

Efficient Routing and Congestion Control in Multi-Flow MANET Environment

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Abstract:

The congestion control within the TCP (Transmission Control Protocol) plays a critical role in amending data rate to evade congestion from happening possibilities. Based on TCP communication sender not only guarantees the successful packet delivery, but also maintains the correct sequence of packets by receiving the frequent acknowledgement from the receiver. In this research we proposed a congestion control scheme with modified TCP and queue length variation with OLSR routing protocol in MANET. The TCP protocol performance is modified by forwarding busy channel signals to predecessor nodes through intermediate nodes in network. The congestion is controlled by that novel method of detecting the node is busy or ready for communication. If the communication is start in network and the possibility if congestion is arise, then in that case the queue length is handle the possibility of congestion. The congestion is minimized due to awaring about the channel busy status and nodes buffer status or queue status. The TCP protocol is able to handle the congestion situation but i.e. completely based on acknowledgement of receiver and also not very effective to control it. The proposed TCP congestion control OLSR routing is improves the network performance by reducing packet loss. The performance of network is measure through performance metrics like throughput, PDF and Routing overhead in different node density scenarios. The performance of proposed scheme is provides the better results.

Keywords-- TCP, OLSR, Routing, Congestion, Channel, MANET Bhopal, India

I. INTRODUCTION

Mobility and also the lack of any mounted infrastructure create Mobile Ad-hoc Networks (MANETs) terribly beautiful for brand spanking new age applications. There area unit numerous problems and challenges in coming up with a MANET network. At transport layer, end-systems will gather info regarding every used path: congestion state, capability and latency. This info will then be accustomed react to congestion events within the network by moving the traffic removed from engorged methods [1].

Mobile Ad-hoc Networks (MANETs) are component offensively beautiful for up to date applications. There are unit lots of problems and challenges in coming up with a Manet network. as a result of active topology structure and node amendment each second on its position, one in every of the live challenges is congestion, in MANET if sender node need to send knowledge into the therefore me specific receiver therefore terribly initial broadcast routing packet onto the network and obtain destination through the shortest path (if we tend to apply AODV) or minimum intermediate hop (if we tend to use DSR) once obtaining path sender sends actual

knowledge through uni-path link however at an equivalent time quite one sender share common link so congestion occur onto the network that's live issue for MANET. Therefore varied scientist works therein filed for step-down of congestion from network. During this outline we tend to focus congestion step-down minimization multipath routing in ad-hoc network and transport layer base congestion management or rate analysis base congestion management in MANET.

In multipath technique sender sends info through lots of than one path to receiver node which will increase the performance of the network unit management the one share path congestion once that we've a bent to in addition analyze info rate of sender if sender rate larger than the receiver node thus we've a bent to reduce the exploit rate on the bases of transport layer technique. The method of discovering multiple routes among the distinct provide and single destination at the time of single route discovery corresponds to multi-path routing [1]. In MANET, the prevailing problems like quantify ability, security, network period of time, etc are going to be handled by the multi-path routing protocols [2]. This protocol enhances the end-to-end turnout and offers load reconciliation in MANETs.

II. CONGESTION ISSUE IN MANET

When the requirements become larger than most capability of the communication link considerably throughout multiple hosts creating a shot to access a shared media, congestion happens within the network. Congestion may additionally be caused throughout the subsequent conditions.

- When the load within the link goes on the far side the carrying capability.
- When the broadcasting packets area unit surplus in nature.
- When lots of form of packets field has becomes day trip and retransmitted.
- When the quantity of node will increase. During variance of the packet delay [4].

The congestion detected at intervals the network can strictly worsen network turnout [3]. It ends up in the packet losses, information measure degradation and energy expenditure [5]. Once the engorged network is left unattended i.e., once applicable congestion management technique isn't dead, it ends up in congestion collapse of the network. Therefore the knowledge won't deliver to destined node in effective manner [3].

III. ROUTING PROTOCOL OVERVIEW

Mobile Ad-hoc networks are self-organizing and self-configuring multihop wireless networks, where the structure of the network changes dynamically. This is mainly due to the mobility of the nodes [10]. Nodes in these networks utilize the same random access wireless channel, cooperating in an intimate manner to engaging themselves in multihop forwarding. The node in the network not only acts as hosts but also as routers that route data to/from other nodes in network [11].

