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Energy Efficient Peer-To-Peer Rectangular Indexing-System Architecture

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Abstract: Mobile P2P networking is an enabling technology for mobile devices to self-organize in an unstructured style and communicate in a peer-to-peer fashion. Due to user mobility and the unrestricted switching on/off of the mobile devices, links are intermittently connected and end-to-end paths may not exist, causing routing a very challenging problem**.** The major problem with peer-to-peer applications is to find the nodes having desired information and downloading the same by saving the battery power in mobile prevalent computing environment. The past techniques though have produced satisfactory results but none of them addressed this problem. In this paper we propose a architecture of peer-to-peer minimum boundary rectangle (PMBR) indexing scheme designed for mobile peer -to-peer environment. Here the node which contains the users information of interest is easily find out by reading the index.

Keywords: Mobile P2P networking, PMBR, peer -to-peer environment, Indexing-System Architecture.

I. INTRODUCTION

A mobile P2P environment is a set of moving nodes that communicate via short range wireless technologies such as IEEE 802.11, Blue-tooth, or WI-Fi. Basically there are two types of approaches to answer the location alert services [2-3]. Particularly mobile nodes can be furnished with peer-to-peer abilities which will enable them to be a part of self-organizing and controlling and easily be deployed communication equipment [4-6]. Recent advances in wireless networks have led to development of new type of services called as Location Alert Service. These services give the answers to the users queries not only on the basis of data values but also the location where the query was requested. Important classes of problems in Location Alert Services are:

A) Range Query: Where client gets the desired data within particular range.
B) Nearest Neighbour Query: Where clients get the desired data which is closer to query point. Basically there are main two approaches to get the information desired.
• Point-to-Point: Here client will separately send the request message to server and obtains the results via point-point channel.
• Periodic Broadcast: Here client listens to the broadcast channel and obtains the query result via a broadcast channel.

In wireless environment, broadcasting the most accessed data items saves bandwidth as it cuts down the separate but similar responses to requests. To save the scant power in mobile we should have some technique that will save the access time and ultimately the energy of the device. The basic idea to deal with this scenario is to broadcast the data with index that will be effective for client in listening process. Advantages of using the index will be:

1) It reduces communication cost since client only sends the request to the node having desired data items by accessing air indexing.
2) It reduces the amount of time spent listening on the broadcast channel. Over past few years many studies have been introduced for periodic data broadcast. However these techniques approached only distribution of reports about resources without considering inadequate resources of mobile clients. Moreover, none of them considered location based data distribution and indexing for mobile peer-to-peer geographical queries in periodic broadcast systems.

Our main objectives are:
A) Present a new direction of organizing geographical information and supporting geographical queries with help of human mobility.
B) Introduce a new index method for broadcast based mobile P2P environments.
C) Develop a new index search algorithms.

II. LITERATURE SURVEY

This part gives the brief idea about the lots of work done before but still none of them considered the approach which is proposed here. So we have explained that work below.

A. Distribution of Spatio-Temporal Information using hotspots It proposed an approach, where a node generates spatiotemporal resource information and obtains new reports in exchange [O.wolfson et.al. proposed][10]. A moving node constantly receives availability reports from the peers it visits. Since the number of reports saved and communicated by a peer may continuously increase the authors employ a relevance function that prioritizes the availability reports in order to limit the volume of data exchange. However this technique didn't consider the direct exchange of resources.

B. R-tree Indexing Most of the existing studies on spatial search are based on indexes that store the locations of the indexed objects. One example of this is R-tree index. A searching algorithms based on R-tree usually explore the search space in vicinity of the query point using branch and bound approach. It requires the backtracking until target leaf node is found. Information is broadcast based on a predefined sequence and it is only available at the moment when it is broadcast. Backtracking tree search causes a serious problem for sequential access media (e.g., wireless data broadcast channel). B. Zeng et.al explained [11]. However this technique is designed only to support traditional geographical databases and cant not be deployed in wireless environment as they do not consider time characteristics of air index [11-14].

