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ENERGY SENTIENT QOS IMPLEMENTED NODE-DISJOINT MULTIPATH ROUTING PROTOCOLFOR MANET

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Abstract

Some of the main challenges dealing with mobile ad-hoc networks are typically associated with insufficiency of energy and attaining QoS requirements. In order to attain efficient utilization of energy and improve the operational lifetime of the mobile ad-hoc network while at the same time providing reliable packets delivery, energy efficient node disjoint multipath routing was suggested. In such networks attaining Quality of Service (QoS) routing is a not an easy task due to the network breakage by node mobility or high power consumption of mobile nodes. This paper presents a new adaptation of Energy Sentient QoS Implemented in Node- Disjoint Multipath Routing Protocol (ESQI-NDMRP) incorporated with cluster head selection in clusters to allow the sharp selection of node- disjoint routes, and these node-disjoint routes are selected in various cluster head at clusters from the environment circumstance of the network to satisfy the QoS requirements. The performance of our protocol is contrasted with ESQI-NDMRP. From simulation results attained from NS2 simulator by implementing the proposed method, show improved result in terms of energy consumption and throughput as compared to ESQI-NDMRP.

Keywords: ESQI-NDMRP, MANET, DSDV,DSR, MTPR, EECMDR.

1. Introduction

MANET is a wireless infrastructure less network containing mobile nodes. Communication between these nodes can be attained using multi hop wireless links. All nodes will operate as a router and forward data packets to other nodes. Since the nodes are free to move in any direction, there may be common link breakage. AD HOC networking is becoming very popular in this last years and the energy consumption issues and the link constancy properties can be considered two significant metrics to be accounted in the routing schemes. In the majority of the published papers, the concentration is focused on only one of the two aforementioned aspects. In this paper, a new metric that allows optimizing these two criteria is proposed. One of the most accepted technique to distinguish mobile ad hoc network routing protocols is based on how routing information is acquired and preserved by mobile nodes. Using this method mobile ad hoc network routing protocols can be separated into proactive routing, reactive routing and hybrid routing. A proactive routing protocol is otherwise called "table driven" routing protocol.

Therefore, a source node can get a routing path directly if it needs one. The DSDV (Destination-Sequenced Distance Vector), Wireless Routing Protocol (WRP), Distance Routing Effect Algorithm for Mobility (DREAM), Fisheye State Routing (FSR) and Optimized Link State Routing Protocol (OLSR) are instances for reactive proactive protocols for mobile ad hoc networks.

Reactive routing protocols for mobile ad hoc networks are otherwise called "on-demand" routing protocols. In a on-demand routing protocol, routing paths are investigated only when needed. A route discovery function invokes a route-determination method. The discovery process terminates either when a route has been established or no route obtainable after examination for all route permutations. Compared to the table-driven routing protocols for mobile ad hoc networks, less control overhead is a different benefit of the reactive routing protocols. Thus, reactive routing protocols have much better scalability than proactive routing protocols in mobile ad hoc networks. Though, when using reactive routing protocols, source nodes may suffer from long delays for route searching earlier than they can forward data packets. The DSR (Dynamic Source Routing), AODV(Ad-Hoc On Demand Routing), TORA(Temporally Ordered Routing Algorithm), Location Aided Routing (LAR), AOMDV (Ad hoc On-demand Multipath Distance Vector Routing), Associatively Based Routing (ABR) protocol, Signal Stability-base adaptive Routing protocol (SSR) are some examples for reactive routing protocols for mobile ad hoc networks

Hybrid routing protocols are the combination of the merits of both proactive and reactive routing protocols and overcome their limitations. Usually, hybrid routing protocols for mobile ad hoc networks use hierarchical network architectures. Good proactive routing approach and reactive routing approach are exploited in dissimilar hierarchical levels, respectively. The examples of hybrid routing protocols for mobile ad hoc networks are the Zone-based Hierarchical Link State routing (ZHLS) and Hybrid Ad hoc Routing Protocol (HARP) and Zone Routing Protocol (ZRP).

The major aim of this paper is to incorporate the node disjoint concept with cluster head with energy sentient and this can be used to achieve the QoS requirements.

