

- Objectives

The objective of mine for this programming assignment is to enhance understanding of wireless network and accumulating experiences with developing functionalities of mobile wireless adhoc network(MANETs).

Mobile wireless adhoc network is a common and widely used network, I will specifically focus on the routing algorithms and I believe the ideas and insights of this lab will improve my understanding of wireless network.

- Part 1 Answers

1. Firstly, in the macro definition, TX_NEXT is defined as $(5000000 + \text{rand}() \% 5000000)$, and the purpose of defining this macro is to randomize the time interval between sending two frames.
Also, in the reboot_node function, there is a line 'srand(time(NULL) + nodeinfo.nodenum);', which will determine the seed of random function of each node based on their node number, and the purpose of this line is to ensure the generated sequence of random numbers for each node is distinct with others.
Based on the two lines mentioned above, the program can ensure each node will send frames with different random times, thus, there will be no collisions between frames.
2. No, there is no randomization for retransmitting frames. Speaking of the conditions of retransmission, the node which receive frame that is for other nodes will check if it is closer to the destination node compared with the original sender, and it will only retransmit the frame if it is indeed closer, so there is no randomization for the retransmission process itself (retransmissions are not happening randomly).
For the time of retransmission, the node who retransmit a frame will do that just after it receives the frame. Since the time of sending frames are randomized, time to receive any frames is also randomized, thus, as long as the node retransmit frame instantly after receiving it, there is no need to do a retransmission time randomization.
3. These lines will keep generating random numbers to be the destination, until the generated random number does not equal to the nodenum of the sender. The purpose of doing this is to ensure that each mobile node does not send frames to themselves.
4. The payload in each WLAN frame is 2304 bytes.
The mobile nodes will generate a new WLAN frame to transmit for every TX_NEXT $(5000000 + \text{rand}() \% 5000000)$ usecs.

5. (a) The purpose of this function call is to allocate memory for an array to record positions of each mobile node.
 (b) Each node will only call this function once, at the rebooting process.
 (c) There are two blocks of shared memory being allocated by all mobile nodes, one is 'stats' with $2 * \text{sizeof}(\text{int})$ (8 bytes), the other is 'positions' with $\text{NNODES} * \text{sizeof}(\text{CnetPosition})$.
6. In the topology file GEOROUTING, mapwidth and mapheight are both set to 400m, then the possible longest moving path is $\sqrt{400^2 + 400^2} = 565.6854\text{m}$.
 The WALKING_SPEED is 3.0, then the time interval for moving before entering the pause state is $565.6845 / 3.0 = 188.5615 \text{ sec}$
7. The purpose of this line is to ensure the randomly generated point will not exceed the boundary of the map.

- Design Overview

- Design of the program is based on the ideas of provided example program 'georouting'.
- Program assumes the address range of mobile nodes is [1-99] and the address range of anchor nodes is [100-199].
- Program assumes there are at most 15 mobile nodes and 15 anchor nodes.
- Program assumes there are two global environment variables 'mobiles' and 'anchors' defined in the topology file, which serve the purpose of recording addresses of mobile nodes and anchor nodes in strings.
- Mobile nodes will randomly select a node(except itself) to transmit a data frame.
- Mobile nodes will retransmit the received frames to the anchor nodes, if the frame is not for them and they are accessible to the anchor nodes.
- Mobile nodes will hear beacon from anchor nodes and record their positions.
- Mobile nodes will periodically hear from anchor nodes whether there is any stored retransmitted frame in the anchor node being requested.
- Mobile nodes will request to download stored frame if it is for it.
- Anchor nodes at most store 20 retransmitted frames.

- Project Status

The program is complete at this point, and it fulfills the requirements of the specification.

There are several difficulties I encountered when I was implementing functionalities of the program, the most significant one is the way MANETs works. I was firstly confusing about the reachability of signals sent from nodes, I thought only one node can successfully hearing the

signal sent from other nodes and in fact there is a misunderstanding. I finally found out any signals will be heard by all the nodes who are able to hear it, there is no such restriction of number of nodes hearing a signal.

This misinterpretation actually lead my design to an incorrect direction at first, and I need to revise lots of things when I finally found out this problem.

- Testing and Results

Testings of the program is done with the topology file 'TOPOLOGY', which is a topology file defined by myself. The topology file defines 5 mobile nodes, 1 anchor node, map area, and the global environment variables 'mobiles' and 'anchors'.

There is no obvious errors or unexpected phenomenons based on my testings and observations, all the nodes are working finely.

- Acknowledgement

The answers of part 1 are all my individual work without any external helps.
The design of part 2 is based on the ideas of given 'georouting' program.
Some Cnet APIs consults Cnet official documentation.

References:

CMPUT313 Eclass: <https://eclass.srv.ualberta.ca/course/view.php?id=67469>

Cnet Official Website: <https://www.csse.uwa.edu.au/cnet/index.php>