SEM: A Simulation Execution Manager for ns-3

Setup!

This lesson requires some setup. We will download a new copy of ns-3, and use that one for the rest of this lab.

Open up a terminal!

```
cd
git clone --recursive https://github.com/DvdMgr/sem-lab
cd sem-lab
ls -l
```

What is in this folder?

This is what you should see in the sem-lab folder

`ns-3`	Our new ns-3 installation folder
`params`	Ignore this for now!
`Slides`	Folder containing this lesson's slides
`wifi-plot.m`	Octave script to plot the results of our simulations
`wifi-sem.cc`	The ns-3 simulation script we will run

Let's compile ns-3

```
cd ns-3
./waf configure build
```

Summary of what `wifi-sem.cc` does

- Creates a WiFi network
- Provides a set of command line arguments we can use
  - Distance from AP
  - Number of devices
  - MCS
  - Using Request To Send (RTS)
  - Using Short Guard Interval (SGI)
  - Randomness of channel
- Prints the throughput of the network

Playing around with the wifi-sem script

Try some arguments!

```
./waf --run "wifi-sem --useRts=False"
./waf --run "wifi-sem --useRts=True"
./waf --run "wifi-sem --mcs=3 --RngRun=1"
./waf --run "wifi-sem --mcs=3 --RngRun=2"
```

What is SEM?

SEM is a Python library and program that allows you to:

- Run multiple simulations in parallel from the command line
- Export results to various formats (folders, MATLAB)
- Perform both simulations and analysis from the same Python script

SEM is already installed in your system:

```
sem --help
```

Running the program with SEM

Try it! *Make sure to be in the `sem-lab` folder for this (`cd ..`).*
The `sem run` command can be used to run simulations:

```
cd ..
sem run --help
sem run
```

Use [Value1, Value2, . . .] to specify multiple values.

Viewing results

The `sem view` command can be used to view results of previously run simulations:

```
sem view --help
```

Exporting results

The export command can be used to export results:

```
sem export --help
```

Let's export results to a nested folder structure:

```
sem export results-directory
```

Exporting results to MATLAB and plotting

Clean up your results folder with the `rm -r res` command.
Run simulations using a pre-specified parameter space:

```
sem run --parameters params
```

Export results to MATLAB data structure:

```
sem export results.mat --results-dir res
```

Run the MATLAB script to plot results:

```
octave --persist wifiplot.m
```

Exercise

Plot the throughput for increasing mcs and for every setting of SGI and RTS at a fixed distance.

- Reset your results directory

  `rm -r res`

- Make sure you run all the simulations you need
  - What values for MCS, SGI and RTS?
- Export results
- Modify `wifiplot.m` to create the new plot