2.RELATED WORK

A.ENERGY SENTIENT ROUTING PROTOCOLS

A number of routing proposals for ad hoc networks took energy preservation into consideration so as to increase the duration of the wireless nodes by wisely using their battery. And they utilize transmission power control methods to decrease the power at nodes. On the disadvantage, this approach will in most cases tend to choose routes with more hops than others. This is achievable due to the fact that transmission power is inversely relative to distance. Thus, additional energy may be wasted network-wide because a larger number of nodes are now concerned in routing as all nodes that are neighbours to the intermediate nodes will also be affected, unless they were in sleep mode. Minimum battery cost routing (MBCR) utilizes the sum of the opposite of the battery capacity for all intermediate nodes as the metric upon which the route is selected. Though, since it is the summation that has to be minimal, a few hosts may be overused since a route containing nodes with little remaining battery capacity may still be chosen. Min-max battery cost routing (MMBCR) treats nodes more fairly from the standpoint of their residual battery capacity. Smaller remaining battery capacity nodes are avoided and ones with larger battery capacity are favoured when choosing a route. But, more on the whole energy will be consumed throughout the network since minimum total transmission power routes are no longer favoured.

MTPR is employed when all the nodes create a path (note that one path is sufficient) have residual battery capacity that is above a so-called battery protection threshold, and MMBCR is used if no such pathway exists. The joint protocol is called conditional max-min battery capacity routing (CMMBCR). Along with this the expected energy spent in dependably forwarding a packet over a definite link is also considered. In order to increase the network life time, the cost function defined and takes into account energy spending for one packet transmission and available battery capacity. Furthermore the queue load state and the predictable energy spent to transmit all packets in the queue are considered. Still, all of them unobserved the mobility of mobile hosts, and therefore, it seems that they are more appropriate for static networks. A full adder adds binary numbers and record for values carried in as well as out. A one-bit full adder adds three one-bit numbers, often written as A, B, and Cin. A and B are the operands, and Cin is the bit carried in from the next less significant stage.

B.CONNECTIONSSTABILITYBASEDROUTING PROTOCOLS

The LLT routing algorithms are used to calculate the lifetime of wireless links between all two adjacent nodes and then to choose an optimal path. In the associatively-based routing algorithm, a link is measured to be constant when its lifetime exceeds an exact threshold that depends on the qualified speed of mobile hosts. In the signal stability-based adaptive (SSA) routing, all links is divided as a strong one or a weak one, depending on the received signal strength measured when a node receives data packets from the equivalent upstream node. A mobile node just processes a route request (RREQ) that is received from a tough link. Tickoo et al. (2003) estimated the weakness of a link as the variation of the received signal strengths of consecutive packets flowing from the same origin to verify if these two nodes are getting closer or moving apart. two adjacent mobile hosts through online statistical Gerharz et al. (2002) calculate the duration of a link among analysis of the observed links.

C.ENERGY SENTIENT AND CONNECTION STABILITY BASED ROUTING PROTOCOLS

Xin Ming Zhang, Feng Fu Zou, En Bo Wang, and Dan Keun Sung (2010) joint Energy and node and link duration LLT in route lifetime-prediction algorithm, which discover the active nature of movable nodes (i.e., the energy drain rate of nodes and the relative mobility evaluation rate at which adjacent nodes move apart) in a route-discovery period that expect the lifetime of routes discovered, and the highest lifetime route is chosen for persistent data forwarding when making a route decision. Floriano De Rango et al. proposed a Link Stability and Energy Aware Routing protocol (LEAR) protocol, in which the subsequent hop towards destination is the neighbor node that maximize (minimize) the joint connection-stability-energy metric. The energy needed to send a packet is estimated while ignoring the energy spent for overhearing a packet. Power dissipation is calculated in terms of both power consumption at transmitter and receiver. For any node i, its non destination neighboring node j is chosen as a node that has sufficient energy to receive the information transmitted from node i and which is also able of transmitting the information to another relay node. For any node, the energy to transmit the packet should be lower or equal to the remaining energy.

