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Performance Evaluation and Study of Routing Protocols: MANET vs VANET

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Abstract— *In the recent years the number of vehicles on road increases at high speed. A lot of road accidents and traffic congestion emerges. So to control it vehicular ad-hoc network came in picture. In the last few years many protocols were proposed to route the packets efficiently and correctly. But no one was capable of routing the packets in case of cross links. So, a protocol named GEOCROSS was proposed. The introduction of MANETs, VANETs, their routing protocols, protocol structure of VANET, how broadcasting takes place in VANET, how information is disseminated in VANET and VANET communication & routing protocols like vehicular collision warning communication (VCWC), vehicle heading based routing protocol (VHRP) and GEOCROSS routing protocol will discussed in this paper.*

Keywords— MANET, VANET, routing protocols.

I. INTRODUCTION

MANET is a self-configured wireless ad-hoc network of mobile nodes. The MANET organization depends upon the location of nodes, their connectivity, their service discovery capability & their ability to search and route messages using nearest nodes or nearby nodes. The properties of MANETs are data routing abilities, neighbor discovery for data reception and transmission, variable routing paths, flexible network architecture, no access point requirement, peer-peer connectivity, limited wireless connectivity range, data caching saving and aggregation and requirement to solve exposed or hidden terminal problem.

VANET belongs to wireless communication networks area. VANET is the emerging area of MANETs in which vehicles act as the mobile nodes within the network. The basic target of VANET is to increase safety of road users and comfort of passengers. VANET is the wireless network in which communication takes place through wireless links mounted on each node (vehicle) . Each node within VANET act as both, the participant and router of the network as the nodes communicates through other intermediate node that lies within their own transmission range. VANET are self organizing network. It does not rely on any fixed network infrastructure. Although some fixed nodes act as the roadside units to facilitate the vehicular networks for serving geographical data or a gateway to internet etc. Higher node mobility, speed and rapid pattern movement are the main characteristics of VANET. This also causes rapid changes in network topology .

VANET is a special type of MANET, in which vehicles act as nodes. Unlike MANET, vehicles move on predefined roads, vehicles velocity depends on the speed signs and in addition these vehicles also have to follow traffic signs and traffic signals. There are many challenges in VANET that are needed to be solved in order to provide reliable services. Stable & reliable routing in VANET is one of the major issues. Hence more research is needed to be conducted in order to make VANET more applicable. As vehicles have dynamic behavior, high speed and mobility that make routing even more challenging.

VANET routing protocols history starts with traditional MANET protocols such as AODV (Ad hoc on Demand Distance Vector Routing) and DSR (Dynamic Source Routing) . AODV and DSR have been considered efficient for Multi hop wireless ad hoc networks.

II. BASIC CONCEPTS AND BACKGROUND

Ad-hoc networks are self-organized, wireless and decentralized systems that form temporary networks. Wireless technology is becoming the dominant one because of mobility, accessibility and flexibility in information dissemination. Cellular phones, wireless internet like Wi-Fi, satellite televisions etc. are well known applications of wireless technologies. It is a well growing area for research. The two main reasons of rapid growth of mobile computing are lower prices and higher data rates.

MANET (Mobile ad hoc network) is an infra-structure less IP based network of mobile and wireless machine nodes connected with radio. In operation, the nodes of a MANET do not have a centralized administration mechanism. It is known for its routable network properties where each node act as a “router” to forward the traffic to other specified node in the network. MANET (Mobile ad hoc network) is a temporary self organizing system formed by a collection of nodes, which are connected with wireless links. In the

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network, nodes may be disappeared or new nodes may be appeared over the time due to node mobility.

Ad Hoc Networks

A wireless ad hoc network is a multi hop network that is a collection of mobile or sometimes stationary nodes connected with bandwidth constrained wireless links i.e. every node should have wireless interfaces and thus have their own transmission ranges, forming a decentralized ad hoc network. Laptop computer or Personal Digital Assistance (PDA) can be the example of the nodes in a wireless ad hoc network. A node can leave the network or enter into the network whenever it wants. There is no central administration and for that, each node forwards packets according to a routing protocol. A node in an ad hoc network is a host as well as a router. An ad hoc network is a network capable of adjusting itself in the change of routing topology in time. If any route is disturbed by the link failure or something, the station calls a route discovery function to find out an alternative route and forward the packet in the way of that route. To find out the way, a packet should be forwarded. Different routing protocols are available but only one protocol should be fixed before the network becomes operational.

