Review Paper on Network Coding Based Reliable Anycast Routing Protocol for VANET

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Abstract - A Vehicular Ad-hoc Network or VANET is a technology that uses moving cars as nodes in a network to create a mobile network. Communication typically over the Dedicated Short Range Communication at 5.9 GHz frequency. Mobile Ad-hoc Network routing protocols such as AODV,DSR etc. fail in scenario in which no contemporaneous path exists between source and destination because they try to find end-to-end path before data transmission which is not exist in VANET which increase delivery delay and decrease delivery ratio. So VANET uses 'store-carry-forward' paradigm. In network coding, source node or intermediate node allows to combine number of packets it has received or generated into one or several outgoing packets. Reliability is one of the issue. Network coding is a tool for optimization in which node is allowed to combine and encode one or more input packet instead of directly forwarding them, In these paper we reviews basic Linear network coding variants with their performance benefits and theoretical results. We also reviews Random Linear Network Coding (RLNC) variants called g by g and RLNC with MGM. We compare the performance of each.

Keywords- VANET, Network Coding, MGM, Anycasting, Routing.

I. INTRODUCTION

A vehicular ad hoc network(VANET) uses cars as mobile nodes in a MANET to create a mobile network.A VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 metres of each other to connect and, in turn, create a network with a wide range. As cars fall out of the signal range and drop out the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created. It is estimated that the first systems that will integrate this technology are police and fire vehicles to communicate with each other for safety purposes[1].VANET will form the biggest ad hoc network ever implemented, therefore issues of stability, reliability and scalability are of concern.VANET therefore is not an architectural network and not an ad hoc network but a combination of both, this unique characteristic combined with high speed nodes complicates the design of the network[2].In these networks have no fixed communication structures, due to dynamic network topology, frequent disconnected networks, varying communication conditions and hard delay constraints VANETS can be distinguished from other kind of ad hoc networks. There are number of different applications provides by VANET such as e-Safety, traffic management, driver comfort support, maintenance, media services, gaming, e-shopping, crime investigation, defence, Enhanced driver support applications and so on. Many VANET applications need anycast service. For example, Vehicle on road may send the packet requiring optimal route to destination, traffic information, weather information, gas station or restoration location to one of the server on road side ,it is necessary to transmit information from a server to a vehicle or vehicle may transmit information packet regarding accident to one of the server like as ambulance or emergency service providers. Traditional anycast methods proposed for the internet or mobile ad hoc networks are not suitable for VANET, due to the challenge of frequent network partitions. Data transmissions suffer from large end-to-end delays along tree because of the repeted partitions due to frequent disconnections. also these approach may fail to deliver a message when the possibility of network unavailability is high. To increase chance of delivery and to reduce delivery delay, routing approaches in VANET make multiple copies of a packet in the network.

Organization of the Paper

The work of this phase is presented in five sections. Section 2 talks about Linear Network coding method, its Applications and Benefits. Section 3 present the importance of Network Coding with Multi Generation Mixing. Section 4 will give detail about anycasting and its basics and usefulness in VANET routing protocol. Section 5 represent the Conclusion.

