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Reactive and Proactive Routing Protocols Performance Analysis With OPNET

Authors: Navjeet Kaur[1]; Damandeep Kaur[2]

Department Of Electronics and Communication, GCET
Gurdaspur, INDIA.[12]

Abstract

MANET routing protocols working mechanism is as that source node has to find the optimal path in the network. So when ever topology will be changed source node will keep the record of neighbor nodes, Data packets can be forwarded to their neighbors as well as destination node. There are many routing protocols are lying in Mobile Ad-hock network. In this research paper Authors have taken some MANET node in Campus Network for different protocol. For finding the best among protocols, Reactive and proactive MANET Routing Protocols, AODV, OLSR, TORA has been briefly analyzed with some performance metric using OPNET Simulator. Some performance metrics like Voice End to End Delay, jitter, Voice Delay, Voice MOS, E-mail Upload as well as Download Response Time, Http Object Response Time, Database Query Response Time are performance with OPNET Tool, TORA Protocol Provide best Results in Every Performance Matric.

1 Introduction

MANET nodes, which are used to communicate with each other in a wireless environment that does not support any centralized control. In such a type of network all the MANET nodes exchange information without wires. The motive of the MANET network is to find the best route which is known as the optimum route and share data packets with the next router, so that packets can be reached successfully to the destination node finally. MANET network topology is created for a specific purpose, when the purpose is fulfilled, then that topology is changed, that's why MANET network is called temporarily not permanent. Routing is a difficult task to transfer data from one mobile node to another's node. Mobile node interconnected with each other's in different ways MANET can be classified as Dynamic, Multi-node and based on rapid changing mechanism. MANET topology changed within the time it is not predetermined because a MANET node can be connected or disconnected for a specific purpose. MANET is used to transfer and receive data between nodes by wireless communication. It performs dynamically node to node routing, it is not based on a static mechanism in which predetermine routes are selected. In the MANET environment, a single file is divided into various data packets, different paths are used to transmit the data packets, and at the destination end

All the packets synchronize in this way that full file regenerates in the correct order. Nodes act as servers and as well as clients too. MANET is a collection of decentralized system in which laptop; mobile nodes are used to transmit data from one node to others. Figure 1.1 shows the localized MANET consisting of mobile nodes.

Figure 1.1 Mobile Ad-hoc wireless Network

2 AODV (The ad-hoc On Demand Distance Vector)

There are mainly three types of MANET routing protocols exist that defined into different categories

on the behalf of working mechanism. These categories are reactive, proactive and hybrid .AODV Protocol is lying in Reactive class. This protocol is able to perform task with uni-cast as well as multicast routing. AODV works with each uni-cast and multicast routing. As delineate before AODV operating mechanism is on demand suggests that it produce the routes once it's required and demanded by supply nodes .Then supply node delivers the packets knowledge to specific node. The Route is maintained as long as required by the supply. AODV working mechanism is as that it performs the task like route detection, route reply with loop free environment so that it helps to manage the number of mobile nodes congestion. First of all administrator routers send Route Request and second destination nodes Reply question packets. Actually whenever supply node would like the needs Route to destination node within the network source node Broadcasts a Route Request to entire Network, then all the nodes within the network received the data from supply node and send some specific information to source node that was requested by source node. All the nodes send info to supply node. Once supply node sends the data to entire network it's referred to as RREQ. Once all the nodes reply to supply node it's referred to as RREP. By reply the data to supply node is update their information for the source node in network. within the Reactive Routing whenever any node receive the RREQ by supply node, the node whether or not it's going to be destination node or is also has route to the destination.

3 OLSR (Optimized Link State Routing)

It is a proactive routing protocol and is also called as table driven protocol because it permanently stores and updates its routing table. OLSR keeps track of routing table in order to provide a route if needed. OLSR can be implemented in any ad- hoc network. Due to its nature OLSR is called as proactive routing protocol. Multipoint relay (MPR) nodes are shown in the given Figure 1.6 all the nodes in the network do not broadcast the route packets. Just Multipoint Relay (MPR) nodes broadcast route packets. These MPR nodes can be selected in the neighbor of source node. Each node in the network keeps a list of MPR nodes. This MPR selector is obtained from hello packets sending between in neighbor nodes. These routes are built before any source node intends to send a message to a specified destination. Each and every node in the network keeps a routing table. This is the reason the routing overhead for OLSR is minimum than other reactive routing protocols and it provide a shortest route to the destination in the network. There is no need to build the new routes, as the existing in use route does not increase enough routing overhead. It reduces the route discovery delay.