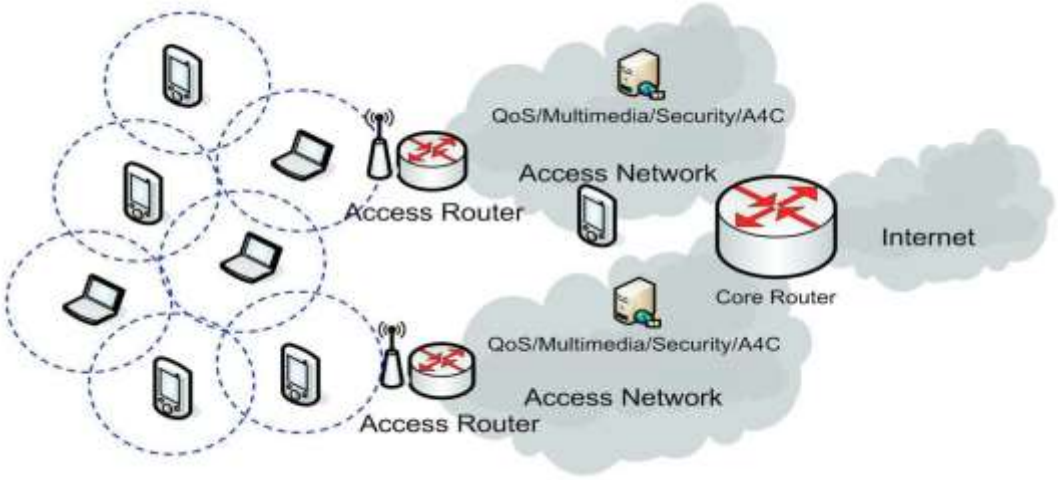

Fig.1: Ad-hoc network architecture

In the figure 2, a typical ad hoc network with three participating nodes is shown, where node1 cannot send packets directly to the node3 because they are not in the same transmission range. Node1 first sends the packet to node2 and node2 acts as a router, forwards the packet to node3 as they are on the same transmission range. There is no central administration and according to the figure 2, it is a clear that change of node mobility changes the routes.

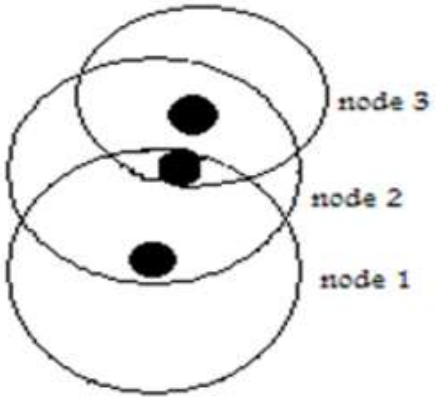

Fig.2: A Typical Ad hoc Network

Types of MANET

There are different types of MANETs including:

- InVANETs – Intelligent vehicular ad hoc networks make use of artificial intelligence to tackle unexpected situations like vehicle collision and accidents.
- Vehicular ad hoc networks (VANETs) – Enables effective communication with another vehicle or helps to communicate with roadside equipments.
- Internet Based Mobile Ad hoc Networks (iMANET) – helps to link fixed as well as mobile nodes.

MANET Characteristics

- In MANET, each node act as both host and router. That is it is autonomous in behavior.
- Multi-hop radio relaying- When a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing.

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- Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here.
- The nodes can join or leave the network anytime, making the network topology dynamic in nature.
- Mobile nodes are characterized with less memory, power and light weight features.
- The reliability, efficiency, stability and capacity of wireless links are often inferior when compared with wired links. This shows the fluctuating link bandwidth of wireless links.
- Mobile and spontaneous behavior which demands minimum human intervention to configure the network.
- All nodes have identical features with similar responsibilities and capabilities and hence it forms a completely symmetric environment.
- High user density and large level of user mobility.
- Nodal connectivity is intermittent.

VANET : VANET is the short form of Vehicular Adhoc Network. It is subclass of network of MANET type.
The routing protocols of MANET are not feasible to be used in the VANET network. If they are used then also they will not be able to deliver required throughput as it has fast changing adhoc network.

