AN OPTIMAL DATA DISTRIBUTION SCHEME FOR VEHICULAR COMMUNICATION USING ROFF AND TMC PROTOCOLS

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Abstract- Vehicular Ad hoc Network (VANET) is constructed with vehicles and road side infrastructures. Vehicle location and speed information are continuously collected to manage the VANET communication. Multi hop broadcasting schemes are used to disseminate safety messages. Forwarder node manages the data transmission process in multi-hop broadcasting protocols. Forwarder node selection process is carried out with reference to the waiting time details. Robust and Fast Forwarding (ROFF) protocol solves the unnecessary delay and collusion issues in data dissemination process. Empty Space Distribution (ESD) bitmap describes the distribution of empty spaces between vehicles. A forwarder candidate acquires its forwarding priority using the concept of ESD bitmap. Collisions are avoided by control the waiting time differences than the predefined lower bound. The Robust and Fast Forwarding (ROFF) protocol is integrated with Trajectory based MultiCast (TMC) protocol for data dissemination process.

Keywords: VANET, Multicasting, ESD map, ROFF,TMC

I. INTRODUCTION

Resent advances in short-range radio technology such as Dedicated Short Range Communications (DSRC) for inter-vehicle communications have driven significant efforts in investigating and developing vehicular networks. By sharing information among moving vehicles, a vehicular network can support a wide variety of real-world applications, including emergence alert [3], advertisement, file sharing [4], [5], data collection [6], etc.A lot of safety applications over vehicular ad-hoc networks (VANET) rely on emergency message dissemination (EMD) through multi-hop broadcast. In EMD, a certain vehicle (i.e. source) issues an emergency message when a dangerous situation such as vehicle collision has been detected. Since the emergency message includes time-sensitive life-critical information, it should be disseminated to all vehicles in the target region as quickly and reliably as possible. Commonly, the target region is a road segment that is up to several kilometers long in the opposite direction of the source. Since the one-hop communication range of a source cannot cover the target region fully, multi-hop broadcasting should be used to disseminate the emergency message [1]. Until now, many broadcast schemes have been proposed to meet the requirements on the timeliness and reliability of EMD. The reliability can be improved by retransmitting the original copy of the emergency message or removing interference from hidden nodes [2], [3]. However, retransmissions and control messages exchanged for the interference avoidance increase the latency of the message dissemination. Apart from reliability issues, for fast message dissemination, the vehicle (called farthest vehicle) farthest from a forwarder in the message dissemination direction should be designated as a next forwarder. However, since the farthest vehicle can fail to successfully receive the message due to an inherently lossy wireless channel, the explicit designation of the farthest vehicle as the next forwarder may cause the multi-hop forwarding to be suspended. In most forwarding mechanisms [1], [4], therefore, vehicles (called forwarder candidates) which have received the broadcast message and are farther away from the previous forwarder
contend to become a new forwarder in a distributed manner.

The common idea behind existing forwarding mechanisms is to differentiate each waiting time (WT) of forwarder candidates. The waiting time ranges from 0 to the predefined upper bound (PUB). A forwarder candidate selects a point in the time range and uses it as the waiting time. In particular, in order to maximize the hop progress of the message in each forwarding, each forwarder candidate uses its waiting time that is inversely proportional to the distance from itself to the previous forwarder. Hence, the farthest forwarder candidate uses the shortest waiting time and then forwards the message first. The other forwarder candidates detect the transmission from the newly selected forwarder and suppress their scheduled transmissions. We reveal two problems of existing fast forwarding schemes in this paper. First, existing schemes tacitly assume the perfect suppression of redundant transmissions, which means that all forwarder candidates can successfully receive the message from FFC within their waiting times. However, due to the short difference between waiting times of forwarder candidates, some forwarder candidates may start their transmissions before detecting the transmission from FFC and such redundant transmissions can collide with the transmission from FFC.