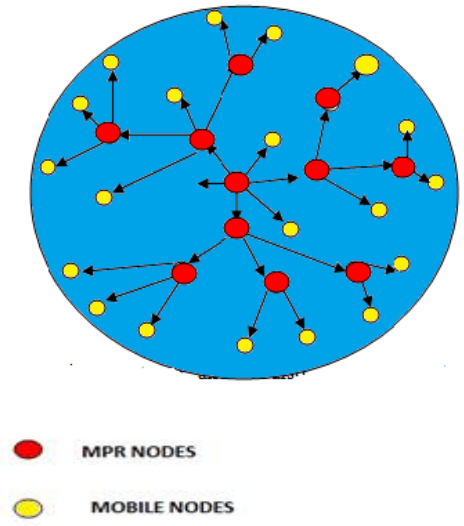

Figure 3.1 MPR node sends the TC message

4 TORA (Temporally Ordered Routing Algorithem) The Temporally-Ordered Routing Algorithm (TORA) is an adaptive routing protocol for multi-hop networks. TORA is a distributed algorithm so that routers only need to maintain knowledge about their neighbors. TORA uses the concept of height associated with a certain destination to describe the routing metric used by routers. Like water flows in pipes, routers with higher heights may forward packet flows to neighbors with lower heights. In TORA, it is necessary for each Node to collect the neighbor's routers information so that it can Searches out easily and transferred all the needed packets to destination in a sequence manner. All the communication of TORA is depended on following packets.

- **Query (QRY)**
- **Update (UPD)**
- **Clear (CLR)**

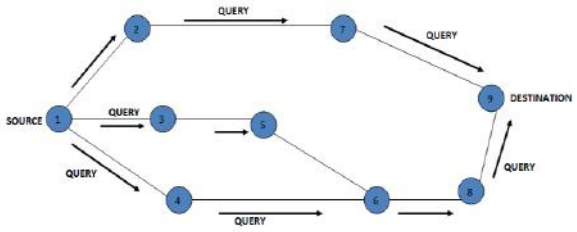

Figure : 4.1 Working of Query Packets in TORA

The QRY packet used to arrange a route and this is broadcast by source node encloses destination address via network. This QRY packet traverses MANET nodes till its destination or it arrive at center node which keeps the destination route. The center or destination node stops QRY packet and broadcast a UPD packet enclosing its height regarding to destination. At destination node height will be zero. Every node which obtains UPD packet puts its height to a greater value of height of neighbor node as of which it got UPD packet and so on. This is a sequence of DAG for creating routes rooted to destination in the network. The value of heights is used to control the nodes from sending packets only from downstream not from upstream. In CLR Packets when a TORA node finds link failure in network A broad cast clear packet (CLR) is flooded over the entire network to erase routes which are not valid for the destination by that node. This node will also update values in its link table accordingly.

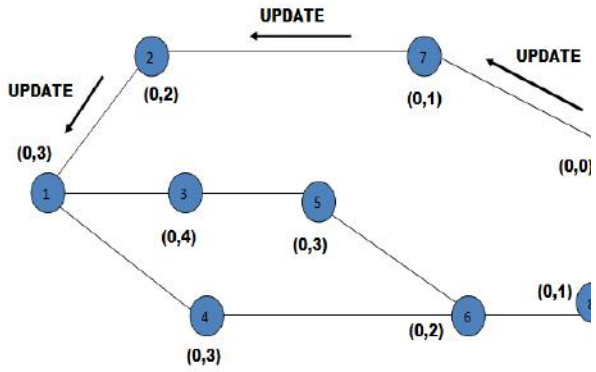

Figure 4.2 Working of Update Packets in TORA

This figure 'Directed Acyclic Graph.' shown that source node is 'a' and destination node is 'g', therefore all the possible routes are created by this way.