Minimum drain rate along with drain rate index and remaining energy is considered for measuring the energy dissipation rate of a given node. LSEA: Link Stability and Energy sentient for Efficient Routing in Mobile Ad Hoc Network proposed a new routing protocol called Link Stability and Energy Aware (LSEA) is proposed, which is a customized version of Ad-hoc On Demand Distance Vector (AODV) protocol. LSEA use a novel route discovery process that takes into description the links constancy and the nodes residual energy to do data routing. This paper, focus in showing how to look up the route discovery process whenever a starting node attempts to communicate with another node for which it has no routing information. This employs Random Waypoint to model node mobility. The simulation show that LSEA cut down the routing overhead by 17% and improve the network life time by 20%, as compared to the traditional AODV. Gun Woo and Lee propose EBL, in which the authors give significance to both link stability and the remaining Battery capacity. The EBL not only increase the energy efficiency but also decrease the network partition

3.CLUSTERING AND NODE-DISJOINT

TECHNIQUE

A.CLUSTERING

The most essential needs of MANETs are the ability to scale hundreds or even thousands of mobile nodes and to operate for the longer period of the time. Clustering has proven to be an effective technique that prolongs the network lifetime by reducing the energy consumption and provides the required scalability has been briefed by Heinzelman et al (2000). Effectively, a clustering algorithm decides a set of nodes that can give a backbone to connect the network to the base station. This set of nodes is called Cluster Head (CH) set and the rest of nodes are called Member Nodes (MN). The clustering algorithm assigns each regular node to be a member of one of the cluster head nodes.

B.SELECTION OF CLUSTER HEAD

The entire network is partitioned into groups called clusters, and each cluster has one cluster head node that works as a coordinator of this cluster. The node having highest energy should be selected as cluster head as shown in Fig. 1. Clustering is a method that partitions the network into interconnected substructures, called clusters. Clustering in MANET guarantees several advantages as compared with traditional networks. But due to the unstable character of MANET clustering in MANET is not an easy task. Compared with flat routing in WSNs, cluster based routing have a variety of advantages, such as more scalability, less load, less energy consumption and more robustness.

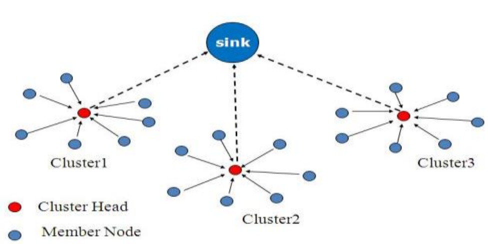


Fig.1. Clustering in MANET

C.MULTIPATH NODE-DISJOINT MODEL

This model describes the probability estimation of node disjoint paths between source and destination in a network. Two paths are said by node-disjoint if and only if there is no frequent intermediate node between them and source and destination nodes are common to both. In Fig.2 Let Pj be the path from the source node S to destination node D via intermediate nodes are 2, 3 and 4. Let Pi be the path from the source node S to destination node D via intermediate nodes are 7 and 6. Let X be a set of all the intermediate nodes on path Pi, Let Y be a set of all intermediate nodes on path Pj, if Pi and Pj are said by node-disjoint if and only if $X \cap Y = \phi$.

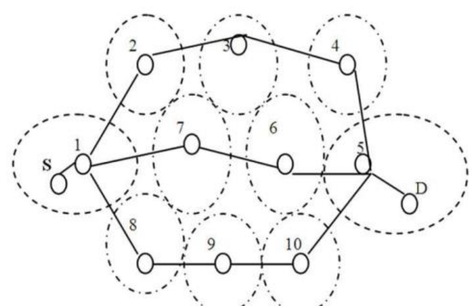


Fig.2. Node-disjoint paths through Cluster heads

D.ENERGYSENTIENTANDEFFICIENT CLUSTERED-BASED MULTIPATH DIVERSITY ROUTING (EECMDR)

The EECMDR protocol form clusters to attain energy efficient routing. For node-disjoint path choice, AODVM protocol is employed and this AODVM can assist multipath routing to all nodes in the network. It does not employ routing through cluster heads. Although, we need node disjoint routing through cluster heads. Hence a few modification has to be made on the EECMDR protocol, AODVM protocol maintains route table at all node because we form all nodes into separate clusters. So each cluster heads only maintain route table and after that run this EECMDR protocol to discover multiple disjoint paths.

