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An Effectual Way of Information Reclamation Using Peer-Peer Approach in Manets

Dr. Debmalya Bhattacharya[1] and Ms. Jyotismita Talukdar[2]

1. Dean-School of Technology
2. Assistant Professor in CSE Departemnt
University of Technology & Management, Shillong, Meghalaya
1. dbhattacharya@utm.ac.in 2. jtalukdar@utm.ac.in

Abstract

This paper focuses on a cooperative environment in wireless ad hoc networks, there is no infrastructure for Manets. Nodes can be able to communicate with another node and transfer information between them in a peer-peer fashion. An effective way of query/response propagation algorithm to avoid network collusion since there is interference with server. In this Eureka, Information Density concept is introduced here interference with server. Using Eureka, Information Density concept is introduced here. In this process, Gateway is used where all files are stored in it. First file requested by the peer is forwarded to the Gateway. The file transfer takes place in the form of chunks from the Gateway to the peer. The chunk sequence number is informed to all peers by the Gateway at the time of file transfer .During delivery of file, if any chunk is missing, peers forward the request to another peer group which has more Information Density. In this way, Missing chunk is retrieved for the peer based on the Eureka solution.

Key words—Mobile ad hoc networks, content retrieval, query forwarding, vehicular networks.

I. INTRODUCTION

Mobile ad hoc networks (MANETs) are often touted as the one solution for connectivity on the move, notwithstanding the technical challenges still lingering as far as their deployment is concerned. Not only do MANETs consist of wireless devices communicating over bandwidth-constrained, time-varying channels, but the freedom of movement these devices enjoy entails a highly dynamic network system. Although all kinds of user applications are envisioned to be run on top of MANETs, two fundamental issues are still debated by the networking community at large: 1) the discovery of services and resources available at other nodes in the MANET and 2) the transfer of information between any two network nodes, possibly with the help of intermediate devices when no direct link exists.

In this work, we examine the suitability of MANETs for applications that rely on a peer-to-peer architecture for information exchange. We develop a solution, named Eureka, whose key idea is to exploit the information density concept and to allow users to estimate where in the MANET the information they are looking for can be found. Our approach yields several advantages:

1. Waste of bandwidth is avoided by sensibly (and selectively) forwarding content queries
2. In a network where a contention-based MAC is used
3. The use of GPS is not required, making our solution suitable for various wireless environments;

A viable application of peer-to-peer MANETs is in the field of vehicular and pedestrian networks [1], where the constraints imposed by the roads/sidewalks layout and by indoor environments (e.g., a shopping mall) limit the regions where the information is to be sought.

The highly dynamic environment typical of these networks provides an interesting challenge to the performance of a peer-to-peer application. However, it is of the utmost importance to minimize the transmission overhead toward sections of the network where the chances of successful information retrieval are slim.

The main contribution of our work revolves around the issue of controlled broadcast of queries. It consists in a solution that steers the propagation of queries only toward regions of the network where the information is more likely to be cached. To discriminate among such regions, we define a quantity called information density and a procedure that lets nodes estimate it.

II. RELATED WORK

The technical challenges of content delivery and sharing in vehicular networks are outlined, where a cooperative downloading strategy, named SPAWN, is proposed. SPAWN addresses peer discovery, content selection, and content discovery. Peer discovery, like our solution, leverages the broadcast nature of the wireless medium, thus allowing nodes to overhear information about the content availability at neighbors. However, different system assumptions set apart SPAWN and our approach, making a direct comparison hardly feasible. The scheme has two phases, a centralized one and a distributed one, while Eureka is completely distributed. SPAWN’s centralized phase provides nodes with lists of information-caching peers, which are then exchanged during the distributed phase. Eureka builds such knowledge implicitly, without the need of a centralized phase. As a consequence, SPAWN would be highly inefficient in the scenarios we consider, where cache volatility is high and the knowledge of other nodes’ caches becomes quickly outdated, while Eureka has been specifically designed to work in systems with fast dynamics.

With regard to routing, several solutions have been proposed to reduce the routing overhead of on-demand protocols. For instance, Location Aided Routing (LAR) and Query Localization limit the query flood by decreasing the number of nodes receiving route queries. In particular, the mechanism in restricts the flooding of queries using GPS, while in the route requests are forwarded only in those areas where old paths existed.