A. Proactive Routing Protocols:

Proactive protocols like Destination Sequenced Distance Vector (DSDV) [10,11], Optimized Link State Routing (OLSR) [12] continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a need for a route to a destination, such route information is available immediately. If the network topology changes too frequently, the cost of maintaining the network might be very high. If the network activity is low, the information about actual topology might even not be used.

B. Reactive Routing Protocols:

The reactive routing protocols Dynamic Source Routing protocol (DSR) [13], Ad Hoc on Demand Distance Vector protocol (AODV) [14], Temporally Ordered Routing Protocol (TORA) [15] are based on some sort of query-reply dialog. Reactive protocols proceed for establishing route(s) to the destination only when the need arises. They do not need periodic transmission of topological information of the network.

C. Hybrid Routing Protocols:

Often reactive or proactive feature of a particular routing protocol might not be enough instead a mixture might yield better solution. Hence, in the recent days, several hybrid protocols are also proposed like ZRP [16].

IV. RELATED WORK

This section presents related work about existing work done in the field of MANET routing protocol, congestion control.

Makoto Ikeda, Elis Kulla et. al.[1] "Congestion Control for Multi-flow Traffic in Wireless Mobile Ad-hoc Networks" In this title, researcher deal with congestion control for multi-flow traffic in wireless mobile ad-hoc networks (MANET) using OLSR routing. This approach done through OLSR routing they also apply multi flow in AODV routing approach.

Kezhong Liu ; Layuan Li [2] in his work titled "Research of QoS-Aware Routing Protocol with Load Balancing for Mobile Ad Hoc Networks" this title combines the multi-constraint QoS mechanism with the load balancing scheme to search the satisfying path between the source node and destination node. The researcher main objective is to develop a load balancing strategy that could monitor any changes to the load status of the neighborhoods and be able to choose the least loaded routes with the knowledge of the surrounding load status. The AQRL protocol makes an extension on the AODV and utilizes the node's resolvable bandwidth and load information to distribute the network loads, which can prevent network from getting into the state of congestion, and avoid the power of congested node to be exhausted.

Yi, J., Adnane, A., David, S. and Parrein, B. [3] in his work titled "Multipath optimized link state routing for mobile ad hoc networks" The algorithm gains great flexibility and extensibility by employing different link metrics and cost functions. In addition, route recovery and loop detection are implemented in MP-OLSR in order to improve quality of service regarding OLSR. Multipath routing protocols for Mobile Ad hoc Network (MANET) address the problem of scalability, security (confidentiality and integrity), lifetime of networks, instability of wireless transmissions, and their adaptation to applications.

G.Vijaya Lakshmi Dr. C.Shoba Bindhu.[4] in his work titled " Congestion Control Avoidance in Ad hoc network using queuing model", they proposed the queuing mechanism hence improves the network metrics such as overall network throughput, reduces the route delay, overhead and traffic blockage probability. The approach is generated over a routing scheme in ad-hoc network.

Vijayaragavan Shanmugam and Duraiswamy Karuppaswamy,[5] in his work titled " An Analysis of Power Aware Congestion Control Multipath Multicast Protocol for Mobile Ad hoc Network", In this title, they propose a Power-Aware Multiple Path Multicast Ad-hoc On Demand Distance Vector (PAMPMAODV) for MANETs. In order to utilize the battery effectively a different strategy has been proposed for route selection. The route selection process has been designed

to select multiple routes based on hop count, end-to-end delay and residual battery capacity. The PAMP-MAODV protocol has been implemented using the group learning module of VCR and compared with MAODV and MP-MAODV routing protocols for parameters such as network traffic, the node speed, the network area, throughput, control overhead, number of receivers and SD of Battery Energy Used.

S.Santhosh baboo and B.Narasimhan, [6] in his work titled "A Hop-by-Hop Congestion-Aware Routing Protocol for Heterogeneous Mobile Ad-hoc Networks", In this title, they propose to develop a hop-by-hop congestion aware routing protocol which employs a combined weight value as a routing metric, based on the data rate, queuing delay, link quality and MAC overhead. Among the discovered routes, the route with minimum cost index is selected, which is based on the node weight of all the in-network nodes.