1. (a)>(b)>(f)>(g)
2. (a)>(b)>(c)>(f)>(g)
3. (a)>(c)>(f)>(g)
4. (a)>(d)>(e)>(g)

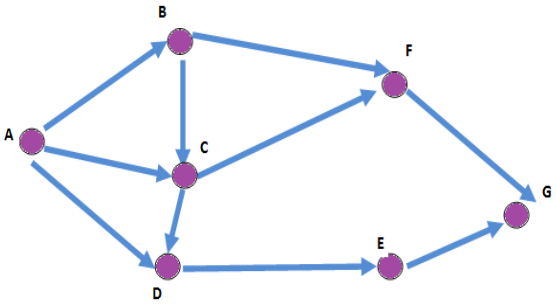

Figure 4.3 Directed Acyclic Graph for TORA

5 literature survey

Soomro Abdul Majid et al (2022) Researhers definef routing protocols and their difficulties linked to security, energy, routing, security assaults on the physical structure of data and layers and attempted to resolve esecurity issues in the literature review. The various routing protocols outlined above are extremely valuable and efficient for new research efforts aimed at identifying current difficulties for future research. Many new approaches, rules, algorithms, and protocols are offered for achieving routing solutions nowadays. However, despite this progress, there are still many research issues, such as which protocol, technique, method, algorithm, or procedure performs best in whatever environment. Although much has been done in this field to date, there are still many challenges and issues to be addressed. In this work, study examine various routing protocol strategies and discuss the issues that these techniques can cause. This will help researchers better understand to improve routing performance.

Nisar et al (2021) in this paper The object of performance analysis of the routing protocol in MANETs is to identify cause and effects of existing and potential problems. This work proposes testing the three most common ad hoc routing protocols Ad-hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR) and Optimized Link State Routing Protocol (OLSR) using Optimized Network Engineering

Tool (OPNET) Modeler simulations using the performance metrics of Throughput, Delay, and Network loading to find an effective routing protocol for routing. it can be concluded that OLSR is the most suitable routing protocol for MANET, based on the routing protocols suggested.

Raza et al (2016) Mobile Ad-Hoc Network (MANET) is an infrastructure less wireless network of autonomous collection of mobile nodes (Smart phones, Laptops, iPads, PDAs etc.). Network is self-configured to reconstruct its topology and routing table information for the exchange of data packets on the joining and leaving of each node on ad-hoc basis. Authors described that MANET applications and challenges. The researchers can get the overall concept of MANET as well as its applications and challenges.

Kaur et al. (2014) In this paper the performance analysis of routing protocols AODV, DSR and OLSR protocols in MANET have been investigated. The investigation considers the impact of scalability, mobility and Network. HTTP, FTP and Email and Video Conferencing heavy traffic load on different types of routing protocols is taken. In the performance assessment throughput adopted for the whole scenarios considered. The simulation using OPNET consider different scenarios that attempt to cover all of the aspects on Network evaluation required. From this paper, In the case of throughput, the throughput of DSR is very less than that of AODV and OLSR. But, the throughput of OLSR is higher than that of the reactive routing protocols AODV, DSR; it is because the OLSR protocol is independent of the traffic and Network density compared to AODV, DSR protocols. The simulation results according to web application conclude that throughput is was highest in HTTP and lowest in video conf and Email.

Mahajan and Chopra (2013) discussed the three routing protocols (AODV, OLSR and TORA) based on OPNET simulations. Author motive was to check the performance of these three routing protocols in MANET on the above mentioned parameters. We analyzed for different reactive and proactive ad-hoc routing protocols with different mobile nodes transmitting GSM voice traffic data. Finally it is concluded that the overall performance of OLSR is better choice for small and large Networks. The performance of TORA does scale well with large and small sized Network as compared to AODV. Simulation result also showed TORA reactive routing protocol is the finest suited for MANET protocol in dense population of nodes, whereas AODV has very poor QoS in high populated node Networks with GSM voice traffic data. At the end we came to the point that the performance of routing protocols vary with Network. It is the selection of accurate routing protocols (taking into consideration the type of Network) that ultimately influence the efficiency of that Network in magnificent way. So proactive protocol OLSR outperforms in terms of throughput jitters and gets the same low delay as OLSR.