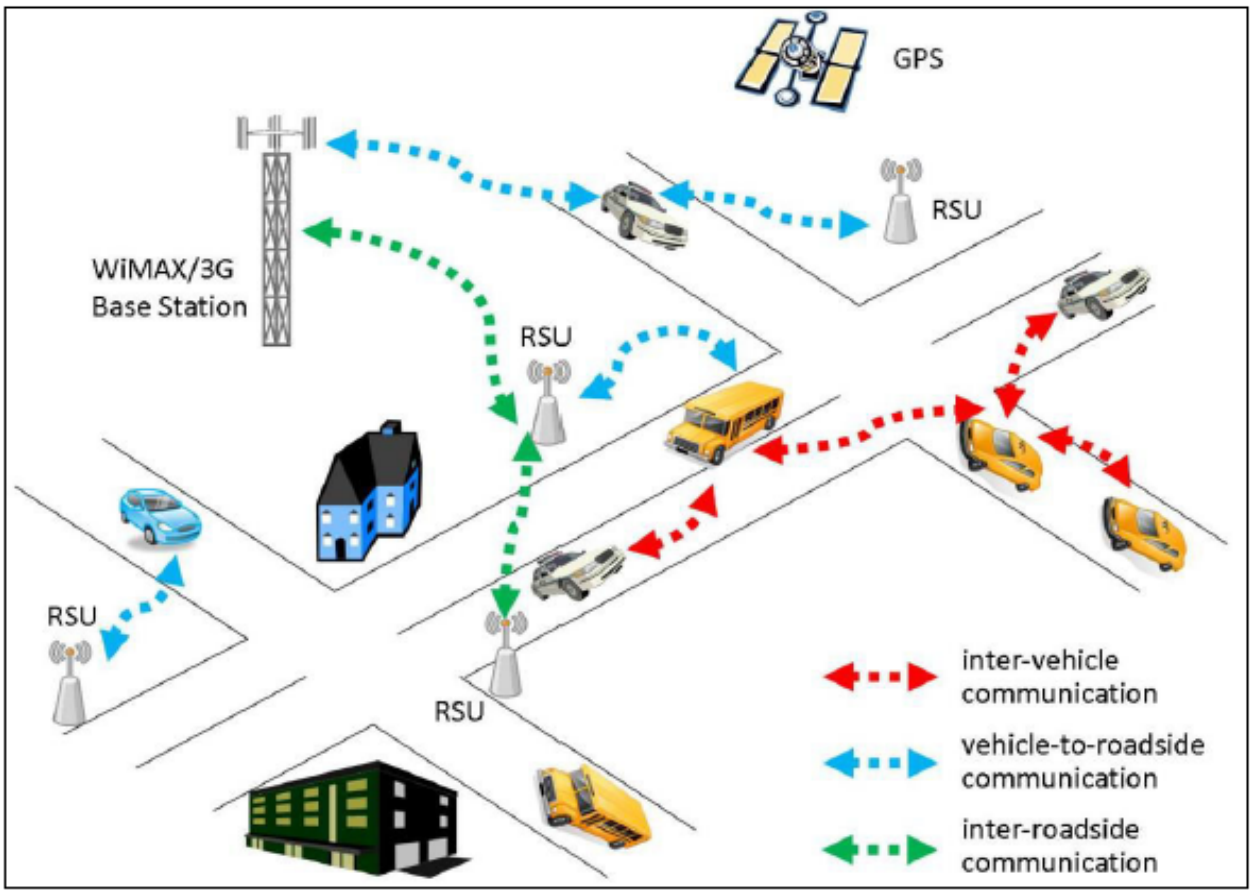

Fig.1 Architecture of VANET[4]

II. NETWORK CODING

Network coding is a recent field in information theory in which, instead of simply forwarding data, nodes may recombine several input packets into one or several output packets. A simple example in a wireless context is a three node topology shown in figure.2 Linear network coding, in general, is similar to this example, with the difference that the xor operation is replaced by a linear combination of data. this allows for a much larger degree of flexibility in the way packet can be combined, network coding is a best suited for environment where only partial or uncertain information is available[5].

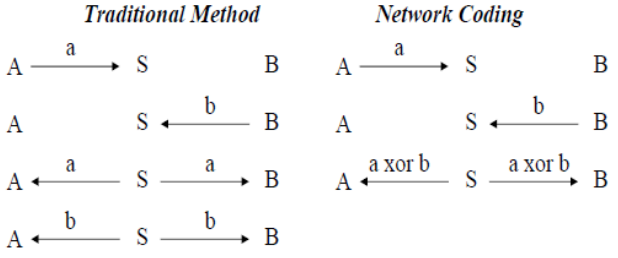

Figure.2 A simple network coding example [5]

Above example shows that Nodes A and B want to exchange packets via an intermediate node S(wireless base station).A[resp.B] will send a packet a[resp.b] to B. which then broadcasts a xor b instead of a and b in sequence. A and B both can recover the packet, while the number of transmission is reduced. Network coding is suited for environment where only undefined or incomplete or uncertain information is available [5].