Tuan Anh Le [7] in his work titled "ecMTCP: An Energy-Aware Congestion Control Algorithm for Multipath TCP" they develop an energy-aware congestion control algorithm for multipath TCP, called ecMTCP. ecMTCP moves traffic from the most congested paths to the more lightly loaded paths, as well as from higher energy cost paths to the lower ones, thus achieving load-balancing and energy-savings.

Jingyuan Wang, Jiangtao Wen et. al.[8] in his work titled "An Improved TCP Congestion Control Algorithm and its Performance" In this title, they propose a novel congestion control algorithm, named TCP-FIT, which could perform gracefully in both wireless and high BDP networks. The algorithm was inspired by parallel TCP, but with the important distinctions that only one TCP connection with one congestion window is established for each TCP session, and that no modifications to other layers (e.g. the application layer) of the end-to-end system need to be made. This work done only transport layer congestion control via TCP improvement method but congestion also occurs in routing time so that work enhance through routing base congestion control technique.

M. Ali, B. G Stewart et. al.[9] In his work titled "Multipath Routing Backbones for Load Balancing in Mobile Ad Hoc Networks" this title we are discuss a new approach based on multipath routing backbones for enhanced load balancing in MANETs. Nodes in MANETs greatly differ with each other in terms of communication and processing capabilities. In the proposed approach, multiple routing backbones are identified from source to destination using intermediate nodes that have better communication and processing capabilities to take part in the mobile routing backbones and efficiently participate in the routing process. This work use multipath technique but not execute multipath simultaneously that case use alternative base load balancing technique.

V. PROBLEM IDENTIFICATION

Multi flow mobile ad-hoc communication is a recent challenge while nodes are limited resource contained i.e. processing power, memory, and energy. In limited range

capable device drastically upgrade the new age to network technology but creates the competitive network while multiple sender shares the common resource or channels, that competitive environment increases the network congestion and overhead. In past decade some researcher or authors gives maximal effort in the field of congestion control and give some percentage of solution to minimized the problem of congestion through different way but not apply combine approach to resolving congestion and overhead so in this dissertation we proposed a technique to resolve the network congestion and overhead problem using "Efficient Routing and Congestion Control in Multi-Flow MANET Environment" that work ensure the end user to congestion free communication while multi flow link or channel are activate in simultaneously during the network nodes are communicative mode.

VI. PROPOSED CONGESTION SCHEME

The proposed work to focus of dominant the congestion from the network with explicit rate measure technique and minimize the congestion dependent wasteful packet flooding, for that purpose we tend to divide our proposal into component part and manage the congestion, it also as provide congestion free communication. whereas multiple sender node are send data packets to the multiple receiver through one or multi path, in his work our path are established with the assistance of OLSR updated routing, they sends the data packet to the destination node or receiver node through the intermediate nodes however multiple sender nodes share the common link that increase the congestion in between communication link. thus here one extra header filed of TCP are added within the protocol design that provides the congestion awareness to the sender and explicit manage the congestion, in before that we tend to measure the congestion in every intermediate node on the bases of incoming and outgoing channel measure and queue utilization of nodes, all node integral the message of channel and queue utilization and forward to next hop that message decode by the receiver node and build call for explicit manage congestion info and send back acknowledgement to sender node, than sender explicit modify rate and provide congestion free communication.

A. Proposed Algorithm

In this section we design the algorithm and control the congestion under multi flow environment, that formal algorithm are divided into three separate parts input, output and operation that combine approach are resolve the problem of congestion.

Algorithm: **Congestion Control in Multi flow MANET**

Input: Nodes: N

Set of Source: S_s

Set of Receiver: R_r

Packet Type: tcp, udp

Connection Pattern: Random

Length of Queue: L_Q

CPU utilization: CU

Queue Threshold: $L_{Q_{th}}$

CPU utilization Threshold: CU_{th}

Congestion bit: C_b
 Acknowledge packet: $Ack_1, Ack_2, \dots, Ack_{n-1}, Ack_n$
 Threshold Delay = response-time $((Ack_2 - Ack_1) * 3)$;
 Routing: OLSR