Parvathavarthini and Dhenakaran.S (2013) Authors seen a great development in the field of wireless Networks (infrastructure based) and in the field of Mobile ad hoc Network (infrastructure less Network).In this paper a number of routing protocols for MANET, are taken which are broadly categorized as proactive and reactive and Hybrid protocols. The effort has been made on the comparative study of Reactive, Proactive and Hybrid routing protocols has been presented in the form of table. There are various shortcomings in different routing protocols and it is difficult to choose routing protocol for different situations as there is tradeoff between various protocols. There are various challenges that need to be met, so these Networks are going to have widespread use in the future.

Jasvinder and Sachdeva (2013) In this paper it was observed that when there is a larger number of nodes and more requests for guidance, it would affect the performance of the Network. Delayed removal of the Attack rate in the state of the Protocol AODV. However, the Network load conditions, and there was more impact of the malicious AODV decade. Address the issue of the second search, the discovery of the ad hoc Networks AODV is more affected by the Attack, compared with the black hole Attacks.

6 Simulation work

The protocols taken in this Research paper are AODV, OLSR and TORA routing protocols. The proposed routing protocols are compared and evaluated based on some quantitative metrics such

as Database query Response Time, Http Object Response Time, Remote Login Response Time, Video End to End Delay, Jitter, MOS value, Voice Packet Delay, Voice End to End Delay. In this work, motive is to evaluate the performance of AODV, TORA and OLSR on the basis of different scenarios. OPNET provides output in a graphical manner in such a way that can easily analyze the performance of network or any device which is being used as described earlier, in this research work have taken AODV,TORA and OLSR protocols. Performance has been checked with various performance metrics. Then three different scenarios for AODV, TORA and OLSR are created .The network topology composed of the following network devices and configuration utilities:

6.1 Database Query Response Time:

Time elapsed between sending a Request and Receiving the Response Packet Measured from the Time when the Database Query Application sends a Request to the Server to the time it receives a Response Packet Every Response Packet sent from a Server to Database Query application is included in the statistic.

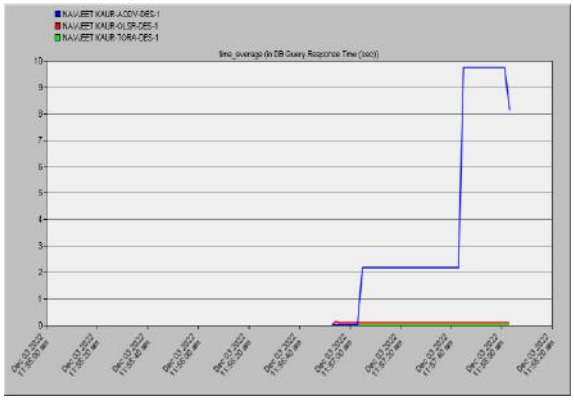

Figure 6.1: Database Query Response Time

According to simulation, from the Figure 4.1, it can be seen that the Database Query Response time for AODV, OLSR & TORA are different .In Database Query Response time performance of TORA is providing best results.

6.2 Http Page Response Time:

Http Object Response time is defined as specific Response time for each inlined oblects from the HTML page.

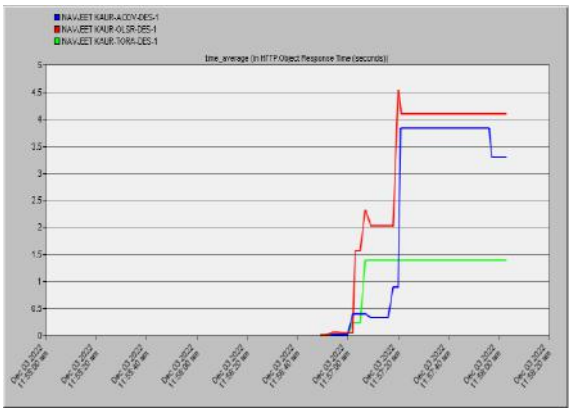

Figure 6.2: Progress of Http Page Response Time

According to simulation, from the Figure 4.2, it can be seen that the Http Page Response Time for AODV, OLSR & TORA are different.. In Http Page Response Time performance of TORA is providing best results.

