Middle-East Journal of Scientific Research 24 (1): 59-64, 2016
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2016.24.01.22858

Region Based Random Deployment for Improved Content Searching in Mobile Disconnected Networks

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Abstract: The problem of content searching in mobile disconnected networks has been well studied in previous research articles and the authors discussed many approaches towards the problem of content search in mobile disconnected networks. Still the approaches suffer with the problem of latency and poor searching quality. To overcome the issue of content search in MDN, the author proposes a region based random deployment approach to improve the search quality. The propose method splits the entire network region into different region and maintains Meta data about the content search. Also, the method monitors the query and computes content popularity from the search query. Based on the content popularity, the method analyses the query and the location of the client nodes. Using all these, the method performs random deployment of cache nodes to support content searching in MDN with reduced latency and improved throughput.

Key words: Mobile Disconnected Networks · Content Searching · Region Based Segmentation · Random Deployment

INTRODUCTION

The mobile disconnected networks are the combination of peer-peer networks with mobility nodes. The network has different topology in the placement of nodes as well as in the behavior also. The network has set of fixed nodes and set of mobile nodes where the mobile nodes have no restriction in their mobility. The network can be visualized as a fixed network with large number of mobile nodes. The devices like mobiles with the wireless communicated peer-peer network can be identified as MDN. The mobile nodes can access the resources available in the unmovable nodes using the wireless communication.

The content searching is the major issue handled in the MDN where the mobility nodes can perform many search operation in the unmovable nodes of the network. The user can access any service available in the fixed nodes or can search the content available in the network. The user submits the query in the network and the result will be returned to the user or the mobility node. What happens in the middle is, as of the mobile node will be displacing at all the fraction of time, the topology changes as well as there will be communication break in the channel. Also the user requested information may be present in the limited nodes of the network, but when the mobile node moves far away then the content searching becomes more difficult and the data transmission also becomes more difficult. This increases the latency of content searching and reduces the throughput of content search.

By splitting the entire region of the network into different sub regions, the content management can be performed in efficient manner. The region based segmentation is the process of splitting the entire region of the network into different quarters and according to the required data, the method can identify the presence of data at each region. By maintaining the requested data in all the region in some of the nodes the problem of content search can be handled in efficient manner.

Maintaining the content in different region also will not improve the performance of content search. The method has to deploy some new nodes or post the resource in some of the existing nodes in the network to execute the query. To perform this the method has to deploy some of the nodes which can hold the data as well as execute the query and forward data packet in the network in order to improve the search efficiency and throughput.

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Related Works: There are number of methods has been discussed for the development of content search in mobile disconnected networks and this section discusses about some of the methods around the problem of content search in MDN.

Community Roamer: A Social-Based Routing Algorithm in Opportunistic Mobile Networks [1], first analyze the threshold configuration of community merging during the process of distributed community discovery. We then introduce a new social-based routing algorithm, called Community Roamer, which identifies those active nodes moving between different clustered communities to create an efficient inter-community forwarding path. Simulations on four real data sets show that the new algorithm has a much lower overhead than the existing algorithms and comparable message delivery ratio.

Leveraging Social Networks for P2P Content-Based File Sharing in Disconnected MANET [2], propose an interest-oriented file searching scheme for high file searching efficiency. Additional strategies for file prefetching, querying-completion and loop-prevention and node churn consideration are discussed to further enhance the file searching efficiency. We first tested our system on the GENI Orbit testbed with a real trace and then conducted event-driven experiment with two real traces and NS2 simulation with simulated disconnected and connected MANET scenarios.

Spoon-P2P Content-Based File Sharing in Disconnected Manets [3], Present peer-to-peer (P2P) file distribution methods in mobile ad hoc networks (MANETs) can be divided into three categories: local broadcasting based advertisement (push) and discovery (pull)-based and contact-based. The first two techniques can simply be time consuming and low ability to accommodate when the demand grows higher. They are mainly developed for linked MANETs, in which end-to-end relativity among nodes is preserved. The contact-based methods adjust to the adaptable nature of disconnected MANETs but fail to regard the social contents of portable nodes, which can be subjugated to advance the file searching effectiveness. In this paper, they a P2P content-based file distribution system, namely SPOON, for disconnected MANETs. The system uses an interest mining algorithm to derive a node's concern from its files for content-based file searching. For competent file searching, SPOON assembles similar-interest nodes that frequently gather with each other as a set. It takes the benefit of node portability by designating constant nodes, which has the most common contact with neighborhood members, as community coordinator for hunt within the community and highly-mobile nodes that visit other communities frequently as community ambassador for search in other communities. An interest-oriented file searching scheme is projected for high file searching efficiency.