Output: Data drop, receiver, sends, throughput, pdr and delay Analysis

Operation:

```

While  $S_s$  communicate with  $R_r$  do
    Information of Path  $S_s, \dots, i, \dots, j, \dots, R_r$ 
    Check intermediate node  $i, j$  status
    If  $L_Q > L_{Q_{th}}$  and  $\%CU > \%CU_{th}$ , Then
        Set  $C_b = 1$ 
    End if
    If  $L_Q \leq L_{Q_{th}}$  and  $\%CU \leq \%CU_{th}$ , Then
        Set  $C_b = 0$ 
    End if
    End do
    If  $C_b = 1$  Then
        New  $L_Q$  allocate  $\leftarrow L_{Q_{old}} + 1$ ;
        New delay = response-time( $Ack_n -$ 
Ackn-1)
    End if
    If delay > delayth Then
        Search new path
        Execute routing (OLSR,  $S_s, R_r$ )
    End if
    If channel == ideal Then
        Established path from  $S_s$  to  $R_r$ 
    Else
        Wait for channel ideal
    End if
Stop
    
```

VII. SIMULATION & RESULT ANALYSIS

Network Simulator (Version 2), wide called NS2 is solely an occurrence driven simulation tool that has established helpful in finding out the dynamic nature of communication networks. Simulation of wired also as wireless network functions and protocols like AODV, FTP, TCP and UDP will be done victimization NS2. In general, NS2 provides users with the way of specifying such network protocols and simulating their corresponding behaviours. The Simulator we've got wont to simulate the ad-hoc routing protocols in is that the Network Simulator (ns) [17] from Berkeley. To simulate the mobile wireless radio atmosphere we've got used a quality extension to ns that's developed by the CMU Monarch project at Carnegie Mellon University. Since its origination in 1989, NS2 has endlessly gained tremendous interest from business, academia, and government.

We simulate our result on the basis of following parameter.

- ▶ **Packet Delivery Ratio:** The ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination.
- ▶ **Average End-to-end Delay:** This includes all the possible delays caused by buffering during route

discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times.

- ▶ **Packet Dropped:** The routers might fail to deliver or drop some packets or data if they arrive when their buffer are already full. Some, none, or all the packets or data might be dropped, depending on the state of the network, and it is impossible to determine what will happen in advance.
- ▶ **Routing Load:** The total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet or each hop counts.

A. Performance Parameters

Let's get Evaluation Parameter like Number of nodes, Dimension, Routing protocol, transport layer protocol, application layer data and maximum speed of mobile nodes etc. According to below table 1 we simulate our network.

Number of nodes	10, 20, 30, 40
Dimension of simulated area	800m × 600 m
Antina	Omedirectional
Simulation time (seconds)	500
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random
Radio Range	550m

B. Throughput Analysis

The MANET are forming temporary network by that the link are not maintained long time because of that the topology in network are frequently changes. The proper data delivery without any congestion or loss of data is improves the routing performance of network. In this graph the throughput performance of OLSR routing protocol is evaluated in case of normal TCP protocol with OLSR (Old) and proposed modified TCP protocol with queue states (Proposed) is appraised in scenario of 20, 30 and 40 nodes in network. The throughput performance is improves because of intermediate nodes are forwarding the busy message and idle message in network and also enhance the queue estimation to provides the extra load handling uin dynamic network. The proposed scheme is reduces the possibility of congestion by that the performance is better than normal routing performance.