II. PROBLEM STATEMENT

Many broadcast schemes have been proposed to meet the requirements on the timeliness and reliability of EMD. The reliability can be improved by retransmitting the original copy of the emergency message or removing interference from hidden nodes. Retransmissions and control messages exchanged for the interference avoidance increase the latency of the message dissemination. Apart from reliability issues, for fast message dissemination, the vehicle farthest from a forwarder in the message dissemination direction should be designated as a next forwarder. Since the farthest vehicle can fail to successfully receive the message due to an inherently lossy wireless channel, the explicit designation of the farthest vehicle as the next forwarder may cause the multi-hop forwarding to be suspended. In most forwarding mechanisms, vehicles have received the broadcast message and are farther away from the previous forwarder contend to become a new forwarder in a distributed manner. Eventually, the forwarder candidate (farthest forwarder candidate(FFC)) farthest from a forwarder is opportunistically delay its forwarding necessarily for a long time even though there is no vehicles farther than itself when it becomes FFC.

Since retransmission can help to increase the reliability of dissemination, each of contention for transmission should be completed as quickly as possible in order to minimize the latency of the overall dissemination process.

First, existing schemes tacitly assume the perfect suppression of redundant transmissions, which means that all forwarder candidates can successfully receive the message from FFC within their waiting times. Due to the short difference between waiting times of forwarder candidates, some forwarder candidates may start their transmissions before detecting the transmission from FFC and such redundant transmissions can collide with the transmission from FFC. The waiting time difference between two forwarder candidates is affected by PUB and the difference between distances from the previous forwarder to the forwarder candidates. The distance difference depends on the spatial vehicle distribution. In addition, under a given distribution of vehicles, a smaller PUB allows the next forwarder to be selected earlier, but results in a higher probability of collisions caused by the short waiting time difference. Existing schemes simply regard PUB as a system parameter without considering the relationship between the selected PUB and collision probability (CP) under dynamically changing vehicle distributions. Second, the vehicle distribution is not uniform and continuously changing due to dynamic VANET traffic conditions. Various scales of empty space with no vehicle can be present between vehicles. Two vehicles separated by a large empty space, one closer to the previous forwarder should

III. RELATED WORK

Information and message exchanges through multicast, where packets are sent from one sender to a group of receivers, have gained popular use and serve as a crucial routine operation in vehicular networks. For example, the taxis in a city may form an information network where each taxi may collect various types of information such as road surface condition, road closure status due to maintenance and traffic accidents. For more efficient information dissemination, a taxi can subscribe for some types of information of its interest, while a vehicle that collects the relevant information can serve as a source to disseminate the collected data through multicast to the group of subscribers.

Different from conventional communication networks, vehicular networks exhibit many unique characteristics, which pose several great challenges to efficient multicast. First, as vehicles may distribute over a vast area, the number of vehicles in a given region can be very limited. Therefore, a vehicular network can be sparse and resemble a delay tolerant network (DTN) that relies on the “carry-and forward” paradigm to exchange information among vehicles. In a sparse network, it is very difficult to find a connected path between any pair of vehicles. Second, as two vehicles can communicate only when they encounter, the encounter opportunities become the critical network resources, which are usually scarce. This makes it necessary for a multicast approach to be cost efficient. Finally, there is great uncertainty with vehicle nobilities, which makes it difficult to predict the future location of a given vehicle. Joon Ahn, Maheswaran Sathiamoorthy, Bhaskar Krishnamachari, are proposed as a first step towards understanding the potential benefits of using delay-tolerant networks to offload the cellular networks, we scope our research interest only to highly mobile vehicular networks. Particularly, we consider the problem of efficient dissemination of some delay-tolerant content to a group of vehicles that share an interest in this content. The delay-tolerant contents can support a variety of services, ranging from traditional traffic information and weather forecast to futuristic mobile advertisement and music sharing. Such applications/ services have been envisioned by industry as a key driving force for future vehicular networks.

IV. PROPOSED WORK

The Robust and Fast Forwarding (ROFF) protocol is integrated with Trajectory based Multicast (TMC) protocol for data dissemination process. Message Forwarding Metric is applied to select the forwarder node with capability factors. Data dissemination process is improved with security and replica features. Network connectivity information is managed with vehicle trajectory information.

Multicast is a crucial routine operation for vehicular networks, which underpins important functions such as message dissemination and group coordination. As vehicles may distribute over a vast area, the number of vehicles in a given region can be limited which results in sparse node distribution in part of the vehicular network. This poses several great challenges for efficient multicast, such as network disconnection, scarce communication opportunities and mobility uncertainty. Existing multicast schemes proposed for vehicular networks typically maintain a forwarding structure assuming the vehicles have a high density and move at low speed while these assumptions are often invalid in a practical vehicular network. As more and more vehicles are equipped with GPS enabled navigation systems, the trajectories of vehicles are becoming increasingly available. In this work, we propose an approach called TMC to exploit vehicle trajectories for efficient multicast in vehicular networks.

