REVIEW ON MANET BASEDEMERGENCY COMMUNICATIONFOR NATURAL DISASTER

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ABSTRACT

Ad hoc network is infrastructure less network which posses characteristics like decentralized administration and very less efforts for setup. Due to this, it is most suitable for many applications like military, disaster area, rescue operation, collaborative computing and conference meeting where it is not possible to setup wired network or infrastructure based wireless network. During any disaster which can be natural or man-made, existing infrastructure may be destroyed so, ad hoc network can facilitate communication among team members (nodes) of rescue team during post disaster situation. There are many challenges for ad hoc network like modeling mobility, connectivity, routing protocol, broadcast method, and energy saving when it is applied to such disaster scenario. This research work is focused on discussing various research methods that focus on providing effective rescue operations the rescue teams needs to communicate in effective and efficient ways. The experimental tests conducted were on all the research works in 2 NS-2 simulatorand it is compared against each other to find the better approach under various performance measures.

Key words:Mobile Ad Hoc Network (MANET), Disaster, routing, and route selection

I.INTRODUCTION

When a disaster occurs it becomes difficult to provide services in the affected areas due to the lack of communication. All modes of communication system get damaged and it takes a lot of time to establish an infrastructure network. To overcome this, infrastructure less Mobile Adhoc network is established using Wi-Fi enabled devices for effective and efficient rescue operations.

In general two types of communications can be considered in classical MANETs, broadcast communications and multihop communications via routing protocols. In broadcast communications, a node shares the same information simultaneously with its one-hop neighbor nodes. It may be suitable for transmitting warning messages, and alarms which are crucial forms of communications in disaster scenarios. When nodes rely on routing protocols for establishing a communication path to a destination node, nodes should maintain routing tables in order to select which is the best next hop to route the information. Regarding the applicability of routing protocols in disaster scenarios, we can think about a situation where a rescue team needs to retransmit certain information to a central unit. A multi-hop route can be established from a crewmember to the central

unit. The routing protocol would be responsible for selecting the best nodes to retransmit the data packets from the crewmember to the central unit.

Communications in disasters scenarios may require interoperability among the mentioned ad hoc communication paradigms. Let us illustrate the necessity of such interoperability with the following example. Suppose a crewmember, which is in a rescue operation, will need to communicate with other crewmembers in a well connected network like a MANET. To do so, they will be establishing a communication path to another crewmember through a routing protocol or spreading out the same information to all crewmembers via a broadcast protocol, for example an emergency message indicating that they are in danger. When ad hoc network is applied for disaster area scenario then there are some challenges that must be met by ad hoc networks. For example, there must be connectivity among the team members of rescue team, prediction of movement of team members, fast delivery of emergency messages, efficient utilization of battery power of nodes and security from outside attacker.

D. G. Reina has discussed three different disaster scenarios using ad hoc network which happened in Germany in May 2005. It shows the applicability of ad hoc network in disaster area using various performance metrics. Quispe, L. E. and Galan, L. M. have analyzed emergency and rescue scenario in urban area using ad hoc network. They also calculated the density of nodes and mobility model to test the performance of existing routing protocols.

This paper continues as follows, section 2 presents the different ad hoc paradigms that can be used in disaster scenarios, describing the main features of each paradigm and their applicability for disaster scenarios. The existing works done for each ad hoc network in disaster scenarios are reviewed in section. Section 3 includes results and finally the main conclusions of this survey paper are found in section 4.

II.LITERATURE SURVEY

Chen et al. proposed a hybrid network model in which a group of adjacent cells served by cellular base station is considered. However, due to disaster some of base station crashed so their cells are treated as dead cells as there is no cellular coverage. This is also possible that due to deterioration of connectivity some mobile nodes within the cell do not able to receive signal. To recover from these issues a hybrid model is designed which combine cellular network and ad hoc network. Nodes are directly connected to cellular network if they are in working base station range and if there is no cellular signal then nodes are working in ad hoc network fashion and communicate with their neighbor. A node which is operating in cellular environment works as a gateway, able to transmit packets coming from neighbors operating in ad hoc mode. A node working in ad hoc network tries to setup a route to operational base station using multi-hopping. If node have route to at least one base station, it make an entry and forward data to that base station. If there is traffic congestion in that base station, node mark that base station as "busy" for certain interval and again search for operation base station. The limitations and issues with this approach are, there is no awareness regarding available communication system and power resources of nodes.