Network coding need to use algebraic nature of data.These is three well known application of network coding in overlay networks: distributed storage system, content distribution and layered multicast. There are two types of network coding. Deterministic Linear Network Coding (LNC) and Random Linear Network Coding (RLNC).In traditional network, relay node or router simply forward the information packet destined to other node. In LNC, source node or intermediate node or router allows to combine number of packets it has received or generated into one or several outgoing packets, where addition and multiplication are performed over the field GF_2^8[6].

Benefits of Network Coding

- Throughput Gain in Static Environment
- Robustness and Adaptability

Applications of Network Coding

- P2P File Distribution
- Wireless Networks
- Ad-Hoc Sensor Networks
- Network Tomography
- Network Security

III. NETWORK CODING WITH MULTI GENERATION MIXING(MGM)

Network Coding with Multi-generation mixing (MGM) is a RLNC approach which improves the performance without increasing buffer size. In MGM mixing set of size m generations can be coded together. A new set of generation packet is mixed with previously transmitted generations. In MGM, N packets are grouped into generations where the size of each generation is k packets. Each generation is assigned sequence number from 0 to N/K.In G-by-G Network coding encoding is allowed amongst packet belonging to the one generation. Each mixing set has an index M.Generation i belongs to mixing set with index M=i/m.Each generation in mixing set has a position index. Position index (1) of generation i in a mixing set of size m is i mod m.G-by-G Network coding is a special case of MGM where m=1.In MGM packets of different generations are encoded together. when node send a packet belonging to generation i with position index 1on mixing set, that node encode all packet that are associated with the generation of same mixing set and have the position indices less than or equal to 1 as shown in Figure.3 [7].

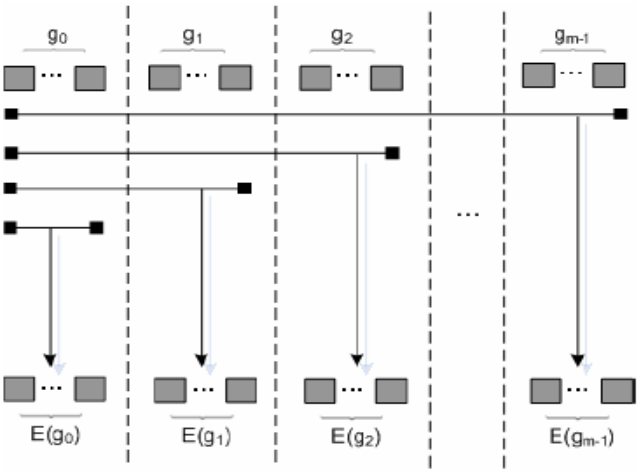

Figure.3 Network Coding with MGM, each generation is encoded with previous generations in mixing set [7]

Size of encoding vector depend on the number of packets encoded together at sender node. Number of packets that are encoded together depends on the position index of the generation with which packet is associated. Packet in generation with position index 1 have the size of encoding vector is (1+1)k. So sender will generate (1+1)k independent packets. In Network coding with MGM goal is to enhance decidable rates in situation where losses prevents efficient propagation of sender packets.MGM allows the cooperatives decoding among the different generation of a mixing set which enhance decidability. Compare to G-by-G network coding with MGM extra encoded packets associated with generation protects more than one generation. Computational overhead is incurred at intermediate node to check the usefulness of received packets and at receiver node to decode received packet [8].

