

# Peer To Peer Content Distribution Using Network Coding in Vehicular Ad-hoc Network

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## Abstract:-

*Distribution of data items such as pictures, audio files, video files and other information through Vehicular Ad-hoc Network (VANET) is a major challenge now-a-days due to network dynamics and high speed mobility. In last few years peer-to-peer (P2P) content distribution technology has been used in various applications for data distribution. Reliability, security and faster communication time are major challenges when P2P content distribution technology is used in VANET for inter vehicle communication. Effective mechanisms are needed for reliable and secure communication with faster communication time. This paper proposes a scheme that uses network coding, homomorphic hash function for reliable and secure communication by making changes in existing AODV protocol which will possibly improve the quality of communication.*

**Keyword:** Network coding, VANET, vehicle to vehicle (V2V), peer-to-peer content distribution, AODV.

## I. INTRODUCTION

The deployment of vehicular communication networks also known as VANET, offers new

opportunities for content and information sharing among vehicles. Vehicles can record and exchange information relevant to safety applications, e.g., notification of accidents or the presence of an immediate danger on the road, or exchange entertainment content, e.g., video sharing. In VANETs wireless-equipped vehicles form a network spontaneously while travelling along the road. Vehicles on the road can communicate with other vehicles on the road, called pure vehicle to vehicle (V2V) communication, and vehicles can communicate with roadside equipments, called vehicle to infrastructure (V2I) communication [1]. Inter-vehicle communication (V2V) system is a promising solution for future communication scenarios that takes place between two vehicles moving on the road. The moving vehicles are expected to organize themselves locally in ad hoc networks without any pre-installed infrastructure. However the problem of providing secure and reliable communication between two vehicles is still being addressed.

The peer-to-peer (P2P) content distribution technology has been successfully used in file sharing, live multimedia streaming and distributed storage and in many other applications for last few years. Compared with traditional Internet technologies, P2P content distribution system is

highly scalable and extensible. Recent work in mobile peer-to-peer networks focuses on the inter vehicle communication without using a centralized server, or the infrastructure. In P2P content distribution system, a source file is divided into segments and any peer can download segments from other peers. Nodes participate actively in the communication process by relaying packets and generating new information so that the download time is reduced. The main idea is to apply network coding as transmission technique to increase the performance of the system and to reduce the coordination of the vehicles participating in this ad-hoc formed communication network.

When network coding scheme is used in VANET for P2P content distribution, the content is divided into smaller blocks and the nodes linearly encode their constituent blocks. The resultant is then shared amongst the neighbouring nodes [2]. In this scheme each node acts as a router and forwards the packet to its neighbouring node that reduces the total time to download the content. If network coding is used for P2P content distribution, when one communicating node is disconnected during the transfer of the data, the receiving node can still download the segments from another peer as all the packets are combined at each node.

Another problem with P2P content distribution is of security. Malicious user can also corrupt the contents when two peers are communicating with each other. Reliable mechanism is required for secure communication. One possible solution is to use homomorphic hash function. In this scheme each node checks for bad blocks infrequently. Even though all checks for malicious block, at any point in time if a node finds a corrupted block it alerts the rest of the nodes about it. When network coding and homomorphic hash function are used in combination it will provide both reliability and

security. If any receiving node finds any corrupted node it will alert other nodes about it and starts receiving the same block from other nodes that is encoded by network coding.

Another problem with P2P content distribution scheme for VANET is of classification of useful information and entertainment data. This problem can be solved by using relay network coding technique. If information like accident on the lane needs to be transmitted, it must be transmitted to all the communicating nodes so 1-bit is attached with the segment that is being transmitted otherwise 0-bit is transmitted so that only the receiving node downloads all the segments from the other nodes.

## II. RELATED WORK

There are various mechanisms available for content distribution in VANET. The R2D2V (RNC-based Regional Data Distribution on VANETs) continuously provides location-dependent information generated by vehicles to other vehicles being driven near the birthplace of data item with shorter delay and low data delivery traffic. This technique uses the random network coding that ensures the reliability but does not address the problem of security and classification of information [3].