Ojetundeet.al designed a new mobile payment system utilizing infrastructure less mobile adhoc networks to enable transactions that permit users to shop in disaster areas. Specifically, the system introduce an endorsement-based mechanism to provide payment guarantees for a customer-to-merchant transaction and a MultiLevel Endorsement (MLE) mechanism with a lightweight scheme based on Bloom filter and Merkle tree to reduce communication overheads. The designed mobile payment system achieves secure transaction by adopting various schemes such as location-based mutual monitoring scheme and blind signature, while a newly introduced event chain mechanism prevents double spending attacks.

Macone et.al designed a proactive routing protocol, named MQ-Routing, and aimed at maximizing the minimum node lifetime and at rapidly adapting to network topology changes. An introduced protocol modifies the Q-Routing algorithm, developed via Reinforcement Learning (RL) techniques, by introducing: (i) new metrics, which account for the paths availability and the energy in the path nodes, and which are dynamically combined and adapted to the changing network topologies and resources; (ii) a fully proactive approach to assure the protocol usage and reactivity in mobile scenarios. The MQ-Routing is a distributed algorithm (property inherited from the Q-Routing algorithm), each neighbour node must communicate some information to node to let it properly compute the variable discount factor. The main objective of the work is to balance the traffic through the network nodes in order to increase the minimum lifetime of the nodes.

Falconiand Melchiorri designed a graph-based algorithm for robotic MANETs coordination in disaster areas. In particular, in the designed approach a leader-follower architecture is exploited in order to control few nodes while ensuring that connectivity is preserved between a base node and an explorer (a robotic explorer or a human rescuer) that is moving in unknown environments.The designed approach exploits a graph–based algorithm where the nodes of the MANET have been divided into two different classes, i.e. leaders (the base node and the explorer node) and followers (the autonomous robots that provide communication broadcasting). Virtual nodes have been included in order to ensure obstacle avoidance by exploiting the graph–based framework.

Vatsaet.al designed a routing mechanism by using various parameters like efficient address allocation over mesh based and tree based multicast through the random casting method of node selection.In tree based routing the network's nodes are arranged in a tree like structure. The tree structure is known for its efficiency in utilizing the network resources optimally. For the purpose of node selection use Route Request (RR) and Route Reply (RP) Packets for Mesh based routing and Tree based Routing. Node selection is performed on the selected nodes after Random Casting. Tree based protocols are generally more efficient in terms of data Transmission. Finally set up a path by using request reply technique over it. The designed routing mechanism will be helpful for disaster area and enhance quality of service of communication.

Reina et.al modelling and assessing ad hoc networks in disaster scenarios.The considered scenario is based on a fire in amusement park near Cologne in 2001. One attraction, the rollercoaster, caught fire. In this accident 70 people were injured. The mobility of nodes is 1–2 m/s for people and 5–12 m/s for transport vehicles. Considering the density and the mobility of nodes in each area, it is noticeable that each area represents a different simulation scenario by itself. The propagation models are used to predict the received power signal at

the physical layer. Each node has a receiving threshold which determines whether the packet is received or not. Three different propagation models are implemented in ns-2 including, free space model, two-ray ground reflection model, and shadowing model.Simulations show that AODV provides the best results in terms of routing metrics.

Zheng et.al demonstrate the concept of hybrid cellular mobile ad hoc network (hybrid cellular MANET) to extend wireless coverage by showing a fully functioning microblogging system for smart phones and tablets without requiring modifications of the existing wireless infrastructure in an emulated disaster area. Participating devices connect to each other through WiFi radio to form a hybrid cellular MANET, relaying data off the MANET through the nodes that have sufficient cellular forwarding capability. The system has a self-organizing, mobility-aware, multi-path routing protocol (HMANET) to control the data forwarding in the hybrid cellular MANET. Thesystem compares its performance with the classic Hybrid Wireless Mesh Protocol (HWMP) used in the IEEE 802.11s standard in the built microblogging system. The experimental results show that the HMANET protocol statistically outperforms the HWMP protocol in terms of adaptiveness to role change and mobility in the hybrid cellular-MANET.