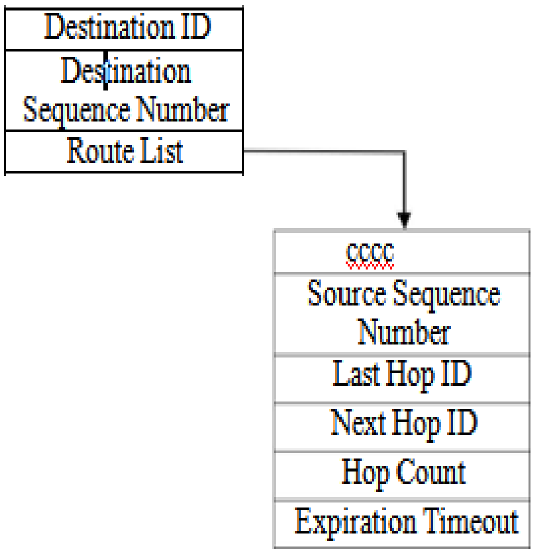


Fig.3. Route Table of AODVM

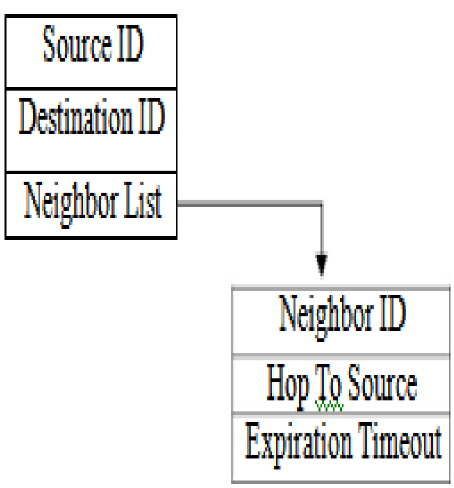


Fig.4. RREQ table of AODVM

Other cluster members do not keep any routing table but they simply transmit and receive packets consequent to allocated paths. To make easy of routing through cluster heads, the first alteration is to be done on the control packets. The AODVM and EECMDR protocol has similar RREQ (Route Request) packets. Although the RREP (Route Reply) packets change and the RREP packet of EECMDR is extended from AODVM by connecting a Cost field because this cost field can bring cumulative cost of cluster heads which has the preliminary value as zero To make easy of routing through cluster heads, the first alteration is to be done on the control packets. The AODVM and EECMDR protocol has similar RREQ (Route Request) packets. Although the RREP (Route Reply) packets change and the RREP packet of EECMDR is extended from AODVM by connecting a Cost field because this cost field can bring cumulative cost of cluster heads which has the preliminary value as zero. Next modification is done on the routing tables. There are two tables like routing table and RREQ table are kept at each node in AODVM. The routing table contains the information of transmitting data packets whereas the RREQ table contains the data's about the routes from source to destination nodes. The EECMDR protocol has equivalent RREQ table and extended routing table with accumulation of cost field which are only maintained at the cluster heads.

4.ENERGY SENTIENT ROUTING MODEL

A.ENERGY CONSUMPTION

According to IEEE conditions of the network interface card (NIC) with 2 Mbps, the consumption of energy to transmit a packet p is E(p)=i *v*tp Joules. Here, i denote the current, v indicate the voltage and tp is the time taken to transmit the packet p. The energy needed to transmit a packet p is given by Etx(p)=280mA*v*tp. The amount of energy is required to receive a packet p is given by Erx(p)=240mA*v*tp. The consumption of energy of overhearing the data transmission may be assumed as correspondent to energy consumption of receiving of the packet.

Route selection and Cost function:

The major objective of route selection is to choose the optimal paths to make longer network’s life time based on cost function .The chief objective of cost function is to provide more weight (or) cost to node with less energy to prolong its life time.

Cost of the path:

Assume two dissimilar costs for the path. The first cost is selected as maximum cost of some intermediate node on the path.The next cost is addition of cost of all intermediate nodes on the path .

