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Analysis of Security Aware Data Transmission with Replica Support under VANET

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Abstract

Vehicular Ad-hoc network (VANET) is constructed with vehicles and roadside infrastructure. Vehicle location and speed information is collected continuously to manage the VANET communication. On-Board Unit (OBU) processes the data from the various sensors on the inside of the cars, and there are conditions of the vehicles. An on-board unit (OBU) is responsible for the communication with external network, such as with other vehicles and infrastructure. Road side Unit (RSU) is an infrastructure for the communication between the vehicles for sharing and information from different vehicles. The data transfer can be performed with vehicle (V2V) and vehicle-to-infrastructure (V2I). Opponents can track a vehicle by observing their communication and movement patterns. Privacy violation and anonymous communication are some security issues in VANET.

Multi Hop broadcasting systems are for the dissemination of safety messages. Freight Forwarder node manages the data transfer process in multi-hop radio protocols. Freight Forwarder node selection process is carried out with reference to the waiting period details. Robust and fast forwarding (ROFF) protocol solves the unnecessary delay and collusion problems in data dissemination process. A freight forwarder candidate is allowed, the waiting time is inversely proportional to its priority forward. The empty space Distribution (ESD) bitmap describes the distribution of spaces between the vehicles. A freight forwarder candidate acquires its priority forward with the concept of the ESD-bitmap. Collisions are avoided by the control the wait time differences than the pre-defined limit.

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Keywords: Intelligent transportation systems (ITS), vehicular ad-hoc networks (VANET), multi-hop broadcasting.

1. Introduction

A number of interesting and desired applications of Intelligent Transportation Systems (ITS) have been promoting the development of a new type of ad-hoc network: vehicular Ad hoc networks (VANets). In these networks, vehicles are equipped with communication equipment, which allows you to exchange messages with each other in the vehicle-to-vehicle communications (V2V) and also for the exchange of messages on the side of the road with a network infrastructure (vehicle-to-road communications - V2R). A number of applications are planned for these networks, some of which have already been possible, in a number of recently designed vehicles (Figure 1.1). Some of the VANET applications are vehicle collision warning, safety distance warning, driver assistance systems, cooperative, cooperative cruise control, Internet access, location, automatic parking and driverless vehicles.

All of these applications require, or can use a kind of localization technology. In the localization problem, the definition of a reference system is carried out under node by their physical location or their relative spatial distribution in relation to each other. For example, location is usually using Global Positioning System (GPS) receiver with a geographic information system, while the vehicle collision warning system can be implemented by comparing the distances between the nodes' locations, combined with geographical dissemination of information.

As his VANets and technological progress in the direction of more critical applications such as vehicle collision warning system (CWS) and driverless vehicles, it is likely that a robust and highly available localization system is required.

The system analyzes the localization requirements a number of VANet applications. Several localization techniques can be used to estimate the location of the vehicle and its advantages and disadvantages are for VANets. None of these techniques can achieve the desired requirements individually VANet localization of critical applications. The localization of information from multiple sources can be combined to a common position that is more accurate and robust through the use of the data fusion techniques.

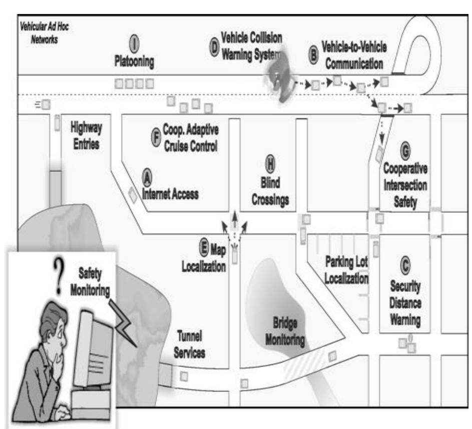

Fig. 1.1. Several VANet Applications

2. Related Work

Extensive research in the past ten years has been to study the technical feasibility of heterogeneous integrated wireless networks. Some of these, on the integration of wireless local area networks and mobile communications, handed over to vertical. It was also the work on the integration of mobile Ad hoc networks (Manet) and cellular systems to improve throughput and increase coverage, and it was the theoretical analysis of the capacity of these heterogeneous networks.