The novelty of TMC includes a message forwarding metric that characterizes the capability of a vehicle to forward a given message to destination nodes and a method of predicting the chance of inter-vehicle encounter between two vehicles based only on their trajectories without accurate timing information. TMC is designed to be a distributed approach. Vehicles make message forwarding decisions based on vehicle trajectories shared through inter-vehicle exchanges without the need of central information management. Vehicular Ad hoc networks (VANET) are constructed to manage communication between vehicles. Robust and Fast Forwarding (ROFF) protocol is used to handle data dissemination process. Trajectory based Multicast (TMC) protocol is applied for multicast data delivery process. The system integrates the ROFF and TMC protocols with security features.

1. RObust and Fast Forwarding (ROFF)

The ROFF, and then its three key components are presented: construction of an ESD bitmap, forwarding priority acquisition and waiting time assignments. Our proposed ROFF protocol is designed under two assumptions: 1) each vehicle is equipped with a GPS system and a digital map. 2) In VANETs, it is assumed that each vehicle periodically broadcasts its beacon message including its current GPS position, velocity, braking/acceleration status, etc. The time interval between two consecutive beacons is called a beacon interval. The default beacon interval is approximately 100 milliseconds. Vehicles can become aware of their surroundings from periodic beacons received Note that ROFF allows each vehicle to simply utilize the information specified in the received beacon messages. Hence, ROFF does not cause any additional message overhead (MO) to collect surrounding information.

A forwarder first constructs a bitmap which describes an empty space distribution (ESD) within NFA according to a procedure introduced and broadcasts an emergency message with the bitmap. The bitmap is used to allow neighbor vehicles to decide whether or not they are allowed to participate in contention and to acquire their forwarding priorities. Selected forwarder candidates contend to be chosen as a new forwarder. A contention resolution is done by differentiating waiting times of forwarder candidates according to our waiting time assignment algorithm.

1.1. ESD Bitmap Construction

ROFF aims to allow each node to decide its waiting time according to a forwarding priority, not the distance from itself to the forwarder. The highest and lowest forwarding priorities are equal to 1 and the number of vehicles within NFA, respectively. In particular, since nodes with an identical forwarding priority have the same waiting time, their transmissions will collide. To avoid such collision, each node should be assigned a unique forwarding priority. To describe how to assign forwarding priorities to vehicles within NFA. Note that each vehicle within NFA is called a potential forwarder candidate (PFC). A PFC becomes a forwarder candidate once it is allowed to participate in contention for choosing a new forwarder.

In VANETs, each vehicle can monitor a topology of its neighbors by collecting periodic beacons from neighbor vehicles. We refer to the neighborhood topology as a local view in this paper. When a PFC receives an emergency message, it can determine its forwarding priority, based on its local view and the location of the previous forwarder. Since PFCs have different local views with each other due to packet loss and high mobility of nodes, it is possible that some PFCs have the same forwarding priority. PFCs should determine their forwarding priorities, based on the same neighborhood topology. Therefore, ROFF utilizes the forwarder's local view as a reference.

1.2 Forwarding Priority Acquisition

The constructed ESD bitmap is piggybacked on the emergency message and broadcasted to PFCs. When a PFC receives an emergency message, it checks whether its distance toward the previous forwarder is indicated in the ESD bitmap in order to check its participation on the contention. A forwarder uses locations of PFCs collected within the beacon interval. Since the BIs of PFCs are not synchronized each other, a forwarder will not always receive the same beacon messages from a PFC within its BI. Since a BI of each PFC can overlapped with at most two successive beacon intervals of any neighbor PFC, it will receive up to two different beacon messages from a neighbor PFC within its BI. Thus, the location of each PFC p used for the ESD bitmap construction is equal to one of two locations: 1) the location that p advertised right before it received the emergency message at time t, 2) the location that p advertised right before t-BI. Therefore, p can decide its participation in contention according to the bit value at position d_1 and d_2, where d_1 and d_2 are the distances from the location of the previous forwarder to L_t and L_{t-BI}, respectively. If the bit at position d_1 or d_2 is 1, p becomes a forwarder candidate.

