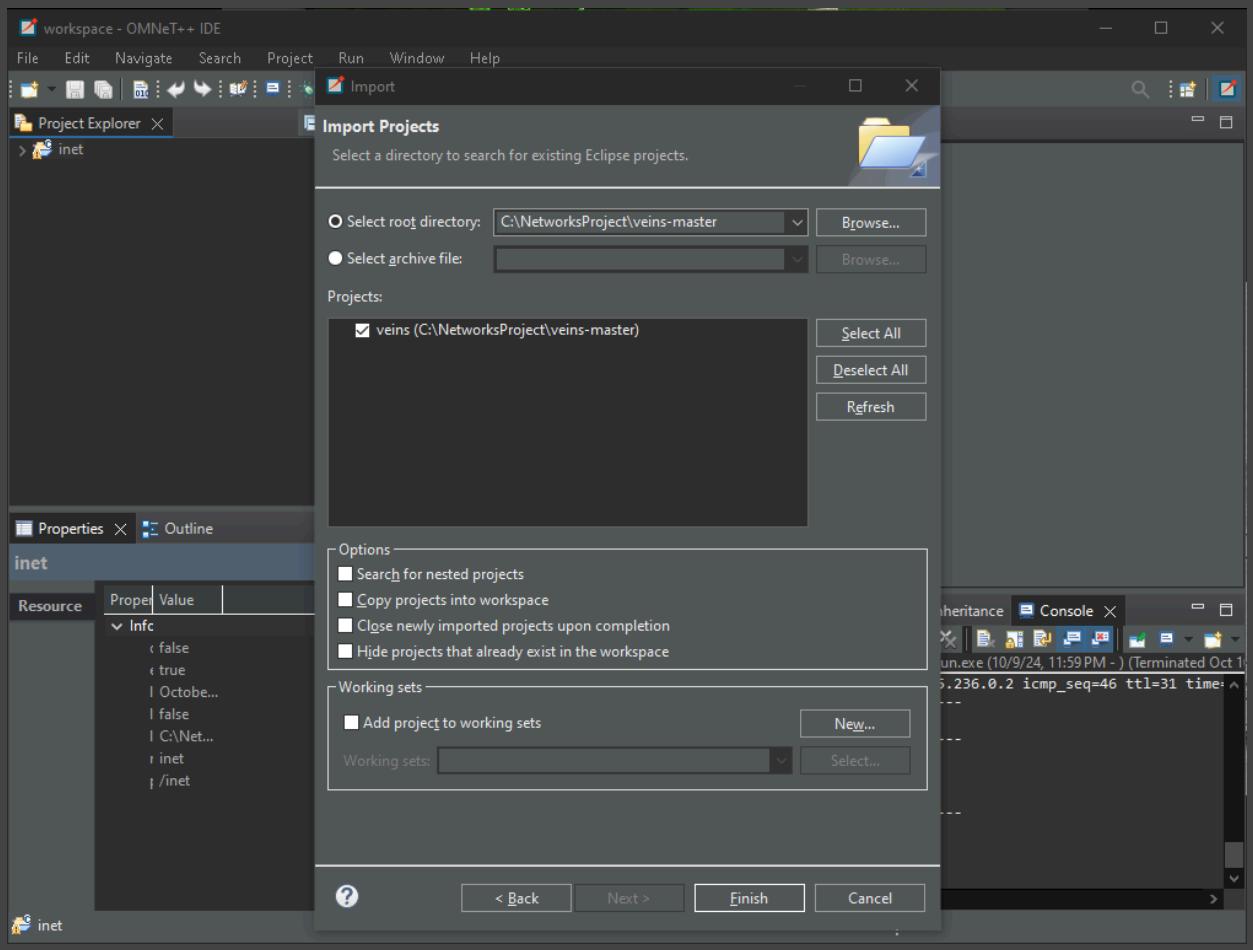
Once we have INET installed, we can move on to installing Veins, which can be found *here*. This process is identical to installing INET. The only difference is that we'll be installing it into our workspace with INET.

Place this into the NetworksProject directory and extract the file.



We'll then go back to our workspace in OMNeT++. You are going to "Import project" and select *General > Existing Projects* into \workspace.


workspace - OMNeT++ IDE
File Edit Navigate Search Project Run Window Help
Project Explorer
inet
New
Import...
Export...
Clean Local
Generate NED Documentation...
Properties
Outline
Properties are not available.
Problems
Module Hierarchy
NED Parameters
NED Inheritance
Console
<terminated> aodv [OMNeT++ Simulation] C:\omnetpp-6.1\bin/opp_run.exe (10/9/24, 11:59 PM -) (Terminated Oct 1
AODVNetwork.host[0].app[0]: reply of 56 bytes from 145.236.0.2 icmp_seq=46 ttl=31 time
AODVNetwork.host[0].app[0]
sent: 47 received: 47 loss rate (%): 0
round-trip min/avg/max (ms): 1.90723/2.13223/12.482
stddev (ms): 1.54249 variance:2.37928e-06
End.
0 items selected