Together with this work, we also propose the integration of the mobile network to another wireless network in our context other mobile network is a delay-tolerant network (DTN), used "store-carry-forward" approach to the distribution of content. Also, in contrast to most previous focus on improving the capacity, our focus is primarily on maximizing the dissemination of content within a time limit time limit while minimizing the cost of cellular access, it is certainly our approach is also free to just cellular bandwidth.

Delay-tolerant networking (Dtn) is new network architecture, provides meaningful data service challenged networks in which permanent network connection is not guaranteed, such as sparse vehicular networks, if such networks are deployed in the first years. The first effort to combat Delay tolerant networks was on the interpretation of reliable and efficient routing protocols under a variety of assumptions about mobility. Encouraged by the promising results, the researchers have been studied, with opportunistic connections between nodes of vehicles to implement delay-tolerant network protocols and applications in the empirical testbed. Our work is done on the vehicle heterogeneous networks is a complement to the above-mentioned studies on "pure" DTNs. In sparse dtns, mobile node encounters are used for opportunistic data transfer, and thus the underlying mobility model has a major influence on your performance. The conventional Random-walk model and random Waypoint model are usually to evaluate DTN protocols. To review our analysis in a credible setting we have a real large vehicles mobility trace from a large metropolitan area (Beijing) in our study.

In our study we use differential equations to model content replication and dissemination. This is similar to (9), where differential equations are used to model the age of content and updates are found, a good approximation for large networks. There were several other previous studies for the distribution of content and replication in vehicular networks. The authors examine the latency performance of different frequency-based replication policies in the context of vehicular networks with limited memory. AdTorrent CarTorrent and present content distribution mechanisms for the distribution of files and display, or, in vehicular networks. In **[8]** The authors of the study, such as user impatience affects content dissemination. Unlike these studies, our focus in this work is on a novel cost optimization problem for the distribution of content on the maximum number of vehicles within a certain period, uses the mobile infrastructure and peer-to-peer communication of vehicles.

There has been some research on cellular Multicast, to improve the efficiency of the cellular network traffic for multicast applications. These works are primarily due to the improvement of the efficiency in dense settings where the demanding nodes are all clearly localized in each cell or, where the multicast. While these techniques may, in addition to the proposed solution in this work, the further improvement of the utility and delay, but not sufficient; when backing up contents vehicles city-wide, it may not be sufficient density in the individual cells to benefit greatly from cellular Multicast.

3. Robust and Fast Forwarding in Vehicular Ad-Hoc Networks

A wide range of security applications on vehicular ad hoc networks (VANET) are based on emergency message dissemination (EMD) through multi-hop broadcast. In the EMD, a specific vehicle problems an emergency message, if a dangerous situation such as vehicle collision is detected. Since the emergency message contains time-sensitive life critical information, it should be disseminated to all vehicles in the target region as quickly and as safely as possible. Often, the target region is a segment Road, up to several kilometers long in the opposite direction from the source. Since the one-hop range of a source can not the goal of the region to the full, multi-hop radio should be used to the dissemination of the emergency message.

Until now, many broadcast systems have been proposed, to the requirements for the timeliness and reliability of the EMD. The reliability can be improved by re-transmit the original copy of the emergency message or remove interference from hidden nodes. Retransmissions and control messages that have been exchanged for the avoidance of interference increase the latency of the message dissemination. In addition to reliability, for the fast message dissemination, the vehicle farthest from a freight forwarder in the message dissemination direction should be the next carrier. Since the most vehicle cannot successfully receive the message due to an inherently lossy radio channel, the explicit designation of most vehicle as the next forwarder can cause the multi-hop forwarding will be suspended. In most of the forwarding mechanisms, vehicles, have the message and the further away from the previous freight forwarder are fighting to a new forwarding agent in a distributed manner. Finally, the freight forwarder candidate (farthest forwarder candidate (FFC) farthest from a freight forwarder is opportunistically selected. In particular, since retransmissions help to increase the reliability of the distribution, each of the strife for transmission should be completed as quickly as possible to the latency of the general dissemination process. Note that conflicting achieve both goals at the same time is a challenge.