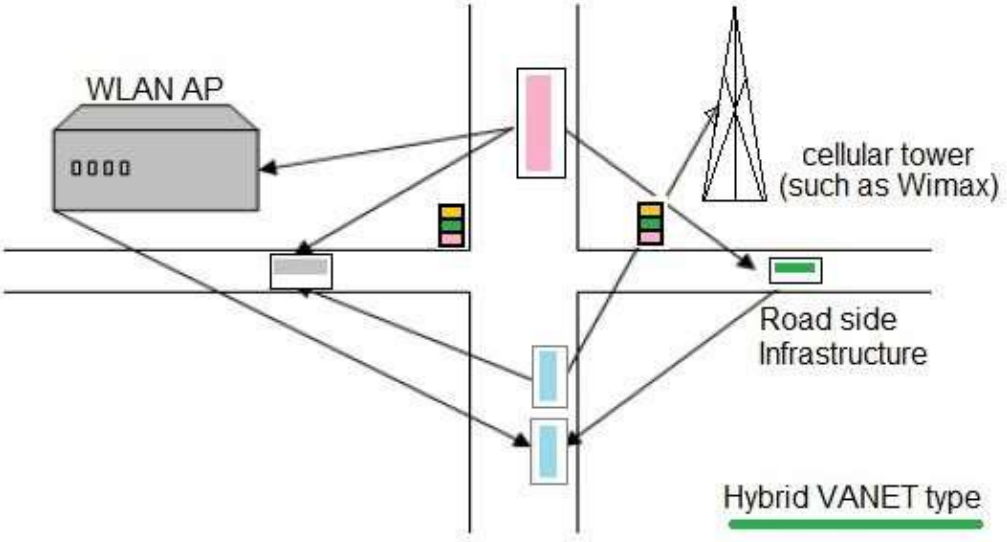

Fig.3: combination of both infrastructure and adhoc networks

In VANET, the communication nodes are moving on pre-defined roads as finalized initially.
The VANET architecture consists of three type of categories as mentioned below:

- cellular and WLAN network
- Pure Ad hoc (network between vehicles and fixed gateways)
- hybrid(combination of both infrastructure and adhoc networks), as shown in figure.

In the first type, fixed gateways and WiMaX/WiFi APs are used at traffic junctions to connect with the internet, to obtain traffic information and used for routing.The VANET nodes are not subject to storage and power limitation.Vehicular Ad hoc Network (VANET) is a subclass of mobile Ad Hoc networks (MANETs). These networks have no fixed infrastructure and instead rely on the vehicles themselves to provide network functionality.
These networks offer several benefits to organizations of any size. While such a network does pose certain safety concerns but this does not limit VANET's potential as a productivity tool. GPS and navigation systems can benefit, as they can be integrated with traffic reports to provide the fastest route to work.

III. PROPERTIES OF AD-HOC ROUTING PROTOCOLS

The properties that are desirable in Ad-Hoc Routing protocols are:

i). Distributed operation: The protocol should be distributed. It should not be dependent on a centralized controlling node. This is the case even for stationary networks. The dissimilarity is that the

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nodes in an ad-hoc network can enter or leave the network very easily and because of mobility the network can be partitioned.

ii). Loop free: To improve the overall performance, the routing protocol should assurance that the routes supplied are loop free. This avoids any misuse of bandwidth or CPU consumption.

iii). Demand based operation: To minimize the control overhead in the network and thus not misuse the network resources the protocol should be reactive. This means that the protocol should react only when needed and should not periodically broadcast control information.

iv). Unidirectional link support: The radio environment can cause the formation of unidirectional links. Utilization of these links and not only the bi-directional links improves the routing protocol performance.

v). Security: The radio environment is especially vulnerable to impersonation attacks so to ensure the wanted behavior of the routing protocol we need some sort of security measures. Authentication and encryption is the way to go and problem here lies within distributing the keys among the nodes in the ad-hoc network.

vi). Power conservation: The nodes in the ad-hoc network can be laptops and thin clients such as PDA's that are limited in battery power and therefore uses some standby mode to save the power. It is therefore very important that the routing protocol has support for these sleep modes.

vii). Multiple routes: To reduce the number of reactions to topological changes and congestion multiple routes can be used. If one route becomes invalid, it is possible that another stored route could still be valid and thus saving the routing protocol from initiating another route discovery procedure.

viii). Quality of Service Support: Some sort of Quality of service is necessary to incorporate into the routing protocol. This helps to find what these networks will be used for. It could be for instance real time traffic support.

IV. ROUTING PROTOCOLS IN VANET

The routing protocols of VANETs fall into two major categories of topology-based and position-based routing. There are many advantages and disadvantages of these routing protocols. We explore the motivation behind their design and trace the evolution of these routing protocols and analyze their efficiency with respect to MANETs as there are countless numbers of routing protocols [9, 14, 15] developed in MANETs, but they do not apply well to VANETs which represent a particularly challenging class of MANETs. They are distributed, self-organizing communication networks as described before.