C. (1.m) Indexing Technique In traditional client-server broadcast environment reducing the access time1 and tuning time2 are the most important issues in terms of power saving and correct answers. (1, m)[T. Imielinski et.al proposed] [14] is the most popular indexing scheme. In this method, the index is broadcast m times during a single broadcast cycle. The broadcast index is broadcast every fraction 1 m of the broadcast cycle. Selective tuning is obtained by multiplexing an index with the data items in the broadcast. In general, the quick access time in a broadcast cycle is obtained when there is no index, since the size of the entire broadcast cycle is minimized but this increases the tuning time. In this case, the average latency time is [O 2 + t] where O denotes the number of data objects and t denotes the download time for data objects. whereas addition of number of index segments in a single broadcast cycle diminishes the average probe wait3 time but increases the access time because of the additional index information. A major drawback of this index is the probe wait time may increase the average access time. Also it doesnt consider the linear streaming property of wireless data broadcast.

D. MAPLE -It is sharing bases nearest neighbor model. Where each node is designed for sharing the results of queries that are cached locally by mobile clients [W.S.Ku et al. proposed] [16]

E. Exponential Sequence Scheme It is novel broadcast-based geographical data distribution and selective tuning algorithm that provide the clients with the ability to perform selective tuning and assist in reducing the clients tuning time.[17-19]. The basic idea is to use exponential pointers from each data item. Each data object contains pointers that contain the Identifiers, localities and advent times of the data items that will be broadcast accordingly. Each client uses an exponential pointer from each data item to minimize the energy consumption. However it is suitable for traditional client-server broadcast environments since the server broadcasts all data items of the whole universe.

F. Query Processing in Broadcast-ed Spatial Index Trees It is technique is used for scheduling a spatial index tree for broadcast in a single and double channel environment. The algorithms executed by the clients aim at minimizing latency and tuning time. However they still supports only for traditional client-server environment.

III. DESIGN APPROACH

A. Energy Consumption Models now we will discuss first the energy consumption models for point-to-point and periodic broadcast approaches and will compare them in terms of energy efficiency. Let εr and εa be the energy consumption for making request and getting acknowledgment. Let εd,εds and εi be the energy required to access the desired data through whole broadcast cycle, receiving the data with selective contacting of nodes and to access the index to get the information of interest. Let εad and n be the energy consumption for the sum of downloading all required data item(s) and the number of node contacts until final results obtained by the client, respectively. These approaches are as described below:

• Point-to-point: Client obtains the desirable result by contacting each node. In this method, the client submits request and receives acknowledge message, the energy consumption significantly since the client must repeatedly send a query and receive an acknowledgment message.
• Periodic Data: In this method, the client tunes the broadcast data items, here size and no of data items affects the energy consumption since the client must stay in active mode until it receives the desired information of data.
• Periodic Index: In this method client tunes indexes and from N nodes. Then client submit the request and obtains final result from Nth node,Here the size and the number of data items do not affect more the energy consumption since the client sends a request message only to the node with the desired information.
• Periodic Index with Selective Data: Here client tunes the indexes from N nodes. Then client obtains the final result from Nth node,Since the client can also selectively contact the data items without sending a request message to other nodes, it is efficient in terms of power and resource consumption, especially when many users request the same data at the same time.

In a mobile P2P network mobile devices can communicate in a peer-to-peer fashion and self-organize in an unstructured style without the need of any infrastructure, making the local wireless connectivity better exploited. But under such a networking paradigm, data delivery is nontrivial as end-to-end paths may not exist due to user mobility and/or the unrestricted switching on/off of the mobile devices. Moreover, the limited wireless spectrum and device resources (storage, computation capability,

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battery power, etc.) together with the rapidly growing number of portable devices and amount of transmitted data, make routing even harder. Thus an effective and efficient routing algorithm in intermittently connected mobile P2P networks should satisfy the following three design requirements:

1) Scalable. With the number of nodes in the network increases, the complexity of the algorithm as well as the information each node carries, maintains, and exchanges with others should not rapidly increase.
2) Distributed. Each node should determine its next hop independently, which means that no centralized routing decision/computation should get involved.
3) Light-weighted. Each node should incur low computation and storage overheads, which implies the simplicity of the routing algorithm

Our design is used the concept of the mobility of the mobile devices, They are mainly controlled by their carriers, the human beings, and the mobility of human beings is driven by their sociality, which is stable in long term Observed human mobilities are as following:

i) Human mobility demonstrates a high degree of spatial regularity-This indicates that each node has a significant probability of returning to a few highly frequently visited places.

ii) Human mobility exhibits spatial locality.-In other words, people usually move within a local region. reports the probability density function of the average displacement of all mobile nodes from their corresponding centers (most frequently visited places). The probability of moving away from its center for a node decreases sharply with the increase of the displacement, exhibiting spatial locality of human mobility.

iii) The activities of human mobility are heterogeneous. In real world, different nodes have different mobility activities characterized by the number of different locations visited within a given time.