In the context of sensor networks, the study in exploits the natural information gradient exhibited by physical phenomena to efficiently route queries toward the event source. Note that our work significantly differs from since one of our main contributions is the definition of the information density concept in MANETs and of the procedure to estimate it. The concept of information density is used

This study allowed us to focus on the need for a network-friendly handling of queries, which was the basis for the introduction of an early version of Eureka. It is restricted to a vehicular environment, and does not carry any comparison with solutions based on satellite positioning systems.

III. SYSTEM OUTLINE

We consider a MANET and one or more gateway nodes that may be either fixed or mobile. We focus on an urban scenario, where users may be either pedestrian (as within a mall) or vehicles (as on the roads of a city section). Below, we outline the characteristics of the network system under study.

3.1 Nodes among Users for Co-operation:

Each user node in the MANET is equipped with a data cache and may wish to access the information stored elsewhere in the network, e.g., at one or more gateways or at other nodes. Connectivity among users and between user and gateways is, however, spotty and cooperation among users is highly desirable. Targeting a solution that must be suitable for different network environments, we do not require nodes to be equipped with additional localization hardware, such as GPS.

The cooperative environment we are addressing falls within the category of peer-to-peer (P2P) networking, allowing users to share files on their own host computers. Unlike traditional client-server networking, peer nodes simultaneously act as both “clients” and “servers” to the other nodes in the network. Coordination among nodes is achieved in several ways, although, for the purpose of the present work, we just consider pure P2P:

Peers act as clients and servers, and there is no central coordination by one or more servers. Indeed, any attempt at providing coordination would suffer from the intermittent nature of connections in a MANET.

3.2 Content Request and Delivery

We assume that N distinct information items, such as Web documents or data files, are available at the gateway node(s) and may be requested by users. Each information item is further divided into single downloadable units, called chunks, each small enough to fit in a single MAC frame. When a user node seeks a specific information item, it advertises to the system which chunks it is missing. The missing chunks are then retrieved from (possibly) different sources, following a procedure that is general enough to apply to different network systems. Such procedure is based on a cross-layer approach, involving the application, network, and MAC layers, and does not assume the use of any specific routing protocol.

The basic features that are required in the system for information request and delivery are listed below, while the operations performed by each node upon reception of a query are outlined by the flowchart:

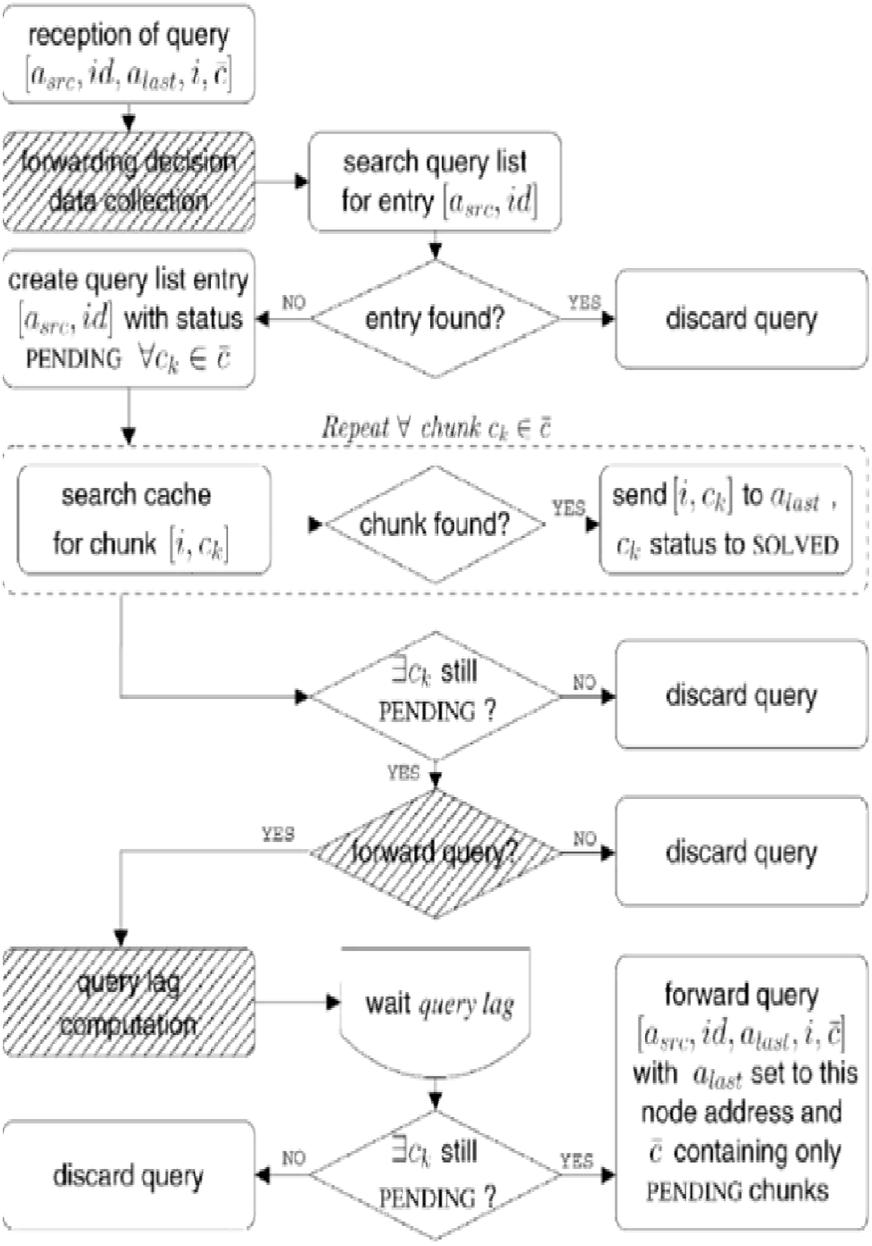
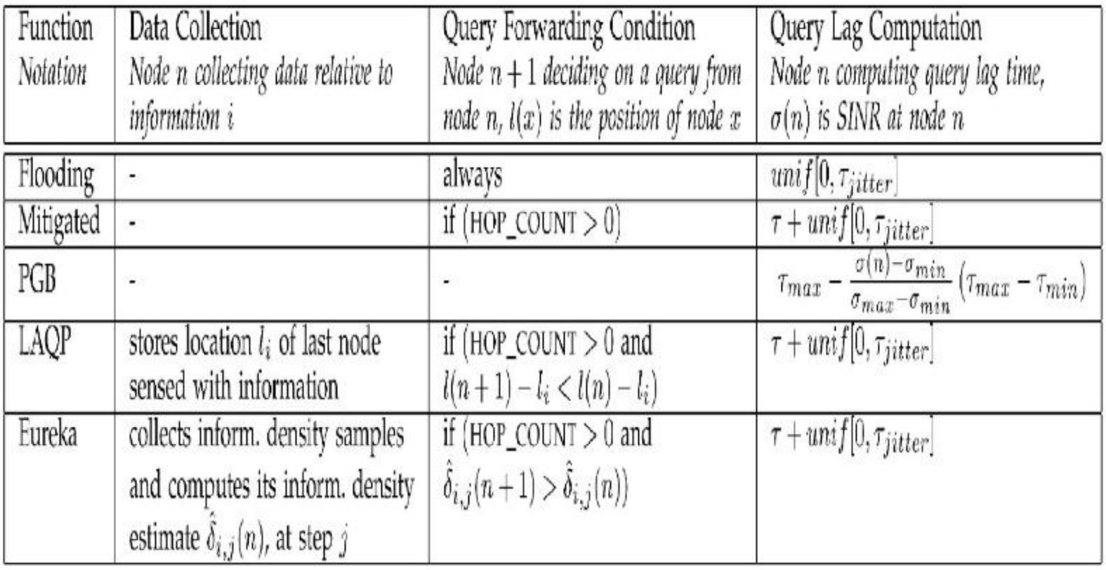


Fig 1: Flow chart of application behavior upon query message reception.

1. Each user application requests an information item not in its cache, say information item i (1<i<N), with rate i.
2. Once created, an information message is sent back to the query source. The way this is done does not affect the query propagation problem. In our implementation, information messages are transmitted along the same path the request came from. In particular, the information message is conveyed through a unicast transmission at the MAC layer, exploiting the query routing details that have been stored by the node application on the way there, namely the last hop address a_{last} from which the query was received. No action is required at the network layer. We stress that nodes along the information message return path do not cache copies of the chunk but simply hand it over. Thus, each query does not generate copies of a chunk other than the one that is possibly stored at the query source, at the end of the content retrieval process. Also, all nodes are able to promiscuously listen to the channel at the MAC layer: this gives the nodes the opportunity to know that a pending query has been satisfied elsewhere and set the status of the retrieved chunks to solved, thus avoiding the relay of duplicated information messages.
3. Information chunks retrieved by the requesting node are locally cached and then dropped at a rate of chunks per second.
4. Query range with limitation: The introduction of aquery time to live (TTL) can shorten the reach of broadcasting.
5. Target selection. Steering the queries toward the rightdirection is, of course, the main remedy against broadcast storms. However, in a volatile MANET environment, what exactly is the right direction? Targeting a specific node that is known to store the information could be attempted.