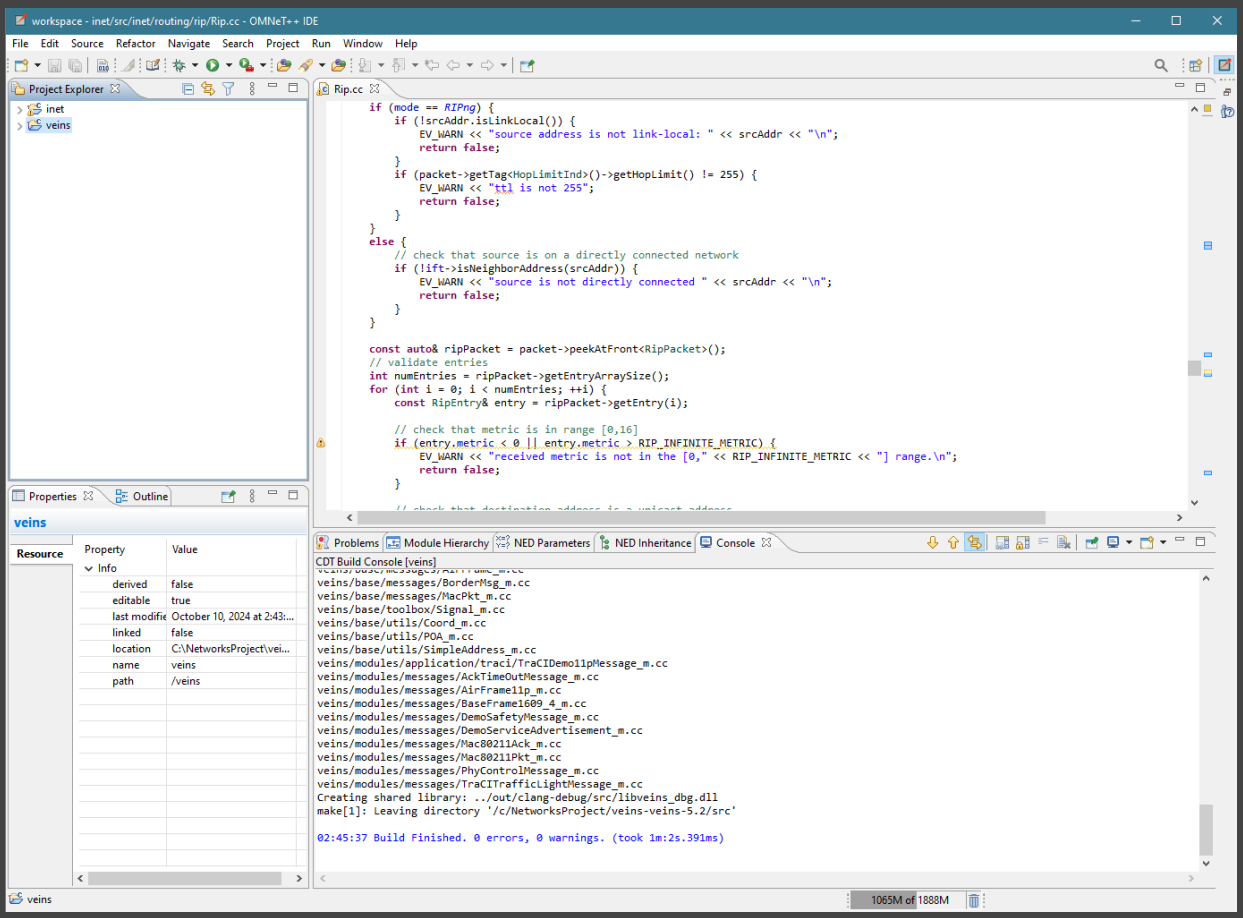


Once this is done you should have the file in your workspace. Right-click on this file and select “Build Project”.

Sam - 10/10/2024: It’s 12:22 AM. Having some issues with Veins installation from GitHub so I picked the main page instead. We’ll see how it goes but I may need to use the recommended version of OMNeT++ depending on how this goes. Okay yeah, we need an older version of OMNeT++. 😕

Sam - 10/10/2024: It’s 12:48 AM. Don’t worry all the links are updated for the correct versions of each program.

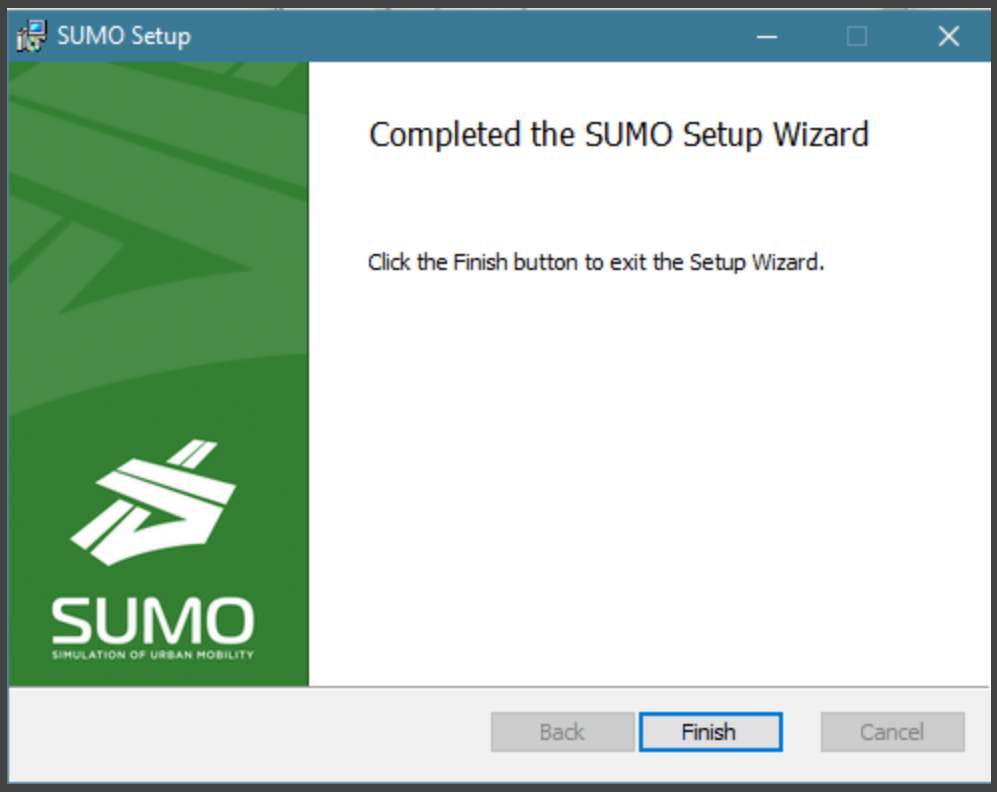
Sam - 10/10/2024: It’s 2:42 AM. I installed version 5.6.2 of OMNeT++ with version 4.2.1 of INET and I finally have a completed build of Veins 5.2!



Installing SUMO 1.8.0

Once we have Veins installed, we can move on to installing SUMO, which can be found *here*. Please note that this is the win64 version of 1.8.0 so if you're running this on a different operating system you can find the rest of the versions from the main website.

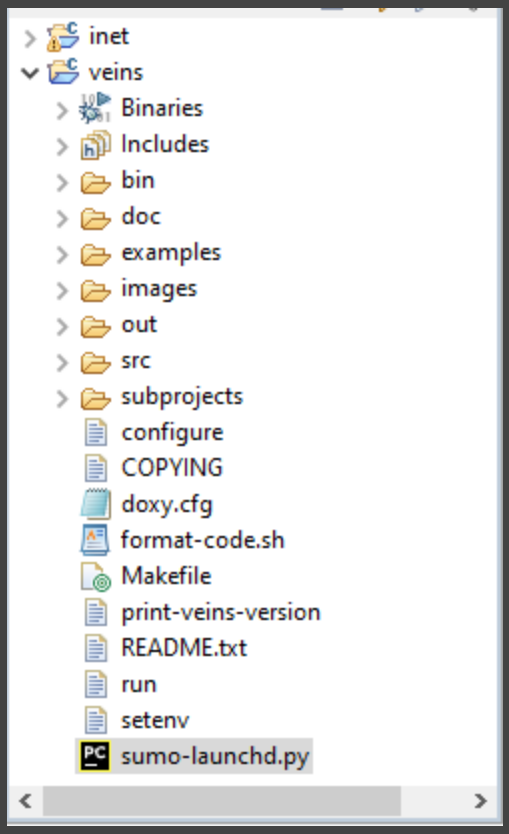
This will download a .msi file for SUMO.
You must know the directory path for this file! Place it in the root directory. OMNeT++ cmd doesn't like special characters in file paths.