Another mechanism known as CCSDV (cooperative content distribution system for vehicles) is based on network coding, vehicle's access point contact prediction and data-prefetching techniques. CCSDV uses network coding to distribute encoded data for the effective sharing of popular contents. It predicts the vehicle's future contact access points before vehicle's arrival. This mechanism is effective in many scenarios like increased delivery throughput and reduced traffic load [4]. Problem with this mechanism is structure of contact map must be

maintained distributedly on each access point. To predict the potential vehicle access point contacts. Problem of security is also not being addressed by this mechanism. Malicious user can corrupt the data blocks when is delivered to node by access point. This mechanism also requires a large amount of investment for deploying Wi-Fi access points.

In Park Cast mechanism parked vehicles with wireless device and rechargeable battery, can communicate with any vehicles driving through them. This reduces the investment cost that is needed for deploying Wi-Fi access points. To each road, parked vehicles at road side are grouped into a line cluster as far as possible, which is locally coordinated for node selection and data transmission. Such a collaborative design paradigm exploits the sequential contacts between moving vehicles and parked ones; implements sequential file transfer, reduce unnecessary messages and collisions, and then expedite content distribution greatly [5]. Problem with this mechanism is of security and reliability. Malicious user can corrupt the contents during the transmission between road side parked vehicle and vehicle that is moving on the road. Problem of reliability occurs when and parked vehicles moves out from its position, transmission of data can not be completed.

Another mechanism for P2P content distribution in VANET is Road Cast which is based on popularity aware content sharing scheme. This mechanism ensures popular data is more likely to be shared with other vehicles so that the overall query delay and the query hit ratio can be improved. Road cast consists of two components called popularity aware

content retrieval and popularity aware data replacement. The popularity aware content retrieval scheme makes use of Information Retrieval (IR) techniques to find the most relevant and popular data towards user's query. The popularity aware data replacement algorithm ensures that the density of different data is proportional to their popularity in the system steady state, which firmly obeys the optimal "square-root" replication rule [6]. This mechanism does not use network coding scheme so the communication is not reliable. Problem of security is not being addressed by this mechanism.

### III. Problems Unrevealed:

There are two different ways to distribute contents in VANET. First one uses road side infrastructure and Wi-Fi access points and another technique uses peer to peer content distribution. The major problem in P2P content distribution is of reliability. If any communicating node is disconnected during the transmission of data, receiving node gets the corrupted block of data and hence whole file gets corrupted so such mechanism is needed that ensures the reliability of communication. Another problem with this technique is of security. When data blocks are transmitted from one peer to another peer, malicious users can access data blocks and corrupt the data blocks so that receiving node gets the bad data block and whole file gets corrupted so some security technique is required that ensures the integrity. Another problem is to decide whether the data block contains entertainment data or secure data. This improves the reliability of communication and also reduces the download time for data transmission.