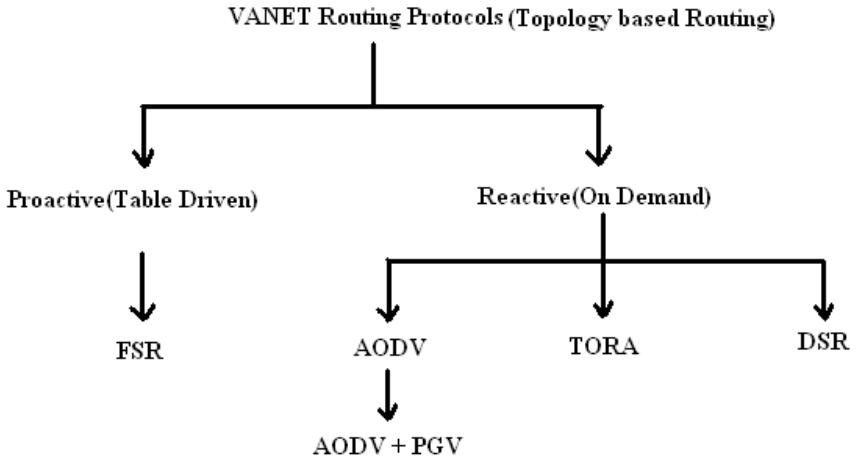

Fig.4: Classification of VANET Routing Protocols

The detailed coverage of relevant routing protocols and their impact on overall VANET architecture is incomplete without discussion of VANET topics and applications. The different types of VANET architectures can be as shown above in the figure. There are a number of MANET routing protocols and surveys written on them, we will therefore only restrict our attention to MANET routing protocols used in the VANET context. Broadcast routing is frequently used in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering

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advertisements and announcements. Broadcasting is used when messages need to be disseminated to the vehicles beyond the transmission range when multi hops are used.

V. CONCLUSION

The study of the various routing protocols considered under MANET and VANET on the basis of their architectures and their performance analysis provides that the protocols which are feasible for a MANET will be feasible in the VANET too but there performance varies with varying traffic conditions and densities. If we look for the best out of the existing protocols then we find that the Reactive protocols will be the best if we want to use the same set of rules in both the VANET and MANET. Moreover AODV results to be the best among the various reactive protocols for both MANET and VANET based on previous research works and studies.

REFERENCES

[1] Different Routing Techniques in VANET from,"personal.psu.edu/ akb5073/ routing_protocol.pdf".

[2] Larry L. Peterson and Bruce S. Davie," Computer networks- A system approach", San Fransisco, Morgan Kaufman Publishers Inc. ISSN 1-55860-368-9.

[3] C. Lochert, B. Scheuermann, and M. Mauve, "A survey on congestion control for mobile ad hoc networks," Wireless Communications andMobile Computing, vol. 7, no. 5, pp. 655–676, 2007.

[4] N. Wisitpongphan, O. Tonguz, J. Parikh, F. Bai, P. Mudalige, and V. Sadekar,

[5] "On the Broadcast Storm Problem in Ad hoc Wireless Network," in IEEE Wireless Communications, to appear.

[6] Deshmuk R., Ambhaika A., " Performance Evaluation of AODV andDSR with Reference to Network Size", International Journal ofComputer Applications (0975 – 8887), Volume 11– No.8, December2010.

[7] Elizabeth M. R. and Chai-Keong T.,,"A review of current routingprotocols for ad hoc mobile wireless networks", Technical report,University of California and Georgia Institute of Technology, USA,1999.

[8] Gerla M., Hong X., Pei G.. "Fisheye State Routing Protocol (FSR)for ad hoc networks",IETF Draft,2001.

[9] Helbing, D., Hennecke, A., Shvetsov, V., Treiber, M. (2002), "MicroandMacrosimulation of Freeway Traffic," Mathematical andComputer Modelling, vol. 35, no. 5/6, pp. 517-547, 2002.

[10] Jaap S., Bechler M., Wolf L. , "Evaluation of Routing Protocols forVehicular Ad Hoc Networks in City Traffic Scenarios," Proceedingsof the 5th International Conference on Intelligent TransportationSystems (ITS) Telecommunications, June, 2005.

[11] Jetcheva J.G., Hu Y.C., PalChaudhuri, S., Saha, A.K., Johnson, D.B., "Design and evaluation of a metropolitan area multitier wireless adhoc network architecture," Mobile Computing Systems andApplications, 2003. Proceedings. Fifth IEEE Workshop on , vol., no.pp. 32-43, 9-10 Oct. 2003.