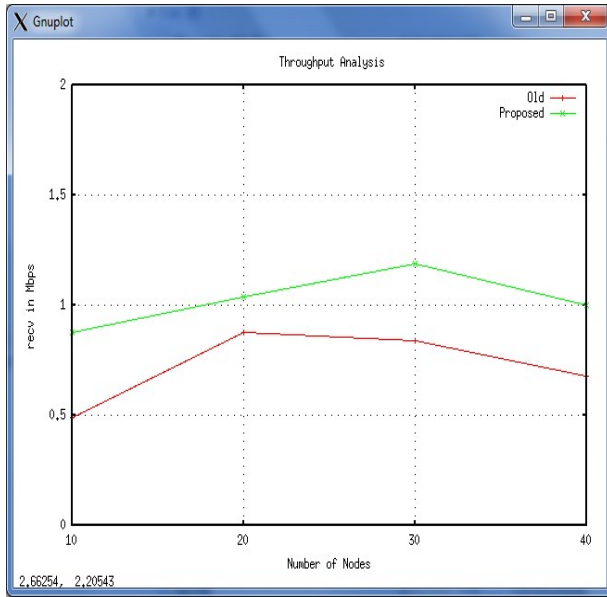


Figure 1 Throughput Analysis

C. Data Drop Analysis

The performance of network are degrades due to loss of data in network and also the performance of network is enhance by better data receiving with respect to sending. In wireless mobile network the bandwidth of link is limited by that the variation in bandwidth is not possible. The congestion problem in network is occurring due to improper load handling in limited bandwidth. In this graph the packet dropping is calculated in case normal TCP with OLSR and proposed modified TCP with OLSR and observe that the dropping of packets are in proposed scheme is minimum. The less packet dropping are shows the better network performance.

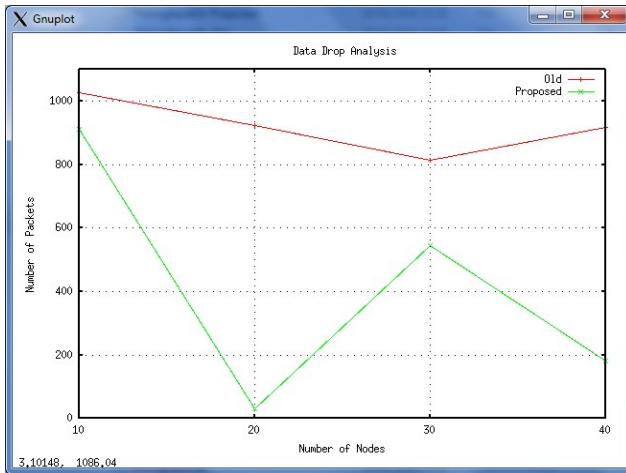


Figure 2 Data Drop Analysis

D. Percentage of Data Drop

The percentage of data dropping in between normal TCP with routing performance of OLSR protocol and proposed TCP is mentioned in this graph

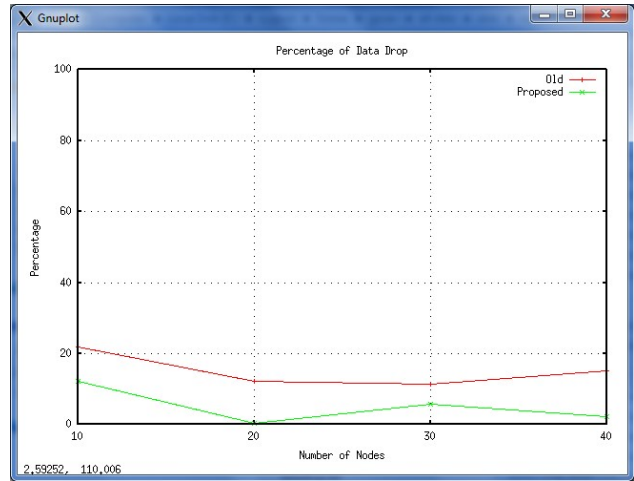


Figure 3 Data Drop Percentage Analysis

The data percentage of dropping in normal performance is about 10 % minimum of total data received in network. However the data percentage of dropping in proposed scheme is only identified about 10% at node density is also 10 and 5% maximum in 30 nodes scenario. The less packet dropping represents the congestion free network performance.

E. Average End-to-End Delay

The proper data sending and receiving is improves the network performance and it is also a good sign of better routing performance in network. If the packet loss in network is more due to congestion then in that case the delay in network is enhanced. In this graph the delay analysis of normal OLSR routing and proposed TCP performance with improved mechanism is evaluated. The graph of proposed scheme in scenario of 10, 20, 30 and 40 nodes are shows better delay performance in network. On the other hand the performance of normal TCP is provides more delay that shows the degradable performance. The delay is measure in Ms (Mille seconds).

