

# Wireless-Perf-Sim

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EEL6591 project for implementing a simulation framework for testing Ad Hoc End to End performance. This framework will check system throughput, end to end latency, jitter, and other relevant KPIs (Key Performance Indicators) such as packet drop rate. The goal is to assist network design for high performance IoT systems such as connected vehicles or high throughput IoT devices such as cameras or any system that might have real time requirements. This framework will take into account the possibility of multi-hop routing that may be prevalent in Ad Hoc Networks.

This framework will either be a modification of ns3 or implemented as a ns3 script. The project is also still in ideation stage, but will evaluate some network performance metrics regardless. It could be modified to compare different topologies together. Framework inputs are also still in the ideation stage. I would personally like to investigate heavily modifying the node applications or some of the NIC to mix in different bitrate demands per node.

## How to Use Tool Brief

### Python Wrapper

The intended way to use this tool is to use the IoT-Latency-Sim.p wrapper developed in the **ns-3-dev** folder. Note: script must run out of the ns-3-dev directory and you must pass in a configuration file.

```
cd ns-3-dev
python3 IoT-Latency-Sim --config=config.cfg
```

### Config File Example

All fields must be populated for this simulation to work.

Two example configs provided in example\_configs folder

- hwdelay - user measured process delay in units of milliseconds
- time\_sec - time to run sim in units of seconds
- hops - number of hops the user wishes to measure
- protocol - routing can either be AODV or OLSR for now.
- packetsize - how large the packets should be in bytes

```
[SIM]
hwdelay = 1
time_sec = 60
hops = 3
protocol = AODV
packetsize = 1024
```

## Real-Time Definitions

- Soft Real-Time -> missing deadlines results in degradation of service (gaming, video/audio streaming)
- Firm Real-Time -> missing deadlines results in service no longer be useful (GPS and other data that can "expire" )
- Hard Real-Time -> missing deadlines results in critical failure of system

## System Outputs

- Latency -> how long it takes for a packet to reach its destination ( average )
- Jitter -> changes in latency ( average )

## System Inputs

**Still in planning, the goal is to make a tool that's useful for network design**

- Number of Hops -> how many relevant nodes are in the system
- Hardware Constraints -> Currently implemented as a fixed delay per hop that the user must measure from available hardware
- Routing protocol -> Tool Supports AODV and OLSR for now
- Time -> how long in seconds the simulation should run

## To Review

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This section includes relevant links to understanding the project. Please review the ns3 tutorial to understand the development environment. NS3 only runs in a linux environment currently which means either WSL,a linux VM, or a Linux dual boot. We're interested in using ns3 for the wireless case.

### ns3 tutorial:

Full tutorial: <https://www.nsnam.org/docs/tutorial/html/>

Wireless Topology Example: <https://www.nsnam.org/docs/tutorial/html/building-topologies.html#building-a-wireless-network-topology>

GitLab (Original Source Code): <https://gitlab.com/nsnam/ns-3-dev>

MANET Example: <https://gitlab.com/nsnam/ns-3-dev/-/blob/master/examples/routing/manet-routing-compare.cc>

### Running NS3 Scripts

I believe there's technically two tools available for running ns3 scripts. In the tutorial it uses `./ns3`, but I've had more success with using `./waf`. \ Link: <https://www.nsnam.org/develop/tools/waf/>

### Geeksforgeeks:

Intro to Ad Hoc Networks: <https://www.geeksforgeeks.org/introduction-of-mobile-ad-hoc-network-manet/>

MANET Routing: <https://www.geeksforgeeks.org/manet-routing-protocols/>

# Folders

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## ns-3-dev

This is the ns3 source code directly with a few scripts I've tried out in the scratch directory.

## Papers

Papers that I've found so far that have some relevant issue or can be used to extrapolate what kind of KPIs (Key Performance Indicators ) we can extend our framework to evaluate.