B.OPTIMAL PATH SELECTION

Let γ be threshold (cut-off) energy of node battery and it is measured that this threshold energy of battery is identical for all the nodes irrespective of their battery capacities. Let M be the group of node disjoint multipath that were found in route discovery from source s to destination d at time t, then a realistic path is given by (1) Where Min is a function that choose least cost. Let F be the set of all feasible paths based equation 5. An optimal path is the feasible path with smallest amount of total cost, it denoted by (2)

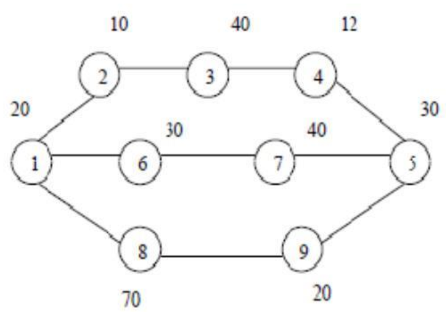


Fig.5. Network with 9 nodes

For example, in fig.3 there are three node disjoint multipath say P1, P2, P3 from starting node 1 to receiving node 5, where P1=1-2-3-4-5, P2=1-6-7-5 and P3=1-8-9-5. Based on equation (3) their costs are C1 (P1) =40, C1 (P2) =40 and C1 (P3) =70. Based on equation (1) P1 and P2 are realistic paths. The total costs of P1 and P2 are C2 (P1) =10+40+12=62, C2 (P2) =30+40=70. According to equation (2), a best path is P1.

Path stability model:

Route P is said to be broken if some one of the following cases occurs. Primarily, any one of the nodes in the route dies due of limited battery energy. Next, any one of the connections is broken since the corresponding two adjacent nodes move out of each other’s communication range. Therefore, the lifetime of route P is expressed as the least value of the duration of both nodes and associations involved in route P. Thus, the lifetime Tp of route P can be denoted as Tp = min (TNi, TCi)

Process of Route discovery:

When a RREQ packet appear at an intermediate node, it is scanned; if destination address of the RREQ is similar as address of intermediate node then the intermediate node perform as destination node to send route reply else if either TTL value of RREQ is reached to zero, or address of intermediate node is already be there then received RREQ will be dropped, or else its partial information is recorded into route request packet. After recoding the partial information,

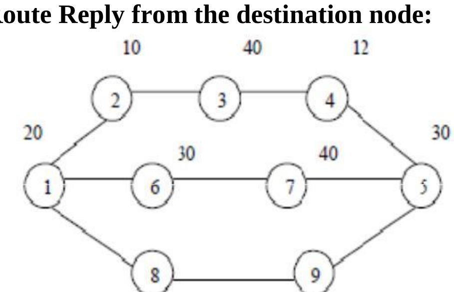
1.The intermediate node transmit the RREQ by incrementing the value of hop field by one

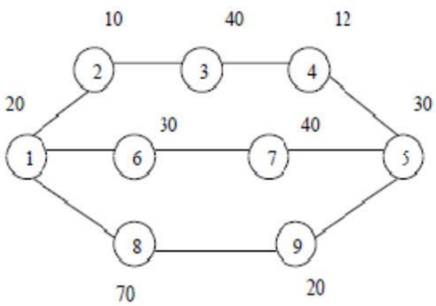
2.By update the max-cost ie Its cost is assigned to Max-cost field if its cost is larger than value of Max-cost field Otherwise Max-cost field will not be disturbed

3.Its cost is added to cost field.

4. Remaining energy field is modified with its energy

Route Reply from the destination node:





Let consider that m be the number of multiple paths from the starting node to the destination, among them, let n be the number of node-disjoint paths. We choose n =3; that are chosen by the destination and they were named as primary (first) path, secondary (second) path and ternary (third) path.

The destination chooses the optimal path, now optimal is considered as primary path. Then it chooses the secondary path which is an best path among m multiple paths excluding primary and it is node-disjoint to primary path. Then it selects the ternary path which is an optimal path among m multiple paths excluding primary path and secondary path and node-disjoint to primary path and secondary path if possible. By make three route reply packets, three paths are returned to source through their respective backward paths. Each route reply carries the path along with its cost and remaining energy.

Route preservation:

Route maintenance algorithm is a simple addition to AOMDV route maintenance. It also employs RERR packets. A node generates or transmits a RERR for a destination when the *last* path to the destination split. AOMDV also includes an optimization to salvage packets transmitted over abortive links by re-forwarding them over alternate paths. The timeout mechanism similarly extends from a single path to several paths.

5.RESULTS AND DISCUSSION

The simulation result of the Energy sentient node-disjoint multipath routing with cluster head technique which is simulated using NETWORK SIMULATOR NS2.34 is shown in following Fig.

