ELG5142 Ubiquitous Sensing for Smart Cities
Assignment 4

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Submission Deadline: Friday, July 22, 2022, 11:59pm (One submission per group)

Assignment 4 is based on NS3 network simulator and mainly based on what you learned in lab9.

For this assignment, you need to create an adhoc vehicular topology in NS3 using WaveMacHelper:

1. The simulation contains 3 vehicles (nodes)

2. The vehicles are mobile on a rectangular area according to RandomWalk2dMobility model (30 marks):
   - The area is a rectangle with bounds 0<x<500 and 0<y<500.
   - The speed of the vehicles is a uniform random number between 8 m/s and 13 m/s.
   - Vehicles are initially positioned randomly on the rectangular area. In order to set the initial positions of the vehicles randomly, you need to use "RandomRectanglePositionAllocator".
     Note: we used "GridPositionAllocator" in lab8 to initially place the nodes on fixed positions. In this assignment, instead of "GridPositionAllocator", you need to use "RandomRectanglePositionAllocator".
     Reference:
     https://www.nsnam.org/doxygen/classns3_1_1_random_walk2d_mobility_model.html
     https://www.nsnam.org/doxygen/classns3_1_1_random_rectangle_position_allocator.html

3. The simulation time is 20 seconds.

4. At second 1, vehicle 1 (vehicle with index 0) sends a broadcast message (wave short message) via control channel (CCH) (30 marks):

   - The packet payload of the CCH message is 500 Bytes.
   - The ethernet type protocol is set to 0x88dc which correspond to WSMP.
   - The transmission characteristics of this CCH broadcast message are as follows:

     - The transmission data rate (wifiMode) is OfdmRate12MbpsBW10MHz.
     - The priority of packets is 7 (the packets priority is a number between 0 and 7, and 7 is the highest priority)
     - The transmission power level is 10.
     - **Hint:** A TxInfo object should be defined for configuring channelNumber, dataRate, priority, txPowerLevel.

5. At intervals of 5 seconds (5, 10, 15, 20), vehicle 1, vehicle2 and vehicle 3 broadcast messages of size 1000 bytes via service channel 1 (SCH1) (40 marks):

   - The priority of the packets sent from vehicle 1 is 0 (lowest priority).
   - The rate of the broadcast for vehicle 1 is 27Mbps.

- The priority of the packets sent from vehicle 2 is 5.
- The rate of the broadcast for vehicle 2 is 9Mbps.

- The priority of the packets sent from vehicle 3 is 7.
- The rate of the broadcast for vehicle 3 is 6Mbps.

6. All the sent packets should have sequence number that increases iteratively per node at each time stamp.
7. A callback function should be defined in your simulation wherein you are supposed to print out the sender and receiver's MAC address, the sequence number and the time stamp.
8. Redundant codes for the three vehicles are not accepted for this assignment. You need to implement your code through loops.

Required files to submit:

1- The code written in c++
2- The command line output of your simulation