**VANET project report**

**COMP 6350 Lj Gao, Xy Wang, Yf Shi**

## Introduction

On the highway there race thousands of trucks every day. If there is a system that can control several trucks that have the same destination, it will reduce many trouble in the traffic. This project is to simulate an Ad Hoc Network (VANET) that can manage trucks on the road to move in a platoon.

We implement an efficient folding algorithm over a vehicular ad hoc network that can be used for trucks communication while moving, joining and leaving. In the simulation, 5 trucks will randomly locate on the road within the range of 350m. Then each truck will accelerate separately to catch up with its former truck to make sure their distance is between 10m to 20m. After all of trucks form a platoon, other trucks out of the network can join the network to reform a platoon or trucks in the network can choose to leave the network and other truck remained in the network will reform a platoon.

## Algorithms

This project consists of three pars; these are network layer, application layer and simulator layer.

The network layer is to implement flooding algorithm. Firstly, the truck checks its configuration file every 100ms and broadcasts its information with UDP datagram which mainly including the truck’s IP address, location, velocity, accelerate and so on. The network layer manages broadcast process. The package is send from original truck and will be delivered to the trucks which are within simulation wifi range. When one truck receives package from others, it will save this package and them broadcast the package to other truck within its wifi range. Using this flooding algorithm, after several broadcasts, the package will be delivered to any remote trucks in the network. In receiving process, the truck will detect several flags in the package to make sure this package will not be broadcast in network forever. Source IP address and sequence number are used to check whether the received package is new one. Or it will be dropped.

In the application layer, each truck will detect its situation and move automatic to make truck form a platoon. In order to control truck precisely, there are several states to figure out trucks. At the beginning, all the trucks are in state 1 when each truck will firstly accelerate and then slowdown in order to approach the front truck. This process will be executed from the last one to the former one in turn. When all truck ensure the distance from its former truck is 10m to 20, they form a platoon and state changed to 3. If a new truck wants to join platoon, its’ state will be set as 4. No matter where the truck is, but within network range, this truck will also endure accelerate and slowdown process and then stop in the first of platoon. In leaving process, the leaving truck will be set as state 5. It will broadcast its leaving alert and then leave the platoon and network. When detect the leaving message, the truck in the back of leaving truck will accelerate to adjust the distance to the front truck.

The simulation layer is simple to simulate truck moving process, calculate new position and velocity in next time. It is executed with application layer in order to control trucks.

## Performance

In general, with several tests, truck can move exactly at will in simulation. It will first form a platoon in 1 minute and complete join and leaving process. Truck’s basic information such as location, velocity and so on will be print on the screen during 5 minutes presentation. However there are several flaws when simulation. Because of conflict between read and write, some of package cannot be written into configuration file and some of information will be missed to print on screen. But they are seldom happened. Some of experimental performance is showed in details in following.

**Average throughput**

The throughput is various in different situations. For example, throughput will larger when there are more trucks in network, because more packets need to be delivered. In a stable network, the truck in center of network has lager throughput than the truck in the edge, because center truck needs to transmit packet from former truck to another. The figures below show average throughput proprieties.





**Packet loss**

There is attenuation when signal transmit. In simulation, we suppose packet loss according to distance between trucks, even though the packet is transmit based on wired line. To simplify the model, we set that the packet will be received successfully within the range of 150m. while if distance between trucks beyond 1500, packet cannot be delivered.



**End to end latency**

Truck’s message is not be received by others immediately, but latency when transmit and process. To calculate end to end latency, we send a unique bit in packet and record time at present. If truck received this unique flag, it wills response to original truck. When original truck receives response, the delay time is half of the delivery interval.

In our simulation, the end to end latency is almost steady. It seldom changed with number of trucks in network, because most of latency is caused by process delay not propagations delay.



## Conclusion

The project was completed according to the requirement. Trucks can move automatic to form a platoon. Joining and leaving process are also completed and any trucks can join or leave after platoon was run stably. In this project, we have learnt lots of knowledge. Not only algorithm in network layer but also java architecture. Much knowledge I learnt in the past is practiced in the project and it will be useful in my following courses.