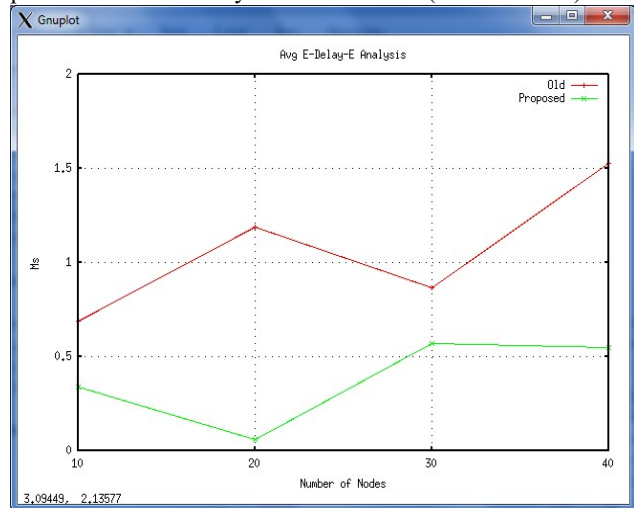


Figure 4 End to End Delay Analysis

F. Overhead Analysis

In dynamic network it is not possible to maintain connection for a long time.

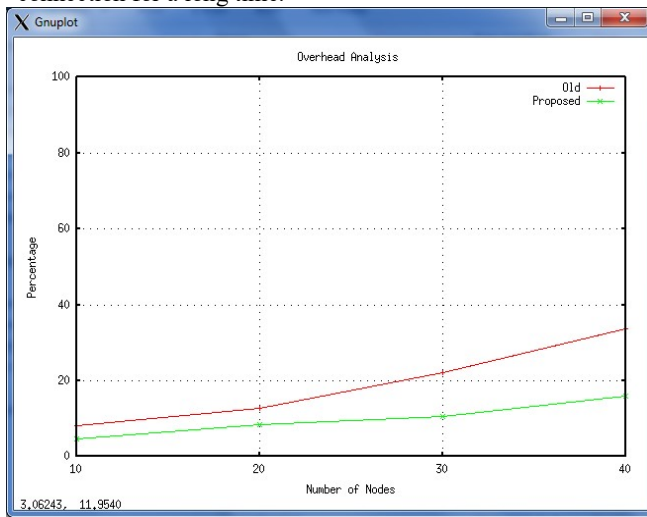


Figure 5 Routing Packets Overhead Analysis

After some time nodes are moves out of range and link is break in network. That's why again routing packets or control packets are flooded in network for finding destination in network for data delivery. The better quantity of routing packets is degrades the quantity of data packets in network and also enhance the delay in network. Due to congestion in network the link are break frequently i.e. the main cause of overhead augmentation. In this graph overhead percentage with respect to total data packet received in network is measured and identified that the proposed TCP performance is better in network. The overhead of proposed scheme is less ten 20 percent in all network scenarios but the normal TCP provides the more than 30% overhead. The proposed scheme is reduces the congestion and provides better routing performance.

VIII. CONCLUSION AND FUTURE WORK

The temporary network is only maintained for some time and if the numbers of nodes are mobile then strong link establishment is really a critical issue in Mobile Ad hoc network (MANET). These networks introduced a new art of network establishment and can be well suited for an environment where either the infrastructure is lost or where deploy an infrastructure is not very cost effective. The MANET is the wireless network then in that case the bandwidth capacity is limited and not possible to enhance as compare to typical wired network. In MANET the congestion control is the critical issue because of this limited bandwidth. In this research we proposed a TCP congestion control queue status based OLSR routing in MANET. In this research the TCP is control the end to end communication by forwarding the busy status of current node to predecessor. That's why the time consumption and possibility of collision is removed. The routing procedure in the network is handled by queue length estimation. The simulation results are evaluated in different node density scenarios like 10, 20, 30 and 40 in proposed

simulation scenario and normal simulation scenario. The performance of proposed scheme is really better. The proper packet forwarding is provides the better network performance and reduces the possibility of congestion. The different simulation results are represent normal TCP communication with OLSR protocol results nor not much effective then proposed scheme. The proposed scheme is improved the routing performance and TCP congestion window in dynamic network.

In dynamic network the attackers are easily affected the network performance then in that case it is very difficult to identified the attacker in network because of congestion also data is drop in network. In future we proposed a security scheme with intelligent knowledge scheme of identified congestion and attacker separately in network. The proposed scheme mentioned in this research is used to identified congestion and also include the concept of security is added on them to identified attacker.

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