Directory path: C:\SUMO

Inside OMNeT++ again you can see that the Veins file contains a Python script called *sumo-launched.py*. It is also important that you know the location of this file.

Default directory path:
C:\NetworksProject\veins-veins-5.2\sumo-launchd.py



In the mingwenv.cmd script you are going to input this command:

(Location of sumo-launchd.py directory) -vv -c (Location of SUMO directory)

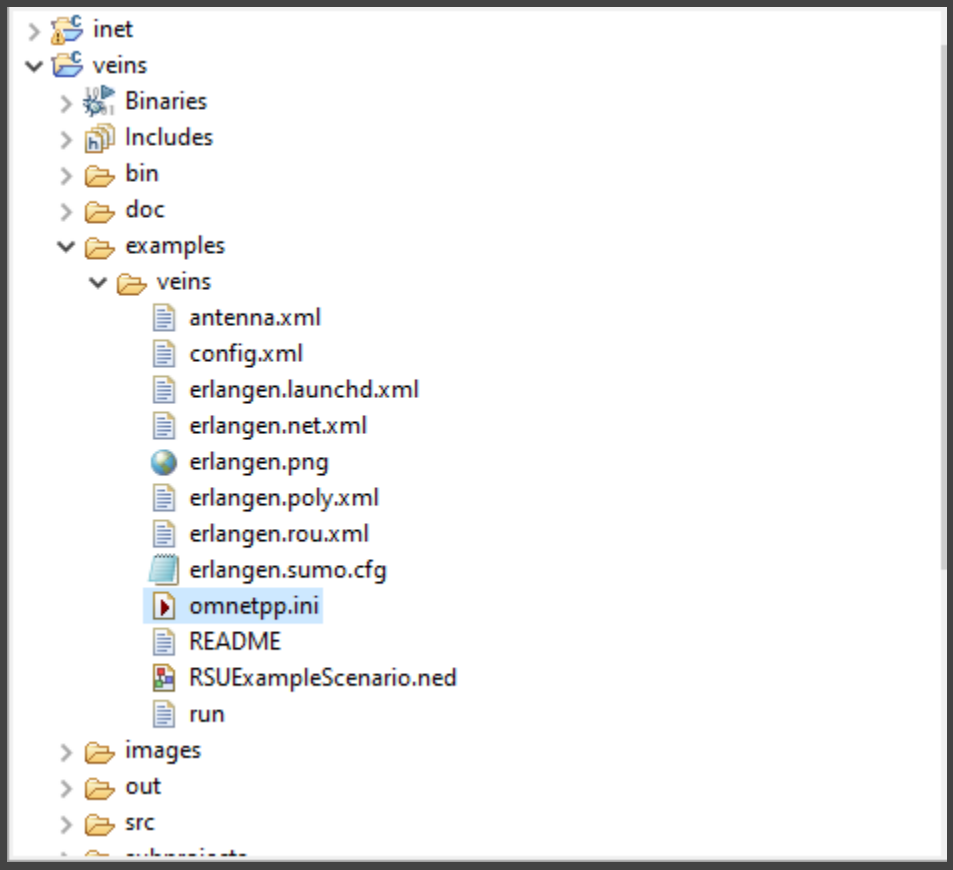
```
C:/NetworksProject/veins-veins-5.2/sumo-launchd.py -vv -c C:/SUMO/bin/sumo.exe
C:/NetworksProject/veins-veins-5.2/sumo-launchd.py -vv -c C:/SUMO/bin/sumo-gui.exe
```

```
/c/omnetpp-5.6.2$ C:/NetworksProject/veins-veins-5.2/sumo-launchd.py -vv -c C:/SUMO/bin/sumo.exe
WARNING: the sumo-launchd.py script is deprecated in favor of bin/veins_launchd. Redirecting.
WARNING: the sumo-launchd.py script is deprecated in favor of bin/veins_launchd. Redirecting.
Logging to C:/Users/eross/AppData/Local/Temp/sumo-launchd.log
Listening on port 9999



/c/omnetpp-5.6.2$

/c/omnetpp-5.6.2$

/c/omnetpp-5.6.2$

/c/omnetpp-5.6.2$ C:/NetworksProject/veins-veins-5.2/sumo-launchd.py -vv -c C:/SUMO/bin/sumo-gui.exe
WARNING: the sumo-launchd.py script is deprecated in favor of bin/veins_launchd. Redirecting.
WARNING: the sumo-launchd.py script is deprecated in favor of bin/veins_launchd. Redirecting.
Logging to C:/Users/eross/AppData/Local/Temp/sumo-launchd.log
Listening on port 9999
```

The sumo.exe will run the cmd script whereas the sumo-gui.exe will run the GUI script.

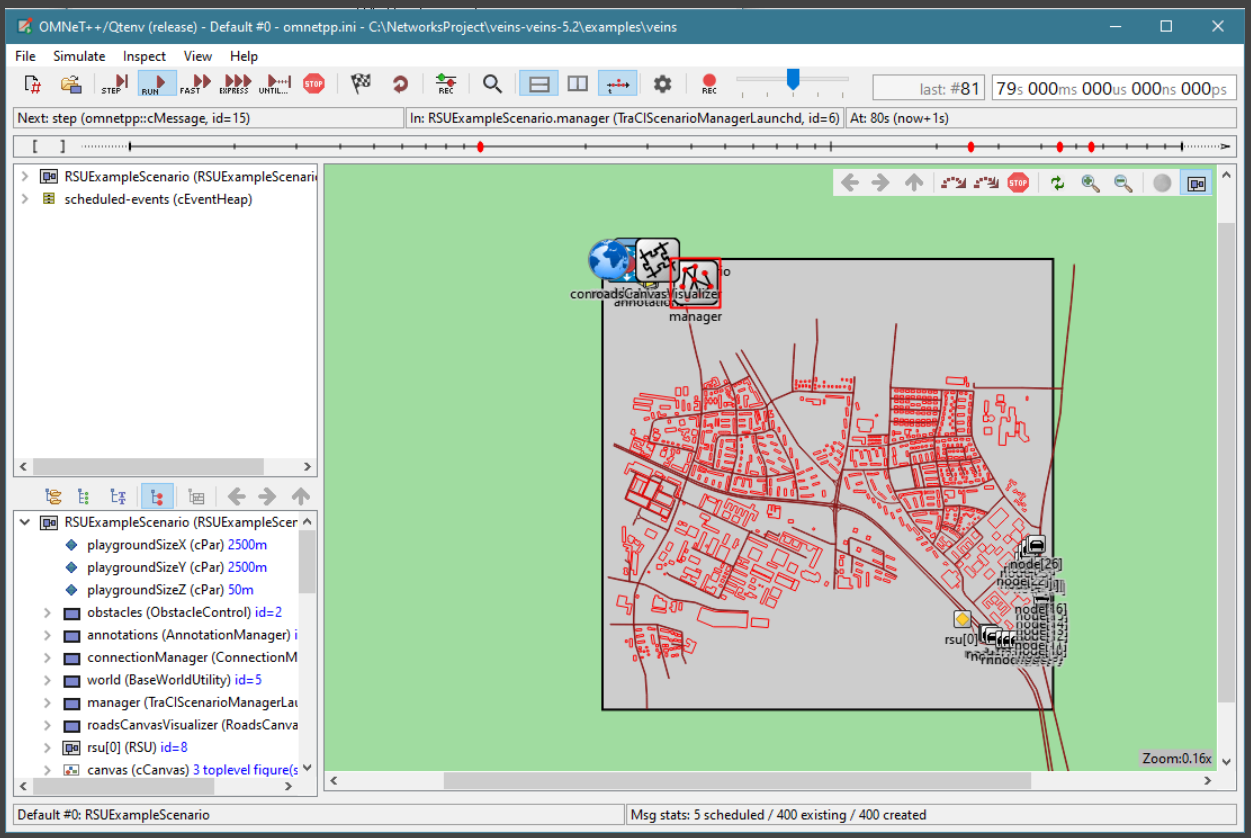
Once this is done you can go back to the OMNeT++ GUI. In the Veins folder you will run the omnetpp.ini file.