1.3 Waiting Time Assignment

ROFF allows each PFC p to be assigned the waiting time inversely proportional to its forwarding priority. In particular, for the successful forwarding, the waiting time of PFC (i) 3 should be at least longer than the waiting time of PFC (i-1) by minDiff. In minDiff was derived, which is the minimum difference between waiting times of two adjacent vehicles for avoiding transmission collisions caused by the short waiting time difference. Consequently, the waiting time of PFC(k) is calculated by WTPFC(k) is the sum of minDiffs between PFCs whose forwarding priorities are higher than k.

2. Trajectory Based Multicast (TMC)

RECENT advances in short-range radio technology such as Dedicated Short Range Communications (DSRC) for inter-vehicle communications have driven significant efforts in investigating and developing vehicular networks. By sharing information among moving vehicles, a vehicular network can support a wide variety of real-world applications, including emergence alert advertisement, file sharing data collection.

Information and message exchanges through multicast, where packets are sent from one sender to a group of receivers, have gained popular use and serve as a crucial routine operation in vehicular networks. For example, the taxis in a city may form an information network where each taxi may collect various types of information such as road surface condition, road closure status due to maintenance and traffic accidents. For more efficient information dissemination, a taxi can subscribe for some types of information of its interest, while a vehicle that collects the relevant information can serve as a source to disseminate the collected data through multicast to the group of subscribers. Different from conventional communication networks, vehicular networks exhibit many unique characteristics, which pose several great challenges to efficient multicast.

First, as vehicles may distribute over a vast area, the number of vehicles in a given region can be very limited. Therefore, a vehicular network can be sparse and resemble a delay tolerant network (DTN) that relies on the ”carry-and forward” paradigm to exchange information among vehicles. In a sparse network, it is very difficult to find a connected path between any pair of vehicles. Second, as two vehicles can communicate only when they encounter the encounter opportunities become the critical network resources, which are usually scarce. This makes it necessary for a multicast approach to be cost efficient. Finally, there is great uncertainty with vehicle mobilities, which makes it difficult to predict the future location of a given vehicle.

A few approaches have been proposed for multicast in vehicular networks. However, stemming from multicast schemes proposed for mobile ad hoc networks (MANETs), these approaches often require maintaining a costly forwarding structure such as a tree or a mesh. They typically assume that vehicles in the network are densely populated and move at a lower speed. Both assumptions may be invalid in a practical vehicular network which often has sparse connections in an area, thus making these multicast approaches inefficient and even fail.

In TMC, a novel message forwarding metric is proposed to characterize the capability of a vehicle to forward a given message to a group of destination nodes, which is defined as a vector of delivery potential of the message to each of the destination nodes. With this metric, a vehicle can simply forward a message to a vehicle that has a higher multicast delivery gain over the vehicle itself. To compute the metric, the key challenge is to predict the chance of encounter between two vehicles based only on their trajectories without accurate timing information. To conquer this challenge, we model the travel time of a vehicle as a Gamma distributed random variable and verify the modeling with real vehicular GPS traces. Then, a novel method is designed to predict the chance of inter-vehicle encounters. The salient feature of TMC is that it is a fully distributed approach in which vehicle trajectories are shared through inter-vehicle exchange and a vehicle makes its message forwarding decision based on the trajectories it learns instead of relying on a central point for information management.To the best of our knowledge, this is the first work that exploits trajectory information to perform efficient multicast in sparse vehicular networks.

3. SHA-1 Algorithm

In cryptography, SHA-1 is a cryptographic hash function designed by the United States National Security

Agency and published by the United States NIST as a U.S. Federal Information Processing Standard. SHA stands for "secure hash algorithm". The four SHA algorithms are structured differently and are distinguished as SHA-0, SHA-1, SHA-2, and SHA-3. SHA-1 is very similar to SHA-0, but corrects an error in the original SHA hash specification that led to significant weaknesses. The SHA-0 algorithm was not adopted by many applications. SHA-2 on the other hand significantly differs from the SHA-1 hash function.