Function *Notation*	Data Collection *Node n collecting data relative to information i*	Query Forwarding Condition *Node $n+1$ deciding on a query from node n, $l(x)$ is the position of node x*	Query Lag Computation *Node n computing query lag time, $\sigma(n)$ is SINR at node n*
Flooding	-	always	$unif[0, \tau_{jitter}]$
Mitigated	-	if (HOP_COUNT > 0)	$\tau + unif[0, \tau_{jitter}]$
PGB	-	-	$\tau_{max} - \frac{\sigma(n)-\sigma_{min}}{\sigma_{max}-\sigma_{min}}(\tau_{max} - \tau_{min})$
LAQP	stores location l_i of last node sensed with information	if (HOP_COUNT > 0 and $l(n+1) - l_i < l(n) - l_i$)	$\tau + unif[0, \tau_{jitter}]$
Eureka	collects inform. density samples and computes its inform. density estimate $\hat{\delta}_{i,j}(n)$, at step j	if (HOP_COUNT > 0 and $\hat{\delta}_{i,j}(n+1) > \hat{\delta}_{i,j}(n)$)	$\tau + unif[0, \tau_{jitter}]$

IV. NETWORK-FRIENDLY QUERY PROPAGATION

4.1 Solutions to Counter Broadcast Storms

The system contains one loose end, namely the issue of query propagation. Since this pertains the main contribution of this paper, we chose to address it separately, in a more organic way. Indeed, the propagation of query messages in the network is a critical aspect of the information sharing mechanism. There are two contrasting requirements. On the one hand, queries for information chunks must be forwarded by relays until they reach nodes holding such chunks, and some redundancy in forwarding is necessary to compensate for the unreliable nature of broad-cast transmission of queries (i.e., no acknowledgments). On the other hand, congestion deriving from excessive spreading of queries and chunk duplication must be limited. The simplest solution for query propagation is, of course, plain flooding of requests.

4.2 Introducing Eureka

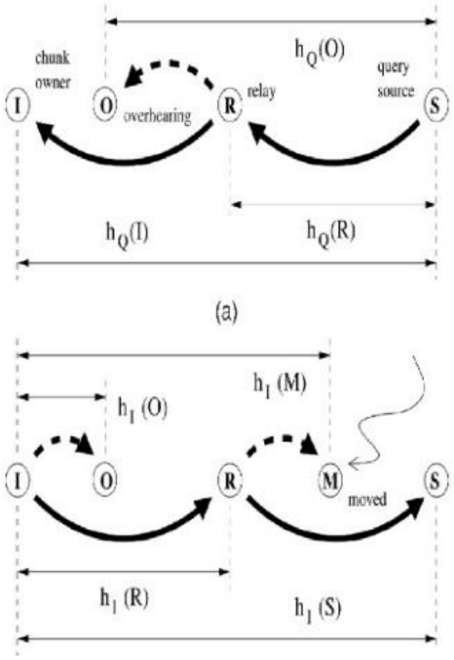
The idea underlying Eureka is best introduced by way of an example. Let us consider a network where a specific information is temporarily clustered around a point (e.g., a roadside gateway advertising the evening special menu of a nearby restaurant to passing vehicles and pedestrian devices, or a vehicular network near a congested road intersection, where a lot of cars—and, as a consequence, of information—are clustered in a small area). If the knowledge of how the information is distributed in the network was available to nodes, it would be possible to drop queries that are moving away from information-dense areas. This avoids useless propagation of requests while retaining a high query success probability.

Our solution, Eureka, hinges on the concept of informationdensity, i.e., the amount of information cached by nodes in aspecific area. Eureka estimates the local spatial density of information chunks cached at neighboring nodes and uses such estimate to steer queries toward areas where they are more likely to find the requested content.