File Path: /veins/examples/veins/omnetpp.ini



Right-click on the script and select “Run as OMNeT++ Simulation”.

We can run this with the Default script.



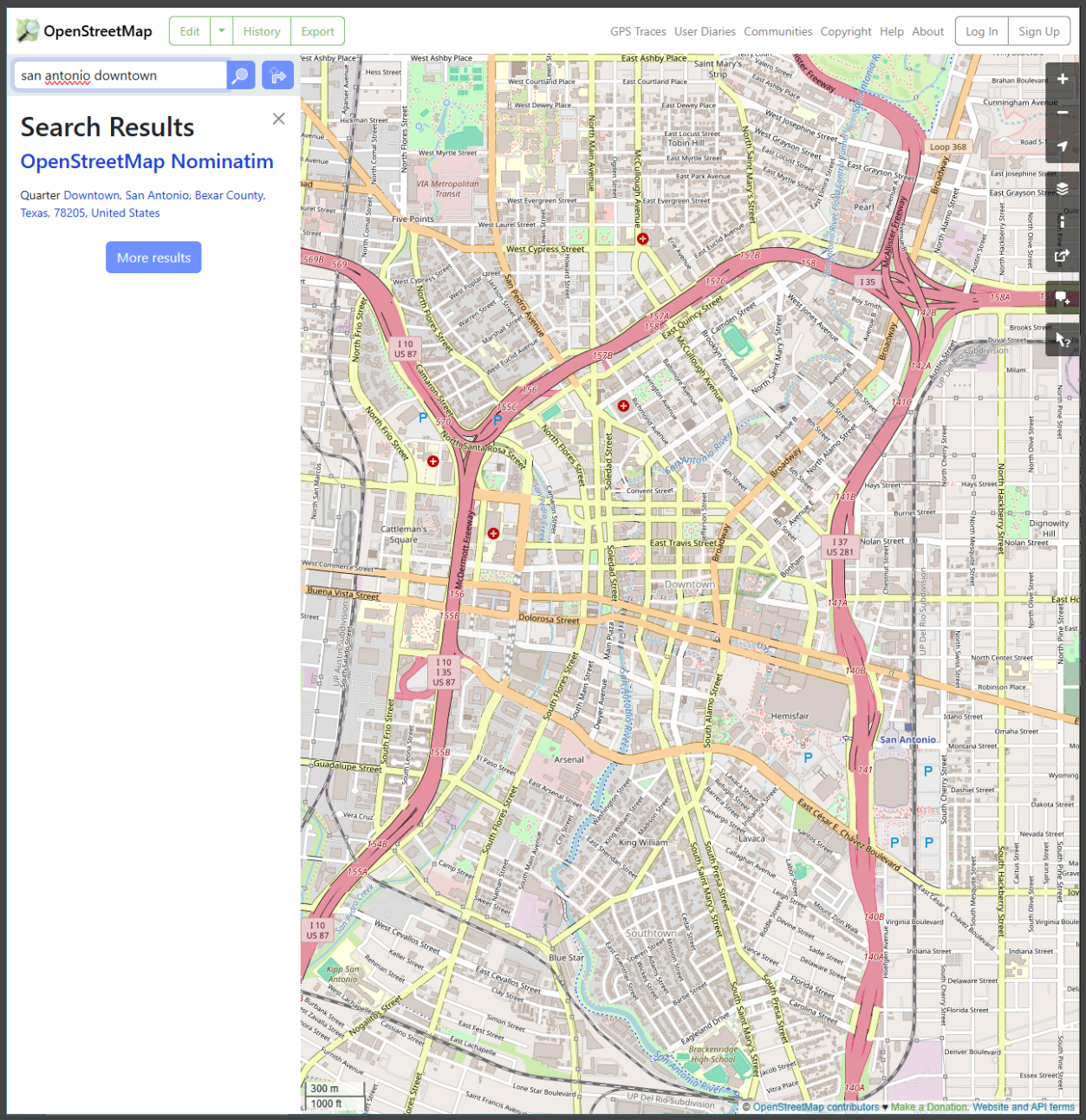
Sam - 10/10/2024: It’s 3:40 AM. I FUCKING DID IT !!!

! https://youtu.be/UfBBCUyoPkQ

Making a Custom Network and Simulation in SUMO using OpenStreetMap of San Antonio Downtown *GUIDE*

For part two of the project we’re going to make a simulation of San Antonio’s downtown streets.

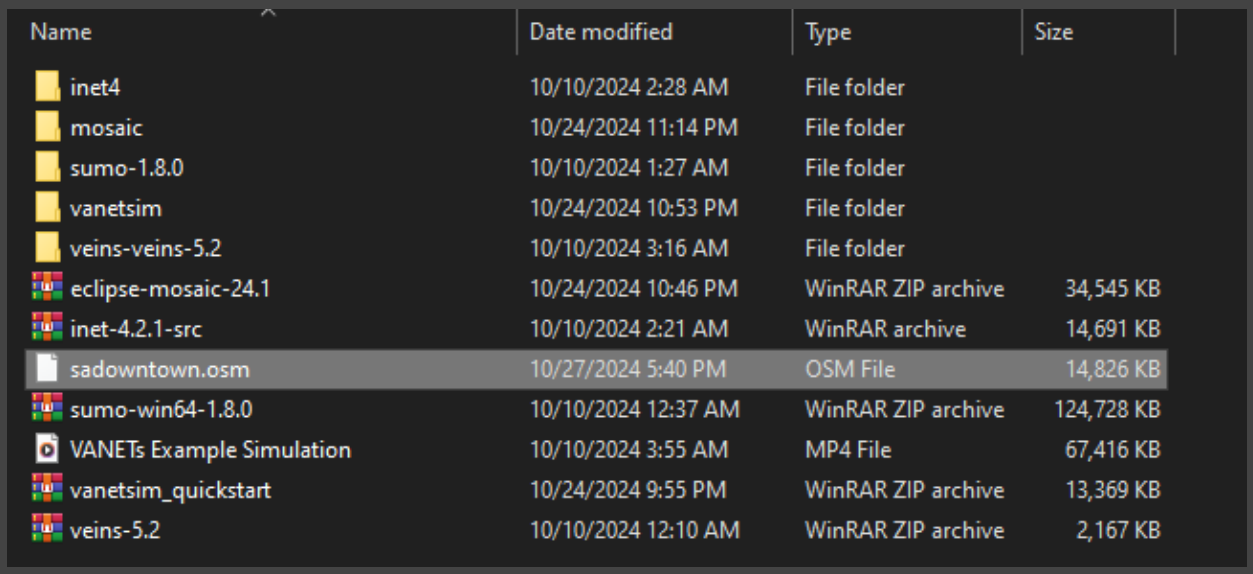
Using OpenStreetMap we can get a snapshot of a detailed rendering of San Antonio downtown. We can then export a section of this map to be used in SUMO. This will give us a map.osm file.