The common idea behind all of the existing forwarding mechanisms to distinguish is waiting time (WT) of the freight forwarder candidates. The waiting time ranges from 0 to the predefined upper limit (PUB). A freight forwarder candidate selects a point in the time domain and uses it as a wait time. In particular with a view to maximizing the hop progress of the message any forwarder candidate uses your waiting time, is inversely proportional to the distance from itself to the previous carrier. Therefore, the farthest forwarder candidate uses the shortest waiting time and then forwards the message first. The other freight forwarders by the newly elected candidates recognize the transfer carrier and suppress their scheduled transmissions.

We show two problems of existing fast forwarding rules in this paper. First, it is the already existing rules tacitly assume the perfect suppression of redundant transfers, which means that all freight forwarder candidates can successfully receive the message from FFC within their waiting times. Due to the short difference between waiting times of the freight forwarder candidates, some freight forwarder applicants can start your transfers before detecting the transmission of FFC and such redundant transfers can interfere with the transfer of FFC. The wait time difference between two candidates freight forwarder is influenced by the pub and the difference between distances from the previous freight forwarder to the forwarding agent candidates. The displacement difference between depends on the spatial distribution of the vehicle. In addition, under a certain distribution of vehicles, a small pub brings the next forwarder you previously selected, but results in a higher probability of collisions through the short wait time difference. Existing rules only in terms pub as a system parameter without regard to the relationship between the selected Pub and collision probability (CP) under dynamically changing vehicle Distribution.

4. Trajectory Based Multicast Communication in VANET

The recent progresses in the SRR-technology as the Dedicated Short Range Communications (DSRC) for inter-communication vehicle have made significant efforts in the research and development of vehicles networks. Through the exchange of information between the moving vehicles, a vehicle network supports a variety of real-world applications, including the creation Alert, advertising, file sharing, data collection (6), etc. information and news exchange via multicast, where packets are sent from one sender to a group of recipients have won popular and serve as a crucial routine use in vehicular networks. For example, the taxis in a city can form a Information Network, where each Taxi can collect different types of information, such as road conditions, road closure status due to maintenance and road accidents. For a more efficient dissemination of information, a taxi can subscribe for some types of information of his interest, while a vehicle, collects the relevant information can as a source for the dissemination of the data collected via multicast to the group of participants.

Unlike conventional communications networks, vehicular networks have many unique characteristics, the pose several large challenges efficient Multicast. First, as vehicles can spread over a huge area, the number of vehicles in a particular region may be very limited. Therefore, a network of vehicles can sparse, and are similar to that of a delay tolerant network (DTN), is based on the "Carry-and-forward" -paradigm to the exchange of information between vehicles. In a small network, it is very difficult to find, a connected path between each pair of vehicles. Secondly, when two vehicles can communicate only if they encounter, the encounter opportunities will be the critical network resources are usually rare. This makes it necessary, a multicast approach will be cost efficient. Finally, there is great uncertainty with vehicle mobility's, which makes it difficult to predict the future location of a specific vehicle. (10) A few approaches have been proposed for Multicast in vehicular networks. However, for multicast schemes proposed for mobile Ad hoc networks (Manet), these approaches often require the maintenance of a costly transfer structure, such as a tree or a grid. They generally assume that the vehicles in the network are densely populated and move at a slower speed. Both assumptions may be invalid in a practical vehicular Network, has often limited connections in a field, as a result of which these multicast approaches inefficient and even fail.

On the other hand, some of the potential opportunities were not used for use in vehicles communication. The vehicles are always in use with GPS (Global Positioning System) activates the navigation systems. A recent report shows that 300 million GPS-devices were shipped in 2009 alone (12). The GPS-enabled navigation system can beat the path to a destination. If the future path of a vehicle is known in advance, its mobility uncertainty is greatly reduced.