Curiosity and Contact History Based File Dissemination in MANET [4], suggest a P2P content-based system, namely SPOON, for disconnected MANETs. The system uses an interest extraction algorithm to derive a node's concern from its files for content-based file searching. For competent file searching, SPOON assembles similar-interest nodes that frequently gather with each other as a set. The interest-oriented file searching scheme is projected for high file searching efficiency.

File Sharing with Role Switching Algorithm in MANET'S [5], proposes interest-oriented file searching proposal for effectuality with additional line of attack for file pre-fetching, querying completion, loop-prevention and node churn consideration for auxiliary enrich of file searching, uses Gnutella for file sharing followed by TORA. For unrivalled file sharing amid communities, role-switching of lively node and firm node switched based on routine. This buoy up intact nodes in community to be erudite with index of file based on network size and to evade encumbering nodes, endow with superfluous enticements for amended consideration. User can search, share file within MANET subscription failsafe service, stay obtainable in its environs.

Determining the Appropriate Thresholds for P2P Content File Sharing in Disconnected MANETs [6-10], proposed system it will aim to find out appropriate thresholds in the P2P file sharing systems. It also improves the capability of the file sharing in the disconnected networks. Further, the proposed system will relate the SPOON algorithm to larger mobile ad hoc networks to monitor the content based file sharing efficiency.

A Study of Opportunistic Networks for Efficient Ubiquitous Computing [11], discuss what makes opportunistic networks different to mobile peer-to-peer networks and mobile ad hoc networks; two network types that are closely related. We present a number of applications with a focus on data dissemination. It concludes with an overview of future research issues by naming a number of open and unsolved problems.

Cell phone disconnection disrupts access to healthcare and health resources: A technology maintenance perspective [12], Cell phone disconnection was a regular occurrence that delayed access to care and threatened client privacy. Temporary disconnection also

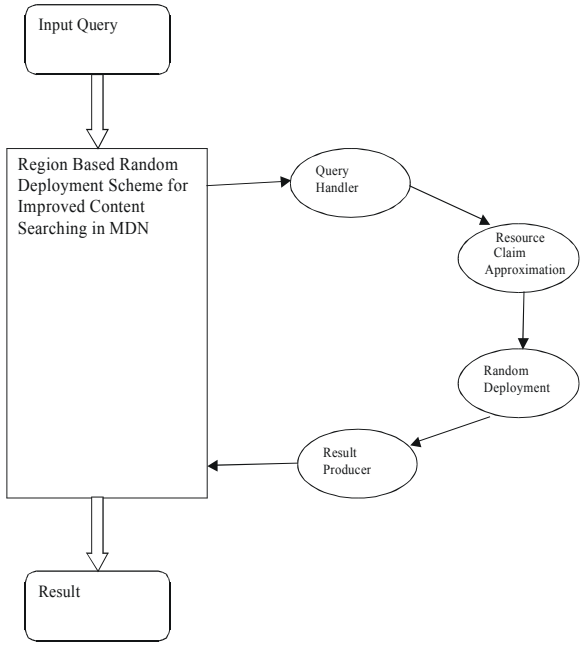


Fig. 1: Architecture of proposed system

contributed to lost employment, lost welfare benefits and strains on social support networks—all of which are critical for optimizing health. Results are interpreted through a lens of technology maintenance, which argues that the poor will struggle to maintain digital access after ownership and public availability are realized. The potential worsening of health inequalities and related policy implications are discussed.

The above discussed method has the problem of higher latency and produces less throughput ratio in content searching.