#### IV. proposed system:

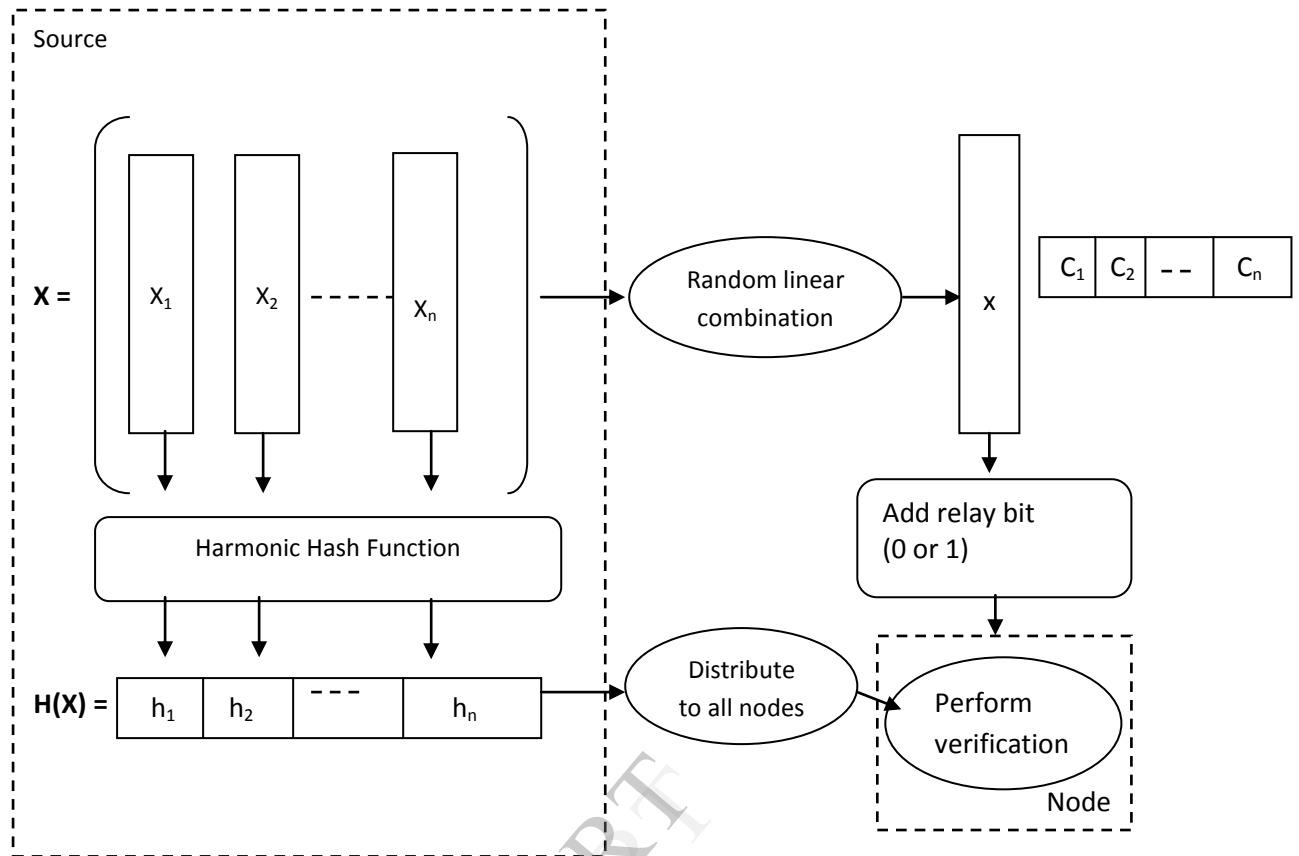


Fig. 1:- proposed system for peer-to-peer content distribution in VANET using network coding and harmonic hash function.

In this paper we mainly focus on how content are reliably and securely distributed in VANET.

First issue that need to be addressed for VANET is reliability. In peer-to-peer content distribution, if any communicating node is disconnected during the transmission of data, receiving node gets the corrupted block of data and hence whole file gets corrupted. This problem can be solved using network coding techniques. Our proposed system uses linear network coding technique that generates the random linear combination of data blocks. In this technique, at the seed node, a file  $X$  is divided into  $n$  pieces  $X_1, X_2 \dots X_n$ . Here, node exchange coded frames instead of file pieces. Coded frame can be defined as the linear combination of file pieces. That is  $C = \sum_{k=1}^n e_k x_k$  where  $e_k$  is an arithmetic function. Whenever the seed node is requested to exchange a coded frame, the node

transmits a newly generated coded frame  $C$  and when generating a new frame  $C$ , each  $e_k$  is drawn randomly hence the combinations are known as random linear combination. When a node receives a data block it encodes the block and forward this block to 1-hop neighbouring node so when one node gets disconnected during transmission, receiving node gets the same data block from another node. This technique solves the problem of reliability.

The problem of security in P2P content distribution can be solved by Harmonic Hash Function. A hash function  $H$  is applied to each block when the file is divided in various blocks to obtain hash values  $h_1, h_2 \dots h_n$ . These hash values are distributed to all the nodes reliably in advance. After receiving a coded block  $x$ , which is linear combination of original  $n$

blocks with co-efficient  $c_1, c_2 \dots c_n$ , a node will be able to verify the integrity of  $X$  using  $x, C$  and the hash values making the use of homomorphic property of  $H$ .