5. Problem Statement

Multi Hop broadcasting systems are for the dissemination of safety messages. Freight Forwarder node manages the data transfer process in multi-hop radio protocols. Freight Forwarder node selection process is carried out with reference to the waiting period details. Robust and fast forwarding (ROFF) protocol solves the unnecessary delay and collusion problems in data dissemination process. A freight forwarder candidate is allowed, the waiting time is inversely proportional to its priority forward. The empty space Distribution (ESD) bitmap describes the distribution of spaces between the vehicles. A freight forwarder candidate acquires its priority forward with the concept of the ESD-bitmap. Collisions are avoided by the control the wait time differences than the pre-defined limit. The following problems are characterized by the current VANET data transfer methods.

- Multicast data delivery is not supported
- Data security is not provided
- Forwarder node selection is not optimized
- Sparse vehicular network conditions are not managed

6. Security Aware Data Transmission under VANET

The robust and fast forwarding (ROFF) protocol is integrated trajectory based multicast (TMC) protocol for the dissemination of data processing. Message forwarding metric is applied; select the forwarder node with the ability factors. Data dissemination process with improved security features. Information about the network connection is managed with lane information.

The VANET data transmission scheme is adapted handle multicast and broadcast operations. Replicas are used to improve the data transfer process. Data transfer process with improved security features. The system is divided into six large assemblies. You are ESD-bitmap construction, freight forwarder node, trajectory analysis, Multicast data transfer, data dissemination process and improvement of security for the data transmission.

6.1. ESD Bitmap Construction

The topology of the neighbors identifies vehicles by collecting periodic beacons of neighboring vehicles. Neighborhood topology known as local advertisements. Each vehicle maintains a neighbor table (NBT) for the monitoring of the local view. Update and Delete operations on the neighbor table is carried out, in order to maintain the freshness of the local view. Space between the vehicles is represented in the empty space Distribution (ESD) bitmap. The ESD-bitmap is built by two phases. A freight forwarder measures each other their distances all PFC with potential candidates Freight Forwarder (PFC) -topology. The ESD-bitmap is built with distance information of the vehicles.

6.2. Forwarder Node Selection

Robust and fast forwarding (ROFF) -protocol is used to freight forwarder nodes. Each vehicle within the naive forwarding area (NFA) is as potential candidates Freight Forwarder (PFC). Wait time and arrangements are factors taken into account in the Forwarder node selection process. A PFC can be assigned as a freight forwarder candidate if it is allowed to the new forwarder selection. Transmission priority is used to assign the waiting time limits for the Spediteur-Knoten . Transmission priority is based on the empty space Distribution (ESD) bitmaps and the previous location of the freight forwarder. Any forwarder candidate is assigned with different wait time limits. The wait time is for initiating the data forwarding process

6*.3. Trajectory Analysis*

Trajectory of vehicles is identified using Global Positioning Services (GPS) enabled navigation systems. Trajectory based Multicast (TMC) exploits vehicle trajectories for efficient multicast in vehicular networks. Message forwarding metric is estimated to identify the capability of a vehicle to forward a message to destination nodes. TMC scheme uses the distributed approach for the message communication process.

6.4. Multicast Data Transmission

Message dissemination and group coordination operations are carried out under the multicast transmission. Network disconnection, sparse communication and mobility uncertainty factors are handled in the data transmission process. Trajectory information is used to make the message forwarding decisions. Message forwarding metric is also used to predict the entry of intermediate vehicle.

6.5. Data Dissemination Process

Data dissemination operations are carried out using the forwarder nodes. Empty Space Distribution (ESD) bitmap and trajectory information are used to handle the data transmission process. Replica nodes are used to maintain the frequently transferred messages. Forwarder nodes collect the messages from the replica nodes.

6.6. Security Enhancement for data delivery

Group keys are used for the data encryption/decryption operations in the multicast data transmission process. Data security is provided with Advanced Encryption Standard (AES) algorithm. Secure Hash Algorithm (SHA) is used for the data integrity verification in VANET communication. Message forwarder nodes are verified with trust levels.