Region Based Random Deployment Technique: The region based random deployment approach starts with identifying the source points where the request is available and identifies the location of the mobile node. Then the method splits the entire region into number of quarters and identifies the list of nodes where the requested resources are available. Based on the query of resource the method computes the resource claim rate for each quarter and performs approximation based on resource claim rate. Based on the resource claim rate and number of locations where the source is available, the method performs random deployment to improve the search performance. The entire process can be split into number of stages namely: Query Handler, Resource Claim Approximation and Random Deployment. We will discuss each of the functional stage in detail in this section.

The Figure 1, shows the architecture of the proposed system and it shows the functional stages of the proposed system.

Query Handler: The query handler is the process of coordinating the complete query processing. The method receives the input query request from the mobile nodes and identifies the location where the data is available and computes the resource claim and performs approximation. Based on resource claim and approximation values the method performs random deployment. Finally the method executes the query and return results to the user.

Algorithm:
Input: Resource Request Rreq.
Output: Result Res.
Start
Initialize Resource Table Rt.
Identify requested resource Rreq.
Split entire network in to regions.

$$Rs = \int_{i=1}^{4} Split(Region,(i \times 90))$$

for each region Ri from Rs
RCA=Perform resource claim approximation(Ri).
if RCA<RTh then
Perform random deployment.
end
end
Identify region of mobile node.
Execute query.
Stop

The above discussed algorithm performs region splitting and resource claim approximation to perform query execution for the input query.

Resource Claim Approximation: Resource claim is the measure computed based on the number of request being received from the mobile users at any time and the number of locations the data has been present. Also the method uses the number of mobile nodes present in the region and the number of request being received to compute the resource claim factor. The computed resource claim factor will be used to perform result generation and random deployment.

Algorithm:
Input: Resource Table Rt, Region R, Request Trace Ret.
Output: Resource Claim Factor RCF.

Start

Compute Number of Nodes NN = Σ *Nodes* $\in$ *R*

Compute number of request generated.

Tr = $\int_{i=1}^{size(Ret)} \Sigma * Tri \in Ret)$

Compute Resource Claim Factor Rcf = $\left(Tr/_{NN}\right)$ × *Number of nodes resource available*.

End

The above discussed algorithm computes the resource claim factor which will be used to perform query processing.

Random Deployment: The random deployment is the process of deploying static nodes in the region of the network to store the information or resource which is required by the mobile nodes of MDN. The method is called when the resource claim factor of any resource in any region is greater than the threshold. The method is given with the resource claim factor and number of nodes, based on the given values the method computes the number of locations the method has to deploy random nodes [13-15].

Algorithm:

Input: Resource Claim Factor Rcf, Number of nodes Nn, Number of resource nodes Nrn

Output: Null

Start

compute resource availability factor RAF.

RAF = $\frac{Rcf}{nn} \times Nrn$

if RAF<RTh then

Compute number of random nodes Rn = $\left(RCF/_{RAF}\right) \times \frac{Tr}{Nrm}$

deploy Rn nodes in the region.

End

Stop

The above discussed random deployment algorithm computes resource availability factor for each resource. Based on the value of resource availability factor the method computes the number of nodes the resource has to be deployed.

Result Producer: The final result to the user will be generated by this approach. The method generates result for the query being generated by the client node and sends to the mobile node. Also the result has information about the location of resource and the next query to be submitted. This will reduce the time complexity of query processing in the mobile disconnected networks.

RESULTS AND DISCUSSION

The proposed region based random deployment approach for content searching in mobile disconnected network has been implemented and tested for its results. The proposed method has been measured for its efficiency in content searching and the method has produced efficient results. The above discussed approach has been evaluated with the following parameters.

The Table 1, shows the simulation parameters being used in evaluating the proposed method.