Generally when we send the packet, we apply the network coding on every data block and send it to another node. But in this mechanism we apply the network coding when we want. For example if we want to send secure message to other node than we first apply the network coding and also mention 1-bit on header part and after that send it to other node. The other nodes will receive the data and watch if it contains the 1-bit in header part than it also apply the network coding on that data. This process continuous until all nodes receives the data block and if data blocks contains is entertainment data like after 1 km there is a good hotel than the sender add 0-bit on header part that means network coding is not needed, its not a secure data. This kind of data is broadcasted. The other nodes receive the data and watch the header file if it is 0 than it simply pass it to other. This provides the reliability in the communication and also reduces the processing time for a data block.

## V. Conclusion:

As the Vehicular ad-hoc is a new area of research and development, developing a system that provides both reliability and integrity of data block with lower processing time is a major challenge now-a-days for inter vehicle communication. The proposed system ensures the reliability and integrity of data blocks using network coding and harmonic hash function for peer to peer content distribution technique between two vehicles moving on the road. This system also reduces the processing time required for each data block using relay bits technique.

## VI. REFERENCES

- [1] Aswathy M C1 and Tripti C2 "A Cluster Based Enhancement to AODV for inter-vehicular communication in VANET" International Journal of Grid Computing & i2012
- [2]ShabbirAhmed,SaliI.S.Kanhere "VANETCODE: Network Coding to Enhance Cooperative Downloading in Vehicular Ad-Hoc Networks" *IWCMC'06*, July 3–6, 2006
- [3] Naruhiro Kusumine ,Susumu Ishihara "Abiding Regional Data Distribution using Relay and Random Network Coding on VANETs" 2012 26th IEEE International Conference on Advanced Information Networking and Applications
- [4] Da Zhang, Chai Kiat Yeo "A Cooperative Content Distribution System For Vehicles" IEEE 2011
- [5] Nianbo Liu\_, Ming Liu\_, Guihai Cheny, Jiannong Caoz "The Sharing at Roadside: Vehicular Content Distribution Using Parked Vehicles" The 31<sup>st</sup> Annual IEEE International Conference on Computer Communications : Mini Conference,IEEE 2009
- [6] Yang Zhang, Jing Zhao and Guohong Cao Roadcast: A Popularity Aware Content Sharing Scheme in VANETs
- [7] Qiming Li, John C.S. Lui, Fellow, IEEE, and Dah-Ming Chiu, Fellow, IEEE "On the Security and Efficiency of Content Distribution via Network Coding", IEEE TRANSACTIONS ON DEPENDABLE AND SECURE COMPUTING, VOL. 9, NO. 2, MARCH/APRIL 2012
- [8] Yi Yun-hui, Wang Run-liu "The Research of Network Coding Algorithm in P2P Content Distribution System"International Conference on Computer Science and Electronics Engineering IEEE 2012
- [9] Xiaoli Wang, Qun Zhao, Yongsheng Zhang "Efficient Peer-to-Peer Content Distribution Using Network Coding",IEEE 2011

- [10] Maryam Hosseini Sohei, Ali Movaghar Najmeh Sadat Bathaee “Utilizing Network Coding for File Dessimination in Peer-to-Peer Systems” IEEE 2009
- [11] Qing Wang, Pingyi Fan, Seand Khaled Ben Letaief, “On the Joint V2I and V2V Scheduling for Cooperative VANETs With Network Coding” IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 61, NO. 1, JANUARY 2012
- [12] Uichin Lee, JoonSang Park, Joseph Yeh, Giovanni Pau, Mario Gerla “CodeTorrent: Content Distribution using Network Coding in VANET\_” ACM 2006
- [13] Nadia N. Qadri, M. Fleury, M. Ghanbari “Approaching P2P Communication in a Vehicular Ad Hoc Network ” IEEE 2009

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