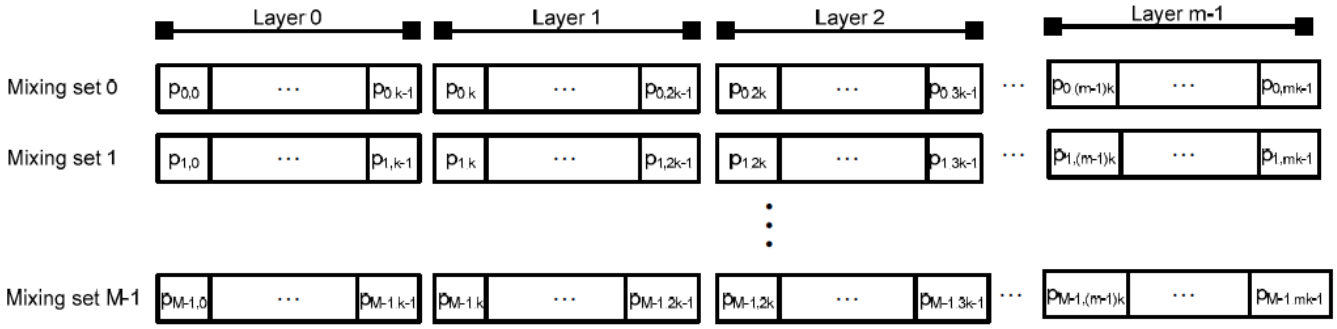

Figure.4 Generation's partitioning with MGM into different layers of priority. Mixing set size is m, generation size is k [9]

In G-by-G Network coding computation are performed on packets within the generation so it is fixed due to fixed generation size. But in MGM encoding/Decoding is performed on packets belonging to at least one generation in mixing set and so computational overhead is not fixed. In MGM in case generation is unrecoverable due to the reception of insufficient encoding ,it is still possible to recover that generation collectively as a subset of mixing set

generations. Packets received with generation of higher position indices have information from generation of lower position indices in the same mixing set. Redundant encoded packets enhance the reliability of communication. With MGM extra packets protects all generations with lower position indices. While in G-by-G network coding extra packets that generation only.

In MGM there are different options for sending extra packets. One option is distribute the packets over all generations of mixing set. Another option is to send extra encodings with the last generation of mixing set. So, extra encodings protects all mixing set generations.

IV. ANYCASTING

Anycast is a network addressing and routing methodology in which datagram from a single sender are routed to the topologically nearest node in a group of potential receivers, though it may be sent to several nodes, all identified by the same destination address.[10].

There are four kinds [12] of datacasting schemes: unicast, multicast, broadcast, and anycast. Besides the one-to-one, one-to-many, and one-to-all modes of packet delivery,

Anycast provides one-to-any service. In the anycast mechanism, service providers are assigned a single anycast address within an anycast group. When a client sends packets to an anycast server by an anycast address, routers will attempt to deliver the packets to a server which matches the anycast address. The source node does not need to care about how to pick the closest destination node.

Anycast [11] is a service that allows a node to send a message to at least one, and preferably only one, of the members in a group. The idea behind anycast is that a client wants to send packets to any one of several possible servers offering a particular service or application but does not really care any specific one. Anycast can be used to implement resource discovery mechanisms which are powerful buildings block for many distributed systems, including file sharing etc.

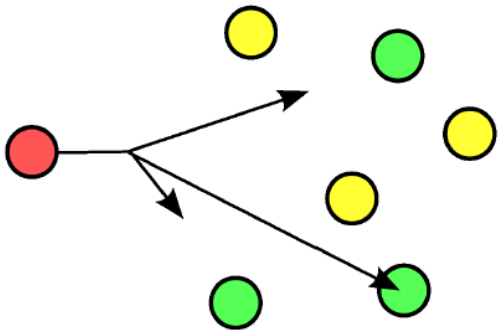

Figure.5 Anycast Network Topology[10]

Anycast in DTNs means that a node wants to send a message to any one of a destination group and intermediate nodes help to deliver the message by leveraging their mobility when no contemporaneous path exists between the sender node and any node of the destination group. A typical scenario, shown in Fig.5, is in a park, people cluster to watch some musical performances and they want to share and search music files at the same time. People in different clusters may be disconnected while people or cars moving between clusters can act as carriers to deliver messages. Anycast can be used to find a person who owns a certain file. Moreover, DTN anycast can be used in a disaster rescue field, in which people may want to find a doctor or a fireman without knowing their IDs or accurate locations. In anycast, the destination can be any one of a group of nodes. Thus during the routing, both the path to a destination group member and the destination of the anycast message can be changed dynamically according to current vehicle movement situation[11].