In order to see if our map has any potential issues we will be using an OSM editor "JOSM" which can be found here. For now I'm just going to assume this file is fine as is since San Antonio downtown is a pretty well populated area most likely the map data is up to date. *(May be a risky assumption)*

In order to convert this map.osm file to a usable format for SUMO we're going to need to convert it so we'll use Command Prompt's netconvert operator. Here is that ugly command:

```
netconvert --osm-files sadowntown.osm --output-file sadowntown.net.xml --geometry.remove --roundabouts.guess
--ramps.guess --tls.guess-signals --tls.join
```



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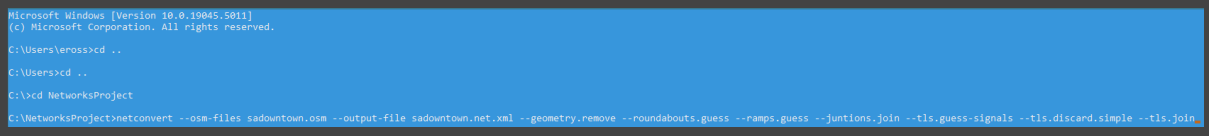
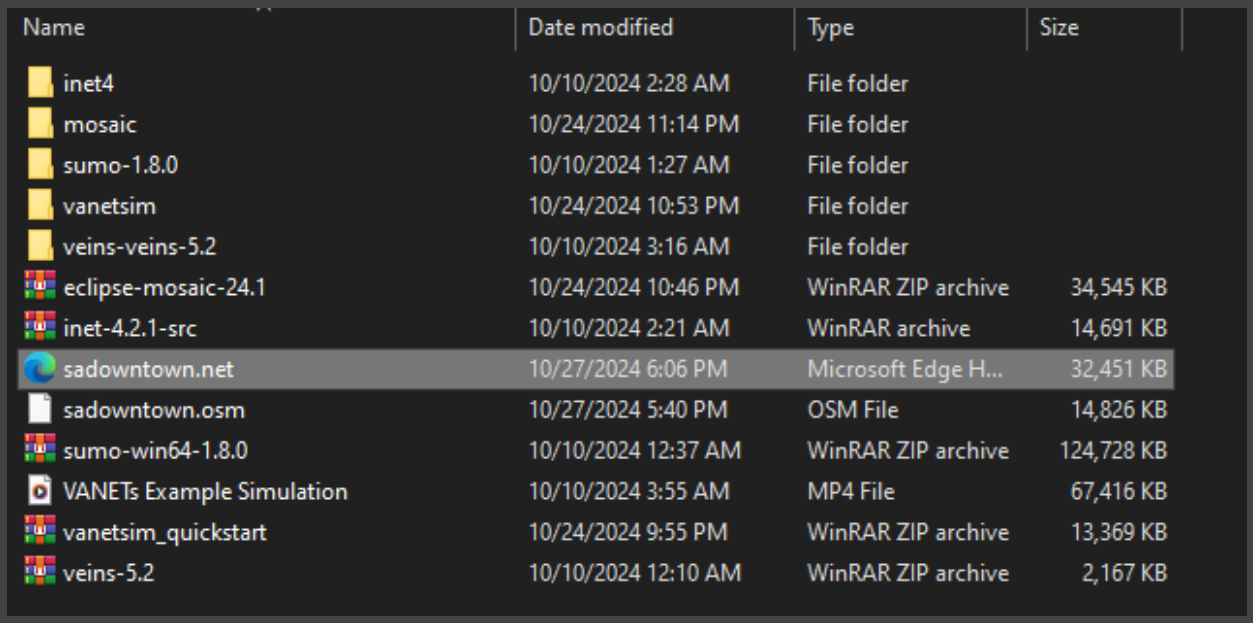
vanetsim	10/24/2024 10:53 PM	File folder	
veins-veins-5.2	10/10/2024 3:16 AM	File folder	
eclipse-mosaic-24.1	10/24/2024 10:46 PM	WinRAR ZIP archive	34,545 KB
inet-4.2.1-src	10/10/2024 2:21 AM	WinRAR archive	14,691 KB
sadowntown.osm	10/27/2024 5:40 PM	OSM File	14,826 KB
sumo-win64-1.8.0	10/10/2024 12:37 AM	WinRAR ZIP archive	124,728 KB
VANETs Example Simulation	10/10/2024 3:55 AM	MP4 File	67,416 KB
vanetsim_quickstart	10/24/2024 9:55 PM	WinRAR ZIP archive	13,369 KB
veins-5.2	10/10/2024 12:10 AM	WinRAR ZIP archive	2,167 KB