7. Performance Analysis

The comparative analysis is carried out against various protocols such as Simple Timer-based Forwarding (STF), Robust and Fast Forwarding (ROFF), Trajectory based Multicast (TMC) and Integrated ROFF and TMC protocol (IRT).The Robust and Fast Forwarding (ROFF) protocol is applied to perform the broadcast data transmission. The ROFF protocol uses the forwarder nodes for the data transmission process. The Trajectory based Multicast (TMC) protocol manages the multicast data transmission over the vehicular ad-hoc network environment. Trajectory path information is used for the data transmission process.

The Integrated ROFF and TMC (IRT) protocol combines the multicast and broadcast operations for the data transmission process. The Robust and Fast Forwarding (ROFF) and (IRT) protocols are analyzed with different settings. Average throughput parameter is used to verify the performance of the Robust and Fast Forwarding (ROFF) protocol and Integrated ROFF and TMC protocol (IRT) protocols.

Fig 7.1. Shows the comparative analysis between the Robust and Fast Forwarding (ROFF) protocol and Integrated ROFF and TMC protocol (IRT) protocols. The Integrated ROFF and TMC protocol (IRT) protocol increases the average throughput rate 20% than the Robust and Fast Forwarding (ROFF) protocol of the gridlet to the resource.

By assumption that the resource l have a machine list as[machine 1…machine temp,…machine temp] and the machine temp can be illustrated as the machine temp(int machine idtemp, int num PEtemp, int rating PEtemp). The number of PEs and the rating of PEs are represented as rating PE. Rating can be expressed as SPEC or MIPS. The capacity of the resource is calculated based on the number of processing entities currently active under the GridBroker. Based on the rate at which the resource executes its gridlet and result produced to the gridlet at the end of simulation. The capacity of the resource is calculated using the below formula as

$$\textbf{Resource.capacity} = \sum \textbf{numPE(temp)n} \times \textbf{ratingPE(temp)}$$

Multitasking and multiprocessing systems allow currently running tasks to share system resources such as processor, memory, storage, I/O and network by scheduling their use for very short time intervals. A detailed simulation of scheduling tasks in the real system would be complex and time consuming.

Hence, in Gridsim abstract these physical entities and simulate their behaviour using process oriented, discrete event “interrupts” with time interval as large as the time required for the completion of a smallest remaining job.

Need to create a Gridsim user entity that creates and interacts with the resource broker scheduling entity to coordinate execution experiment. These simulated resources resemble the WWG tested resources used in processing a parameter sweep application using the Nimrod G broker. The brokers need to translate it into the GIS per MI (million instructions) for each resource.

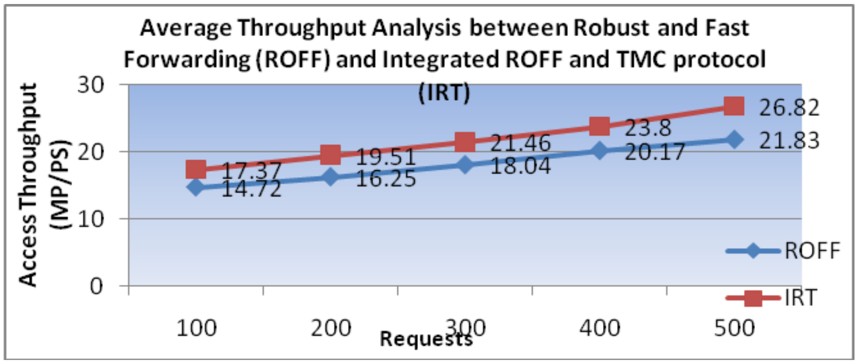

Fig 2 Average Throughput Analysis between Robust and Fast Forwarding (ROFF) and Integrated ROFF and TMC protocol (IRT)

8. Conclusion

Vehicular Ad hoc networks (VANET) are constructed for communication between vehicles. Robust and fast forwarding (ROFF) -protocol is used to handle data dissemination process. Trajectory based multicast (TMC) protocol is used for multicast data delivery process. The system integrates the ROFF and TMC-protocols with security features. The system supports a faster and reliable data transfer scheme with security. The vehicular ad hoc network communication system controls the collision and latency in data dissemination process. The data transfer is carried out without the central information management authority. Multicast and Broadcast operations are integrated in the VANET data communication process.

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