Mahiddin et.al designed a new gateway load balancing and route selection scheme of Manet in disaster scenario. In this approach, all the nodes in the Manet networks are isolated except three nodes that are in internet range. Thus, the other nodes that want to communicate with nodes outside the Manet network must go through these three nodes. These nodes will be a gateway for the MANET network. Only the gateway broadcast advertisementto the nearest node in their coverage range. Node that received the advertisement will keep the information of all gateways. Therefore , when the nodes receive a heavy notification from one of gateways, the message will not be sent to that gateway. The route selection is performed based on the neighboring nodes.

III.EXPERIMENTAL RESULTS

The existing hybrid network model,Tree based routing ,Graph-based algorithm,   MQ-Routing and proposed Gateway load balancing and routing selection scheme are compared in terms of throughput and end to end delay.

1. Throughput

The rate in which the data packets are successfully transmitted over the network or communication links is defined as throughput. It is measured in bits per second (bit/s or bps). It is also specified by units of information processed over a given time slot.

$$\text{Throughput} = \frac{\text{Number of delivered packet} * \text{packet size}}{\text{Total duration of simulation}} \qquad (1)$$
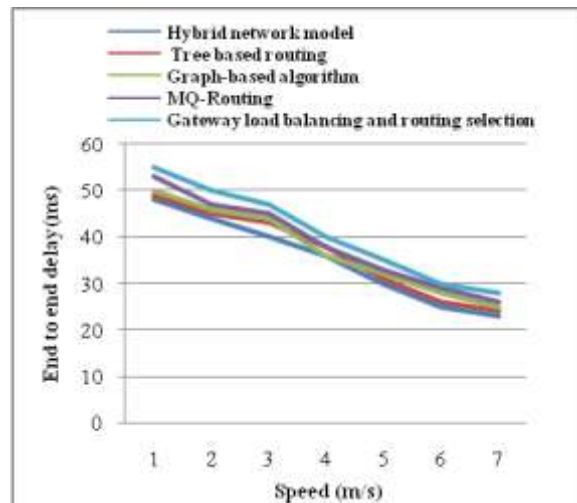
Figure 1: Throughput Comparison

Figure 1 shows the comparison of throughput performance for existing hybrid network model, Tree based routing, Graph-based algorithm, MQ-Routing and proposed Gateway load balancing and routing selection scheme are compared. Speed is taken as x-axis and Throughput is taken as a y-axis. From the graph it is clear that the Gateway load balancing and routing selection scheme achieves high throughput performance.

2. End to end delay

The average time taken by a packet to transmit from source to destination across the network is well-known as End to End delay.
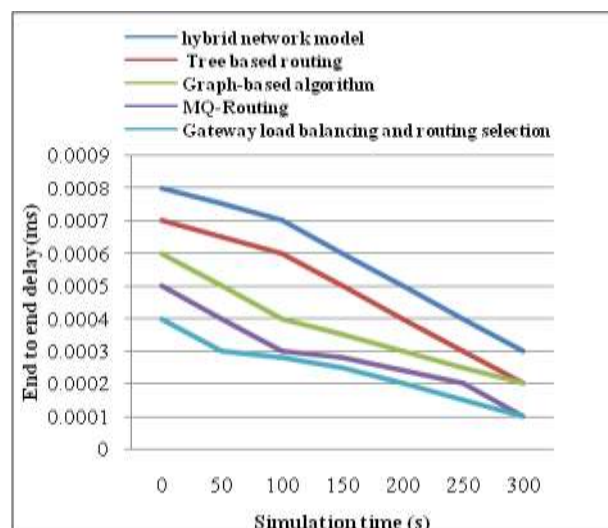

Figure 2: End-to-End Delay Comparison

Figure 2 shows the comparison of end to end delay performance for existing hybrid network model, Tree based routing, Graph-based algorithm, MQ-Routing and proposed Gateway load balancing and routing selection scheme are compared. The simulation times are taken as x-axis and end to end delay is taken as a y-axis. From the graph it is clear that the Gateway load balancing and routing selection scheme achieves less end to end delay.

IV.CONCLUSION

The research paper stated some of the solutions in MANETs for rescue operations to serve better. This paper having discussions on hybrid network model, Tree based routing, Graph-based algorithm , MQ-Routing and Gateway load balancing and routing selection scheme. The research works has been compared with each other based on their resultant metrics to find the better approach to precede the further research scenario in future. With respect to the above discussions the future work may leads to improve the QoS for the network conditions and network architectures.

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