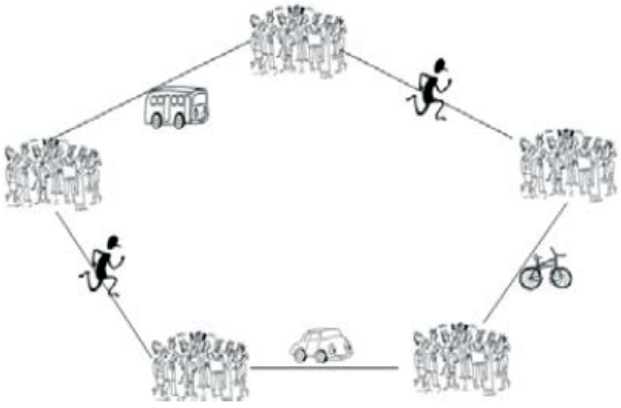

Figure.6. A typical scenario of DTNs. People clusters and cars, buses or other people moving among the clusters can act as carriers to deliver messages[11]

Various methods have been proposed for anycasting communication. These techniques can be classified mainly into two groups:

1.Anycasting in the application-layer

2.Anycasting in the network layer

Application-layer anycasting include research on the model of anycast communications and selection strategy of the target site. Network-layer anycasting is mainly composed of the routing table and routing algorithm in communication [13].

Application of Anycasting

- Domain Name System
- IPv6 transition
- Content delivery networks
- Security

V. CONCLUSION

Due to dynamic network topology and frequent disconnected networks, VANET requires different routing strategy than other Ad-Hoc networks. Many VANET applications need anycast service. To improving reliability without impacting performance, network coding with multi generation mixing is used [3] in that there is a problem of overhead of packets in terms of generation size and mixing set size. So we can work upon that to find optimal mixing set size and generation size as a function of meeting rate, delivery delay and delivery ratio empirically and analytically

REFERENCES

[1] Wikipedia, ”Vehicular ad-hoc network”, http://en.wikipedia.org/wiki/vehicular_ad hoc_network.

[2] M.A.A.GhassanM.T.Abdalla,S.M.Senouci,”Current trends in vehicular ad hoc networks”,Tech.Rep.

[3] Zunnun Narmawala,Ankit Patel,”Network Coding With MGM based Anycast Packet Transmission in Vehicular Ad-Hoc Networks”,IJCST Vol.4,Issue 2,April-June 2013.

[4] Bhuvaneshwari.s, Divya.G, Kirithika. K.b, Nithya.s ”A Survey On Vehicular Ad-Hoc Network”, IJAREEEIE Vol 2,Issue 10,October 2013.

[5] Christina Fragouli, Jean-Yves Le.Boudec,”Network Coding:An Instant Primer”,ACM SIGCOMM Computer Communication Review,Volume 36,January 2006.

[6] C.Fragouli and E. Sojanin, ”Network Coding Applications”, Tech. Rep., Foundations and Trends in Networking Vol.No.2,2007.

[7] H. R. Mohammed Halloush, ”Network Coding with Multi-Generatin Mixing: A Generalized Framework for Practical Network Coding” ,Tech. Rep., IEEE Transactions on wireless Communications, Vol. 10,No. 2,February 2011.

[8] H. R. M. Halloush, ”A Case Study of: S ender Transmission Reliability and Complexity Using Network Coding with Multi-Generation Mixing,”Tech.Rep.,2009.

[9] H. R. Mohammed Halloush, ”Performance Evoluation: Priority Transmission using Network Coding with Multi-Generation Mixing”, Tech. Rep., ICC Proceedings,2009.

[10] Wikipedia,”Anycast”,http://en.wikipedia.org/wiki/Anycast.Wikipedia.

[11] Yili Gong, Yongqiang Xiong, Qian Zhang, Zhensheng Zhang, Wenjie Wang,and Zhiwei Xu1,”Anycasting Routing in Delay Tolererant Networks”,

[12] S. C. Chen, C. R. Dow, S. K. Chen, J. H. Lin, and S. F. Hwang,”An Efficient Anycasting Scheme in Ad-hoc Wireless Networks”,© 2004 IEEE

[13] [13].Chun zhu, Min jin,”An Anycast Routing Algorithm Based on Genetic Algorithm”, WSEAS TRANSACTIONS on COMPUTERS, Issue 1, Volume 8, January 2009