6.3 Voice End to End Delay

It is Avearge number of Packets per second submitted to the transport layers by all voice application in the network

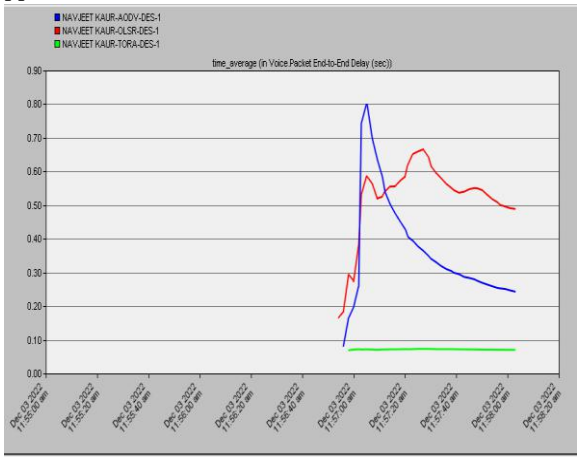

Figure 6.3 Voice End to End Delay

According to simulation, from the Figure 4.8, it can be seen that the Voice End to End Delay Performance time for AODV, OLSR & TORA are different. In Voice End to End Delay performance of TORA is providing best Results.

6.4 Jitter: Voice Jitter is define as if two consecutive packets leave the source node with time stamps t1 & t2 and are played back at the destination node at time t3 & t4 ,then jitter =(t4 - t3) – (t2 – t1). Negative Jitter indicates that the time difference between the packets at the destination node was less than that at source node. Jitter is defined as a variation in the delay of received packets. The sending side transmits

packets in a continuous stream and spaces them evenly apart. Because of network congestion, improper queuing, or configuration errors, the delay between packets can vary instead of remaining constant, as shown in the figure. This variation causes problems for audio playback at receiving end. Playback may experience gaps while waiting for the arrival of variable delayed packets

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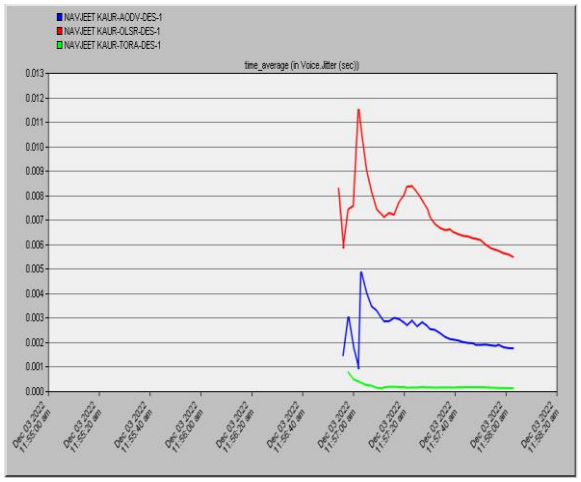

Figure 6.4: Progress of Jitter

According to simulation, from the Figure 4.4, it can be seen that the Jitter performance time for AODV, OLSR & TORA are different. In Jitter performance of TORA is providing best results.

6.5 MOS

In voice and video communication, quality usually dictates whether the experience is a good or bad one. Besides the qualitative description it hears, like 'quite good' or 'very bad', there is a numerical method of expressing voice and video quality. It is called Mean Opinion Score (MOS). MOS gives a numerical indication of the perceived quality of the media received after being transmitted and eventually compressed perceived by people during tests. However, there are software applications that measure MOS on networks, as seen below.

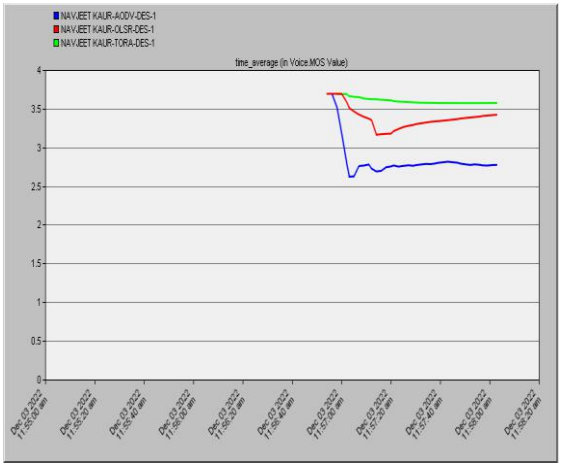

Figure 6.5: Progress of MOS

According to simulation, from the Figure 4.10, it can be seen that the MOS performance time for AODV, OLSR & TORA are not varying much. . However, in MOS performance of TORA is still better.