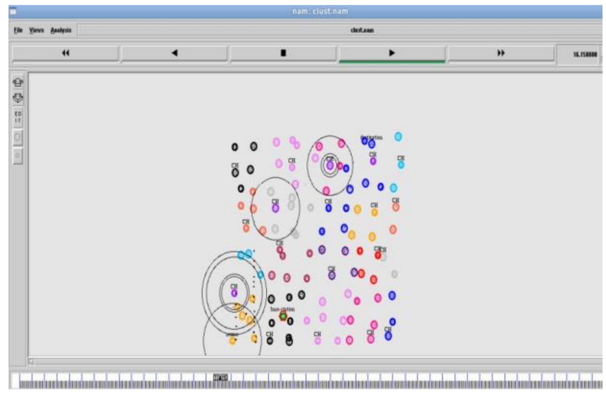
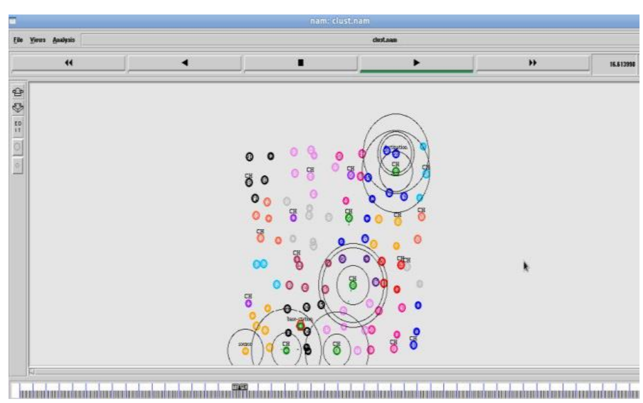


Fig.6. Packet drop in primary path



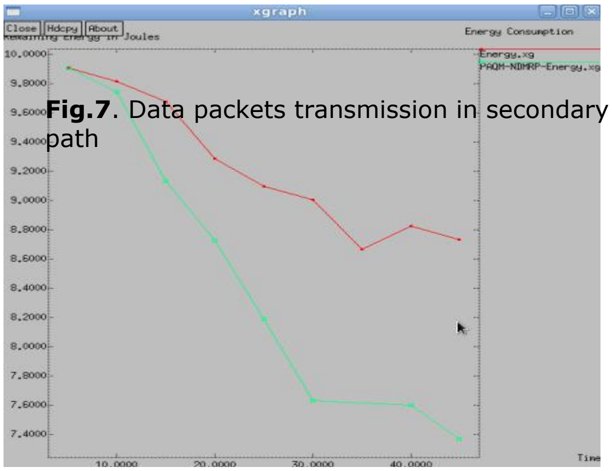


Fig.7. Data packets transmission in secondary path

Fig.8. Comparison of Energy Consumption

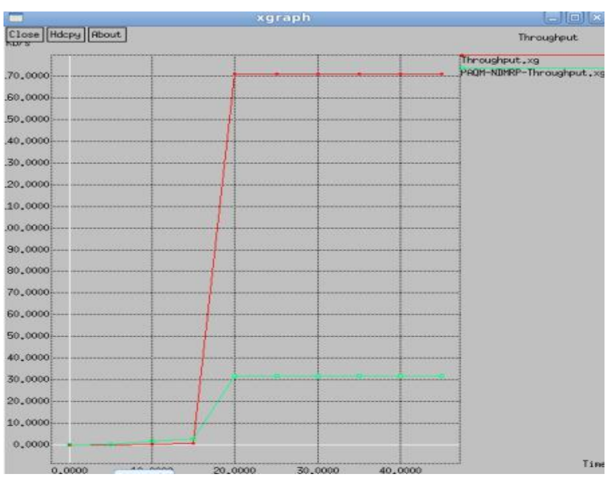


Fig.9. Comparison of Throughput

6. CONCLUSION

We are proposing a node-disjoint multipath routing method incorporated with cluster head with the addition of energy sentient QoS implemented. The proposed route detection method identifies all the available node-disjoint routes using a single flooding of a RREQ message. This greatly reduces the routing overhead caused by route detection and maintenance processes thus increasing the network capacity. To reduce the initial delay, source node can send data as soon as it gets the primary route. Due to multiple routes stored in routing table backup routes are always available for continuous data transmission when the primary route is broken. In the future algorithm security can be implemented by erasing the data's in primary path.

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