Name	Date modified	Type	Size
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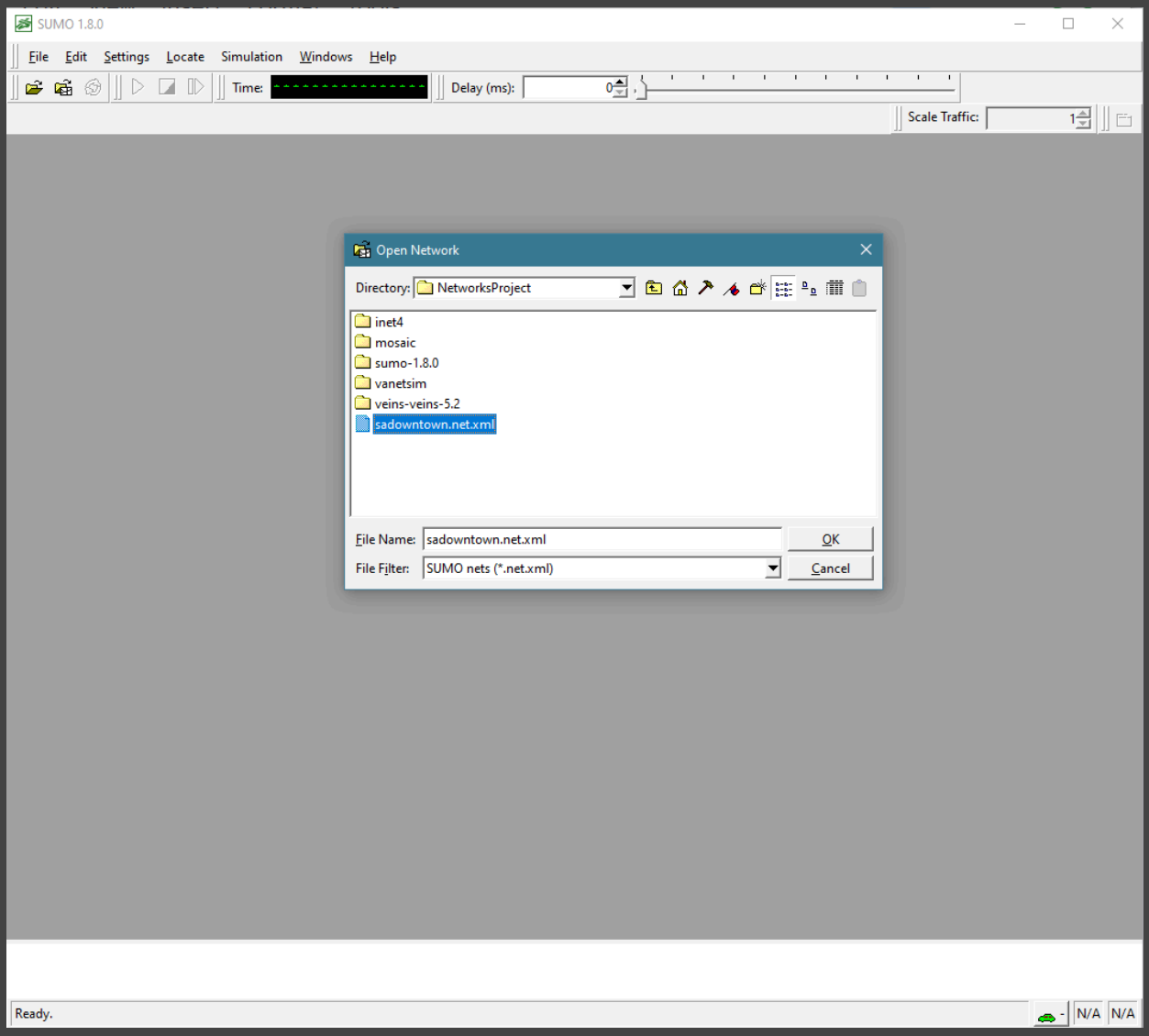
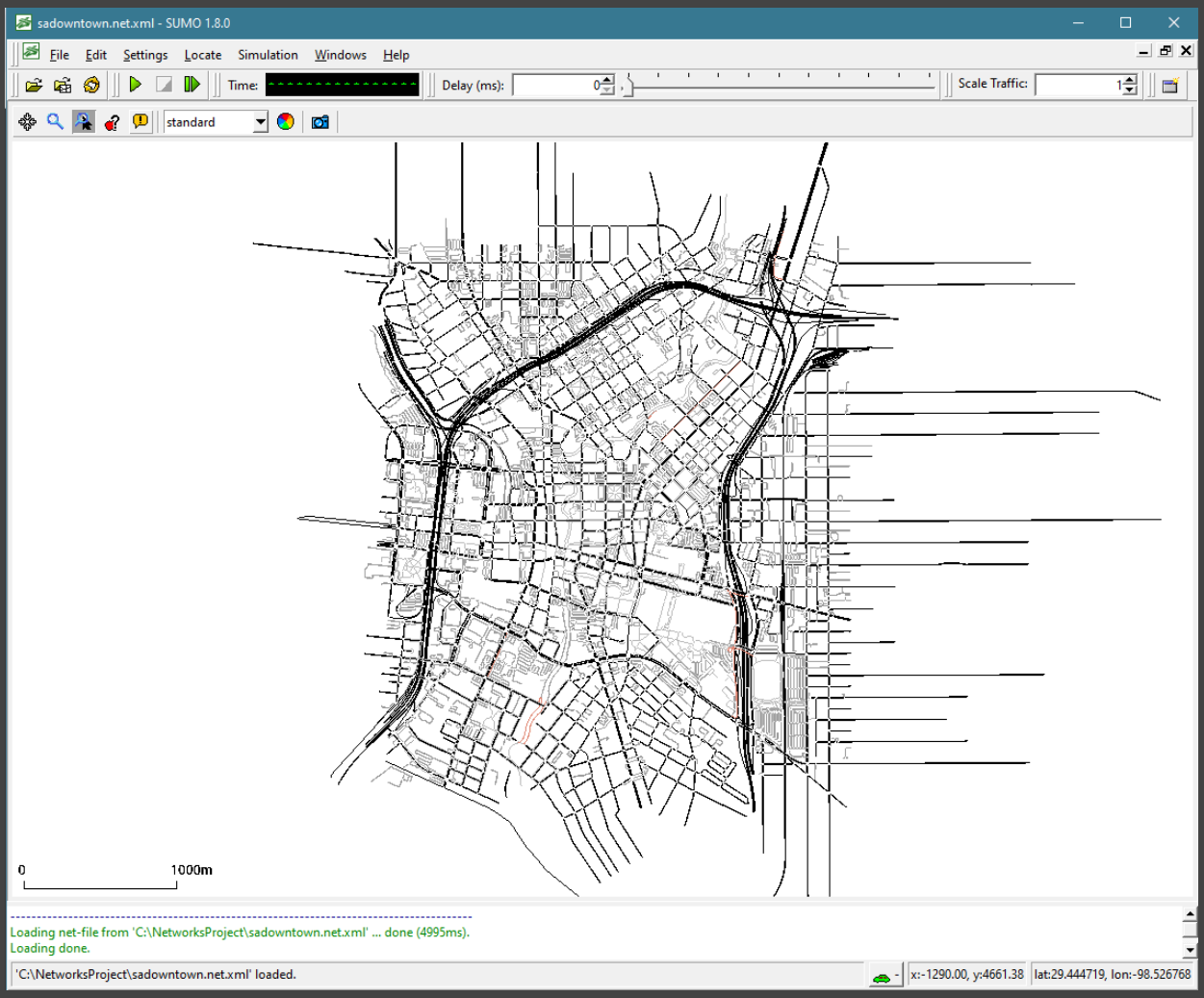
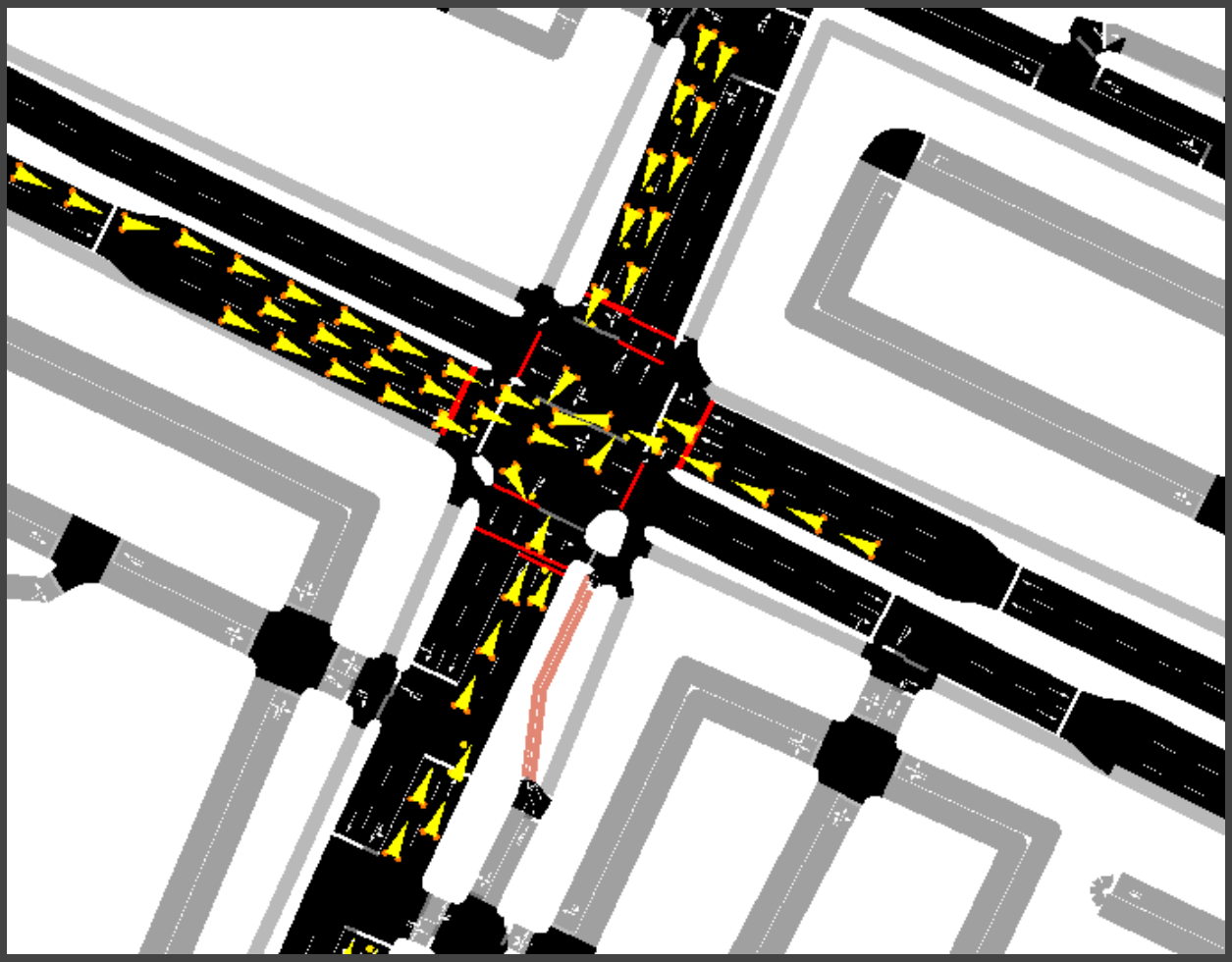
mosaic	10/24/2024 11:14 PM	File folder	
sumo-1.8.0	10/10/2024 1:27 AM	File folder	
vanetsim	10/24/2024 10:53 PM	File folder	
veins-veins-5.2	10/10/2024 3:16 AM	File folder	
eclipse-mosaic-24.1	10/24/2024 10:46 PM	WinRAR ZIP archive	34,545 KB
inet-4.2.1-src	10/10/2024 2:21 AM	WinRAR archive	14,691 KB
sadowntown.net	10/27/2024 6:06 PM	Microsoft Edge H...	32,451 KB
sadowntown.osm	10/27/2024 5:40 PM	OSM File	14,826 KB
sumo-win64-1.8.0	10/10/2024 12:37 AM	WinRAR ZIP archive	124,728 KB
VANETs Example Simulation	10/10/2024 3:55 AM	MP4 File	67,416 KB
vanetsim_quickstart	10/24/2024 9:55 PM	WinRAR ZIP archive	13,369 KB
veins-5.2	10/10/2024 12:10 AM	WinRAR ZIP archive	2,167 KB