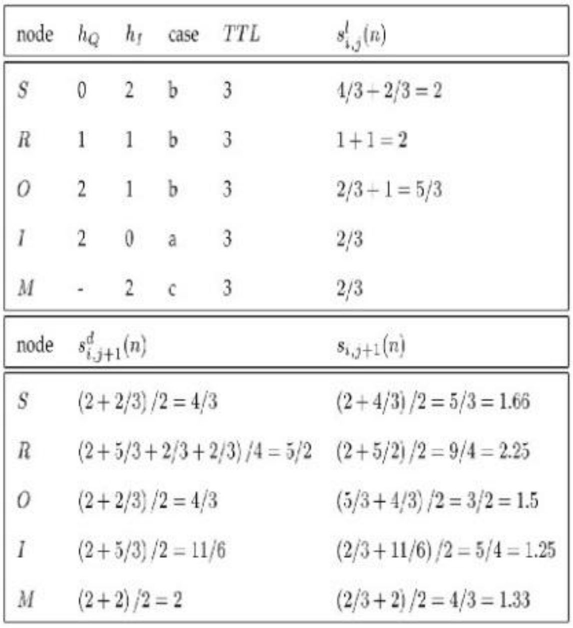
1. Query has a chance to travel toward information-dense areas.
2. If the queried information is popular and the receiver estimate is lower than that carried by the query, then the receiver refrains from broadcasting the query. Therefore, queries are unlikely to probe areas where information is scarce.
3. If the queried information is unpopular, it is likely that information density values are unreliable.

V. INFORMATION DENSITY ESTIMATION IN EUREKA

Our aim is to provide each node in the network with an estimate of the information density in its proximity, so that it can choose whether to forward queries or not according to such estimate. Instrumental to the definition of “node proximity” in our case is the definition of reach range of a generic node n, as its distance from the farthest node that can receive a query generated by node n itself. The process we devise to estimate the information density is fully distributed and is run by all nodes participating in the network. The process amounts to merging estimates ob-served by each node on its own and estimates received by neighboring nodes.



(b)



node	h_Q	h_I	case	TTL	$s^l_{i,j}(n)$
S	0	2	b	3	$4/3+2/3=2$
R	1	1	b	3	$1+1=2$
O	2	1	b	3	$2/3+1=5/3$
I	2	0	a	3	$2/3$
M	-	2	c	3	$2/3$

node	$s^d_{i,j+1}(n)$	$s_{i,j+1}(n)$
S	$(2+2/3)/2=4/3$	$(2+4/3)/2=5/3=1.66$
R	$(2+5/3+2/3+2/3)/4=5/2$	$(2+5/2)/2=9/4=2.25$
O	$(2+2/3)/2=4/3$	$(5/3+4/3)/2=3/2=1.5$
I	$(2+5/3)/2=11/6$	$(2/3+11/6)/2=5/4=1.25$
M	$(2+2)/2=2$	$(2/3+2)/2=4/3=1.33$

(c)

Fig 2: The modules are used in calculating the estimating of information density

5.1 Node creation:

In this process, first size of the node should be given as an input to create nodes and then plotting to be done for the node creation. These nodes are used for sending and receiving the data. Source and destination node able to communicate easy by this way and transfers the information

5.2 Gateway Creation:

Gateway is a network point that acts as an entrance to another network. Gateways work on all seven OSI layers. In Gateway only, Web documents or data files are available. These data files may be requested by user. The data files are converted into single downloadable units called chunks which are stored in peer. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node.

5.3 Information Density Calculation:

Eureka, identifies the regions of the network where the required information is more likely to be stored. The information density function, δi(x, y), is defined as the spatial density of information chunks cached at nodes participating in the network, around a point whose spatial coordinates are (x, y).In Mobile ad hoc Network (MANET). For each and every peer Information Density is calculated. Mobile users may request information contents as well as provide them to another node. Based on the information retrieval mechanism that is Eureka, user query is forwarded to the peer where the information denser is denser.

VI. PERFORMANCE STUDY

After having shown that the density estimation process is indeed accurate in telling apart information density at different locations in the network area, here, we investigate the effectiveness of Eureka in terms of traffic reduction, query success, and query solving time. We first outline the impact of the parameters on the system performance, then we describe our simulation scenario and compare Eureka against other query forwarding schemes, such as flooding-based solutions and LAQP, with or without the use of PGB, under different mobile environments.

Actual and estimated densities of a generic information item as a function of time, as seen by a network node traveling in the urban scenario; a strip at the top of the plot highlights the times at which the node approaches intersections and gateways.