4. Advanced Encryption Standard (AES) Algorithm

The Advanced Encryption Standard (AES) is an encryption standard adopted by the U.S. government. The standard comprises three block ciphers: AES-128, AES-192 and AES-256, adopted from a larger collection originally published as Rijndael. Each AES cipher has a 128-bit block size, with key sizes of 128, 192 and 256 bits, respectively. The AES ciphers have been analyzed extensively and are now used worldwide, as was the case with their predecessor, the Data Encryption Standard (DES). The AES has now replaced DES as the preferred encryption standard.

AES is a cryptographically secure encryption algorithm. A brute force attack requires 2128 trials for the 128-bit key size. In addition, the structure of the algorithm and the round functions used in it ensure high immunity to linear and differential cryptanalysis. Attacks against AES haven't been successful till now and it is the current encryption standard. The AES design can be used in any application that requires protection of data during transmission through the communication network, including applications such as electronic commerce transactions, ATM machines and wireless communication.To increase the robustness of the AES algorithm, the systems have to use longer encryption keys and larger data matrix. To keep the processing time at low values, the systems have to maintain unchanged the complexity of the AES algorithm. The modified AES algorithm (MAES) will work on data matrices. The encryption key will have an equivalent length of about 384, 512, 768 and 1024 bits and the modified algorithm is denoted according to it: MAES-384, MAES- 512, MAES-768 and MAES-1024.

V. CONCLUSION

The RObust and Fast Forwarding protocol introduced a concept of ESD bitmap, which describes the distribution of empty spaces between vehicles within the forwarding area. Based on the ESD bitmap, forwarder candidates avoid the large forwarding latency caused by the empty spaces between vehicles by using the waiting time which is inversely proportional to its forwarding priority regardless of the size of the empty spaces between vehicles. The Robust and Fast Forwarding (ROFF) protocol is integrated with Trajectory based Multicast (TMC) protocol for data dissemination process. Message Forwarding Metric is applied to select the forwarder node with capability factorsThis paper defines the multicasting with secure data distribution

VI. REFERENCES

[1] S. Panichpapiboon and W. attara-Atikom, "A Review of information dissemination protocols for vehicular ad hoc networks," IEEE Commun. Surveys Tuts., vol. 14, no. 3, pp. 784–798, 3rd Quarter 2012.

[2] X. Yang, J. Liu, F. Zhao, and N. Vaidya, "A vehicle-to-vehicle communication protocol for cooperative collision warning," in Proc. Int. Conf. Mobile Ubiquitous Syst., Aug. 2004, pp. 114–123.

[3] J. Sahoo, E. H.-K. Wu, P. K. Sahu, and M. Gerla, "Binary-partitionassisted MAC-layer broadcast for emergency message dissemination in VANETs," IEEE Trans. Intell. Transportation Syst., vol. 12, no. 3, pp. 757–770, Sep. 2011.

[4] R. Chen, W.-L. Jin, and A. Regan, "Broadcasting safety information in vehicular networks: Issues and approaches," IEEE Netw., vol. 24, no. 1, pp. 20–25, Jan./Feb. 2010.

[5] D. Jiang, V. Taliwal, A. Meier, W. Holfelder, and R. Herrtwich, "Design of 5.9 GHz DSRC-Based Vehicular Safety Communication," IEEE Wireless Comm., vol. 13, no. 5, pp. 36-43, Oct. 2006.

[6] Dedicated Short Range Comm. (DSRC) home, http://www.leearmstrong.
com/dsrc/dsrchomeset.htm, 2014..

[7] F. Farnoud and S. Valaee, "Reliable Broadcast of Safety Messages in Vehicular Ad Hoc Networks," Proc. IEEE INFOCOM, pp. 226- 234, 2009.

[8] T. Kitani, T. Shinkawa, N. Shibata, K. Yasumoto, M. Ito, and T. Higashino, "Efficient VANET-Based Traffic Information Sharing Using Buses on Regular Routes," Proc. IEEE Vehicular Technology Conf. (VTC), pp. 3031-3036, 2008.

[9] D. Zhang and C. Yeo, "Enabling Efficient Wifi Based Vehicular Content Distribution," IEEE Trans. Parallel and Distributed Systems, vol. 24, no. 3, pp. 479-492, Mar. 2013.

[10] A. Miloslavov and M. Veeraraghavan, "Sensor Data Fusion Algorithms for Vehicular Cyber Physical Systems," IEEE Trans. Parallel and Distributed Systems, vol. 23, no. 9, pp. 1762-1774, Sept. 2012.