In the SUMO GUI now we can open this network file.


SUMO 1.8.0
File Edit Settings Locate Simulation Windows Help
Time:
Delay (ms):
0
Scale Traffic:
1
Open Network
Directory: NetworksProject
inet4
mosaic
sumo-1.8.0
vanetsim
veins-veins-5.2
sadowntown.net.xml
File Name: sadowntown.net.xml
OK
File Filter: SUMO nets (*.net.xml)
Cancel
Ready.
N/A
N/A



So much documentation… Just refer to the Youtube link 🙂



I love downtown SA.

Importing the SUMO Simulation into OMNET

Installing VANETsim

The install link to VANETsim can be found *here*. Make sure to download version 1.3.

This software uses its own open source network and mobility simulator. Dependencies like OMNeT++ and SUMO are not required for this download making it relatively straightforward. The main con is that the software is no longer supported as of 2017. It has a relatively limited feature set compared to the other softwares in this documentation.

The download website also includes all the documentation. For more information the Github can be found *here*.

! https://youtu.be/SmOWvnn1HPM

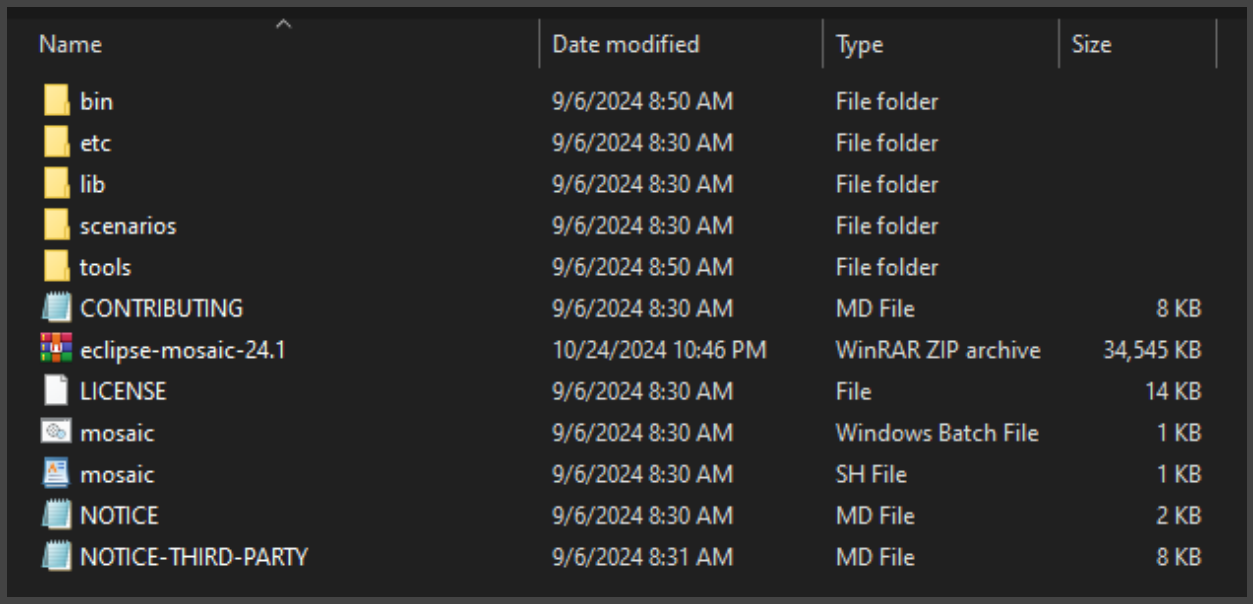
Installing Eclipse MOSAIC *GUIDE*

The link to Eclipse MOSAIC 24.1 can be found *here*. You can place this file in the same NetworksProject directory we used for our first installation.

File Path: C:\NetworksProject

We're going to make a new folder 'mosaic' for this simulator. You can extract the zip file here:

File Path: C:\NetworksProject\mosaic



Name	Date modified	Type	Size
bin	9/6/2024 8:50 AM	File folder	
etc	9/6/2024 8:30 AM	File folder	
lib	9/6/2024 8:30 AM	File folder	
scenarios	9/6/2024 8:30 AM	File folder	
tools	9/6/2024 8:50 AM	File folder	
CONTRIBUTING	9/6/2024 8:30 AM	MD File	8 KB
eclipse-mosaic-24.1	10/24/2024 10:46 PM	WinRAR ZIP archive	34,545 KB
LICENSE	9/6/2024 8:30 AM	File	14 KB
mosaic	9/6/2024 8:30 AM	Windows Batch File	1 KB
mosaic	9/6/2024 8:30 AM	SH File	1 KB
NOTICE	9/6/2024 8:30 AM	MD File	2 KB
NOTICE-THIRD-PARTY	9/6/2024 8:31 AM	MD File	8 KB

To run a single simulation via CMD, call the Eclipse MOSAIC start script with the following command line arguments (Windows):

```
mosaic.bat -s <scenario.name>
mosaic.bat -c .\scenarios\<scenario.name>\scenario_config.json
```

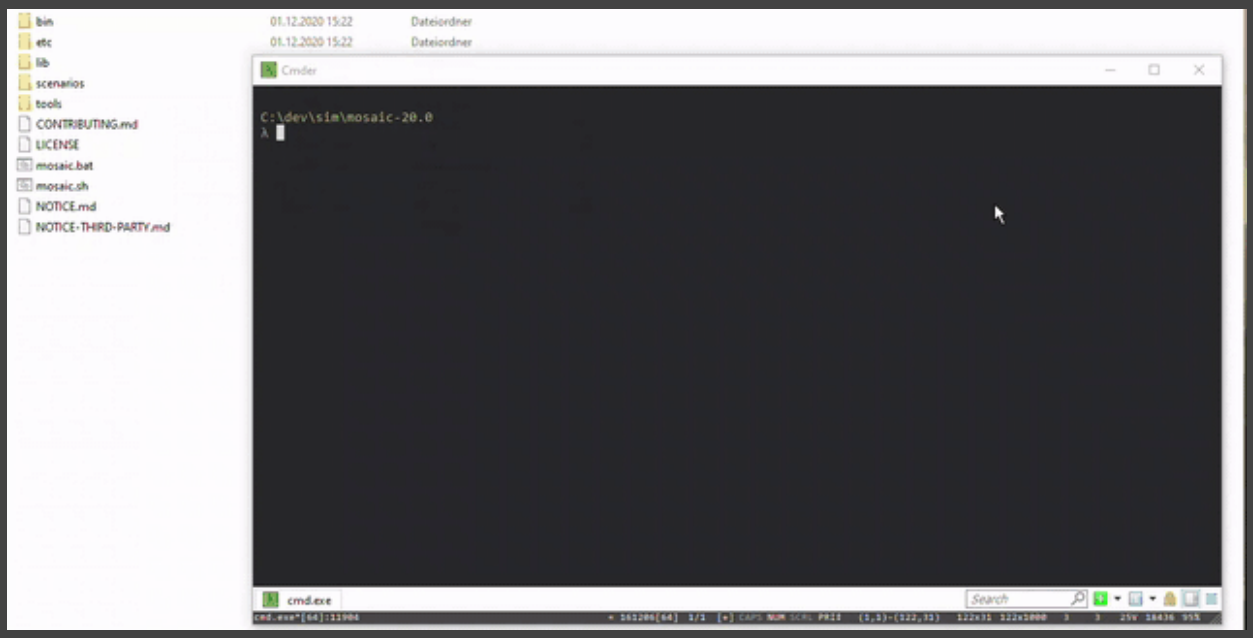
In our case we will be using the Barnim scenario:

```
C:\>cd NetworksProject

C:\NetworksProject>cd mosaic

C:\NetworksProject\mosaic>mosaic.bat -s Barnim -v
2024-10-24 23:16:33,610 INFO  ROOT - Running Eclipse MOSAIC 24.1 on Java JRE v19.0.2 (Oracle Corporation)
2024-10-24 23:16:33,653 INFO  FederationManagement - Start federation with id 'Barnim'
2024-10-24 23:16:33,830 INFO  FederationManagement - Add ambassador/federate with id 'application'
2024-10-24 23:16:33,831 INFO  FederationManagement - Add ambassador/federate with id 'environment'
2024-10-24 23:16:33,832 INFO  FederationManagement - Add ambassador/federate with id 'mapping'
2024-10-24 23:16:33,832 INFO  FederationManagement - Add ambassador/federate with id 'sns'
2024-10-24 23:16:33,832 INFO  FederationManagement - Add ambassador/federate with id 'sumo'
2024-10-24 23:16:33,839 INFO  FederationManagement - Deploying federate 'sumo' locally in .\tmp\sumo
2024-10-24 23:16:33,856 INFO  FederationManagement - Starting federate 'sumo' locally in .\tmp\sumo
2024-10-24 23:16:33,857 INFO  FederationManagement - Add ambassador/federate with id 'output'
```

This will load a Websocket visualization in your browser:



! https://youtu.be/2STMHNzhLPE