6.6 Voice Packets Delay: Delay is caused when packets of data (voice) take more time than expected to reach their destination. This causes some disruption is the voice quality.

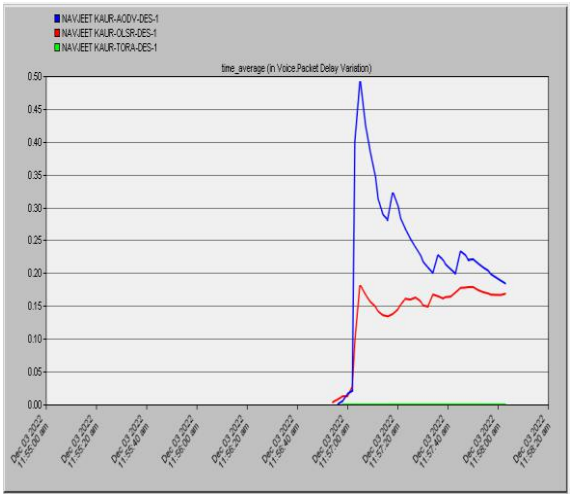

Figure 6.6: Progress of Voice Packets Delay

According to simulation, from the Figure 4.11, it can be seen that the Voice Packets Delay performance time for AODV, OLSR & TORA are different.. In Voice Packets Delay performance of TORA is providing best results.

6.7 E-mail Download Response Time: Time Taken to Download Particular E-mail data Known as E-mail Download Response Time.

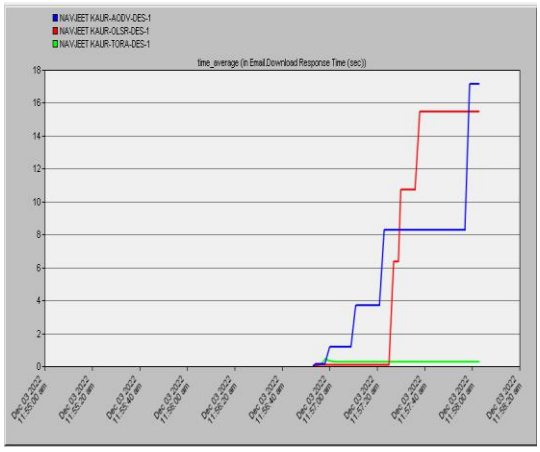

Figure 6.7 E-mail Download Response Time

.6.8 E-mail Upload Response Time: Time Taken to Upload Particular E-mail data Known as E-mail Upload Response Time.

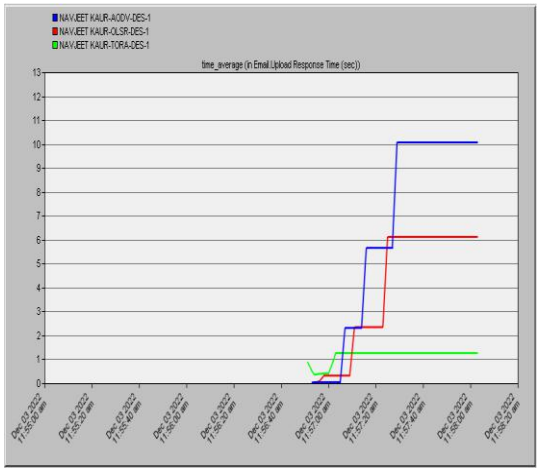

Figure :6.8 E-mail Upload Response Time

7. Conclusion

In this Research work, it is presented work creating three different MANET Networks which are based on different Routing Protocols such as AODV, OLSR & TORA . To Obtain the Performance of different MANET Network different setup of some related devices has been configured. To fulfill the objectives of this paper then it is created three different scenarios in which 25 MANET nodes has been taken each for different Network. The behavior of three different Networks has been configured. The comparative analysis has been done respectively with TORA, AODV & OLSR for real time applications. Performance has been measured on the basis of some parameters that aimed to figure out the effects of routing protocols. Respective Performance Metrics are Database query Response Time, Http Object Response Time, Jitter, MOS value, Voice Packet Delay, Voice End to End Delay. E-mail Download Response Time, E-mail Upload Response Time. So on behalf of this simulation study TORA is providing best results. In future, research work can be done on the Security analysis and some other performance metrics also can be taken.

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