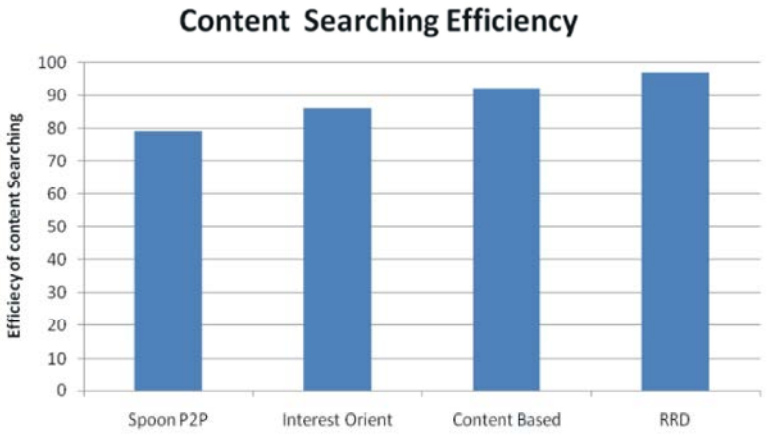
The Graph 1, shows the comparison of content search efficiency produced by different methods and it shows clearly that the proposed method produces more efficient content searching than other methods.

The Graph 2 shows the comparison of latency ratio introduced by different methods and it shows clearly that the proposed method has produced less latency than other methods.

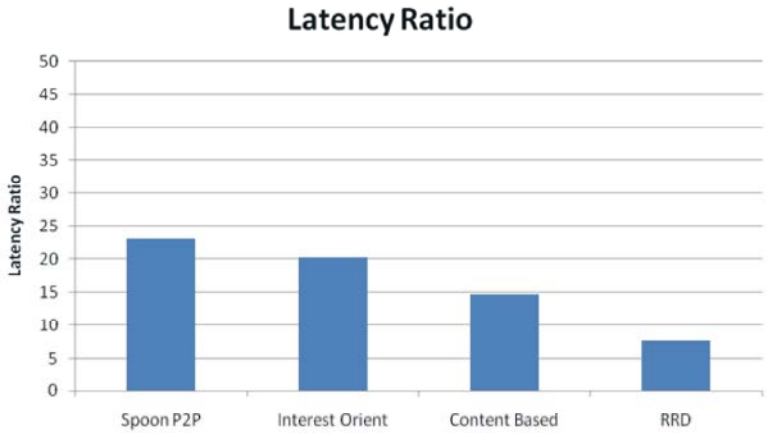
The Graph 3, shows the comparison of time complexity of different methods and it shows clearly that the proposed method produced less time complexity than other methods.

Table 1: Simulation Parameters

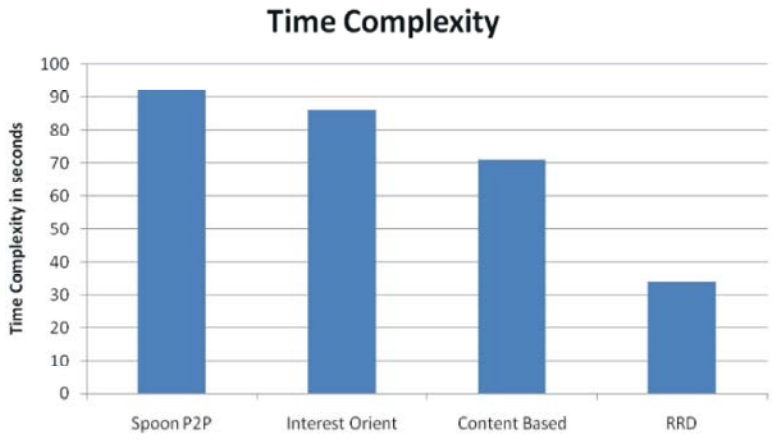
Parameter	Value
Number of Nodes	500
Number of regions	4
Number of data nodes	75
Number of content types	5



Graph 1: Comparison of content search efficiency



Graph 2: Comparison of latency ration introduced



Graph 3: Comparison of time complexity

CONCLUSION

In this paper, we proposed a region based random deployment technique for the improvement of content searching in mobile disconnected network. The method identifies the list of nodes where the content is available and splits the entire region into number of quarters. For each region the method computes the resource claim factor and based on the resource claim factor the method computes the resource availability factor. Using the resource availability factor, the method computes the number of random deployment nodes and deploys the nodes to be deployed. Then the method executes the query and return results to the mobile node. The method produces more efficient results in content searching and reduces the latency of content search.

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