6.1 Impact of Parameters

The impact of the system parameters on the overall performance is given as follows:

- The query generation rate, z, obviously affects the query traffic and, in turn, the information traffic
- The number C of chunk requests per query affects the time needed for a response and the amount of information traffic if more than one node replies; again, targeting only information-dense areas limits the congestion deriving from an excessive number of duplicates. Furthermore, a large C may lessen the effectiveness of the query lag time, further increasing congestion.
- The information set cardinality, N, has an impact on the traffic load, hence on the system performance, but it does not affect the accuracy of the density estimate, since the estimate is performed on single information items

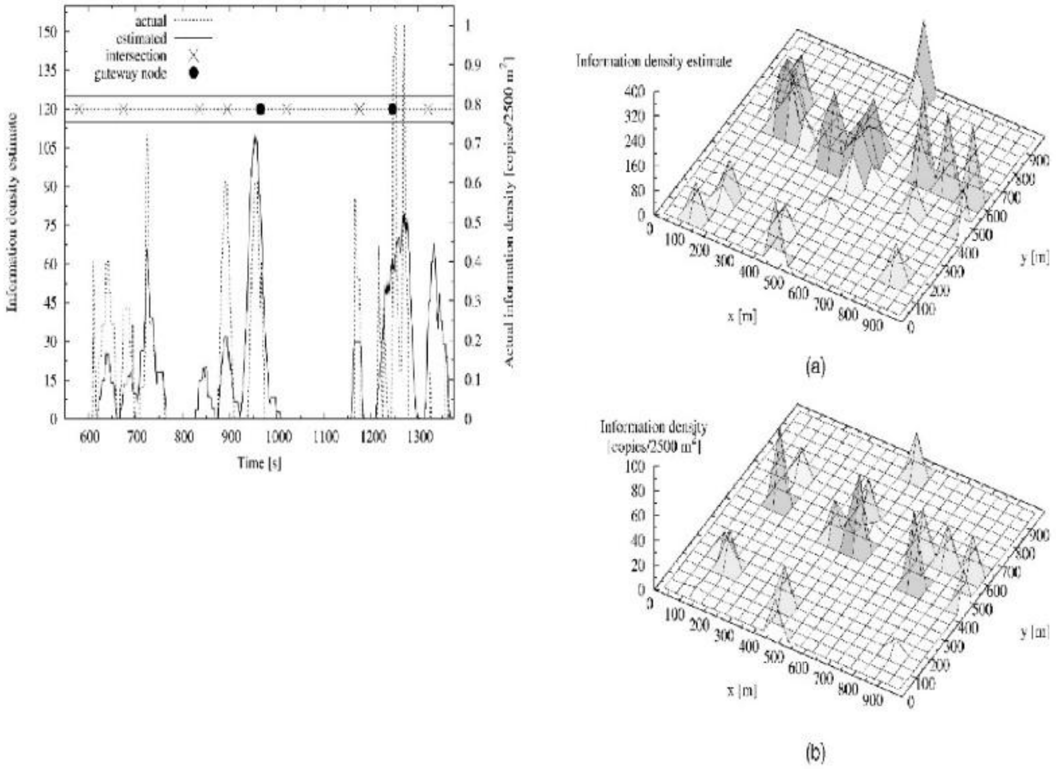


Fig 3: (a) Actual and (b) estimated information density of a generic information item over the urban network, at a fixed time instant

6.2 The Urban Scenario

We compare the performance of flooding, mitigated flooding (i.e., flooding with TTL and query lag), Eureka, andLAQP. We also show the improvements that can be achieved using the PGB mechanism. The performance metrics we consider are as follows:

1. Query traffic: the total amount of traffic ascribed to the transmission (and replication) of queries in the whole network; results take into account the additional GPS-and density-related fields in the query header for the case of LAQP and Eureka;
2 Information traffic: the total amount of traffic ascribed to the transmission (and replication) of reply messages carrying the requested information back to query source; results also take into account duplicated reply messages;
3. Solved queries: the number of information queries solved (i.e., for which all chunks belonging to the information item are received) per second;
4. Query solving time: the average time period elapsed since the generation of a query until the reception of the last missing chunk at the requesting node; clearly, only solved queries contribute to these statistics.

VII. CONCLUSIONS

Thus by using Information Density concept in Mobile Ad hoc Network (MANET),Security for our system is added. Here peer can act as both file request well as deliver the file when missing chunk is requested by peer. In Existing system, File request (Missing chunk) is forwarded to all peers, there collusion occurred and also the system requires intervention of server. The existing system drawback is overcome in our proposed solution namely Eureka. Here Missing chunk requested by the peer is not forwarded to all peers but particularly forwarded based on the Information Density calculation, where the estimation of Information Density is higher. The duplicate transfer of message is considerably decreased in our proposed mechanism.

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