This concept is used for intermittently connected mobile P2P networks, which exploit the spatial locality, spatial regularity, and activity heterogeneity of human mobility to select relays.

IV. MOBILE PEER-TO-PEER ENVIRONMENT

We consider or peer-to-peer model as a geometric model and going to represent it using 2D coordinates. Where these coordinates will specify the locations and each node will be having limited range of transmission so that it can contact to nearest neighbors. Also we are going to use the decentralized environment instead of centralized server as it will provide a powerful access to the data over the network. The said network will typically look like shown in below fig. We assume that the size of data items is same and only one client is allowed to contact to the single broadcast channel at a time. Also to provide efficient access to information we are going to classify the clients in two types as:

• SRD Sufficient Resource Device: The devices will be mainly those which can be provided with external electrical source to get power so client does not have to worry about power consumption. This client will broadcast the data items with PMBR indexes periodically. Example includes: hotels, malls, information centers etc.
• IRD Insufficient Resource Device: These are devices which are having limited power resources. So power consumption should be reduced. Therefore in this case clients will only broadcast PMBR index periodically.

V. PMBR INDEX STRUCTURE

This section includes details about the structure of PMBR Index.

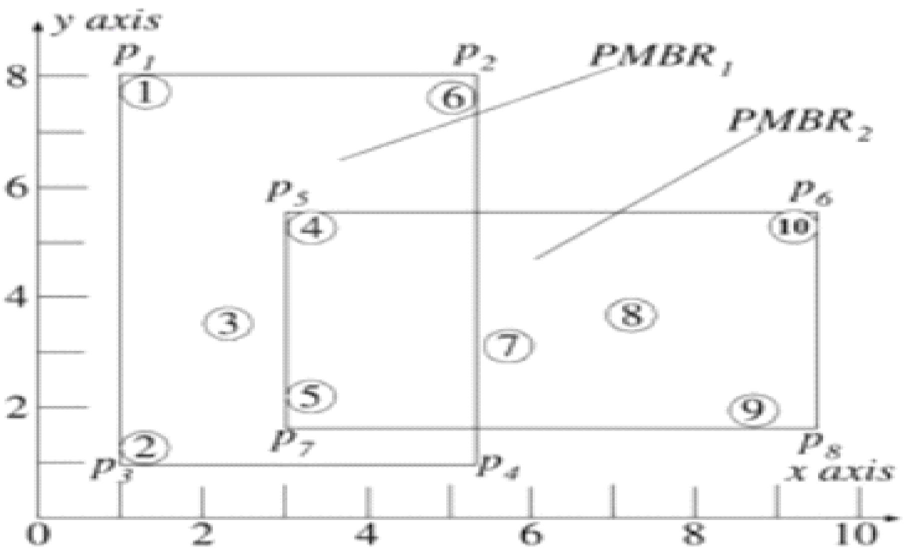

Fig. 1. PMBR Index

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- PMBR Index structure can be graphically shown in terms of 2D coordinates as below:
- Here there are total 2 PMBRs i.e. PMBR1 which contains the bounded object as O1, O2, O3, O4, O5, O6 and PMBR2 which contains the bounded objects as O4,O5,O7,O8,O9,O10. • Let us consider the above fig.1 where SRD clients broadcast PMBRs as 1) PMBR1 : P1(x:1y:8), P2(x:5.3,y:8), P3(x:1,y:1), P4(x:5.3,y:1). And likewise will be PMBR2. • The IRD client will only broadcast the PMBRs but SRD client will broadcasts a)PMBR, b) Ordering of broadcast: Horizontal or Vertical and c) IDs and 2D coordinates of data objects via wireless channel.

VI. SYSTEM ARCHITECTURE

The system architecture as shown below in Fig.2 basically contains following main components:

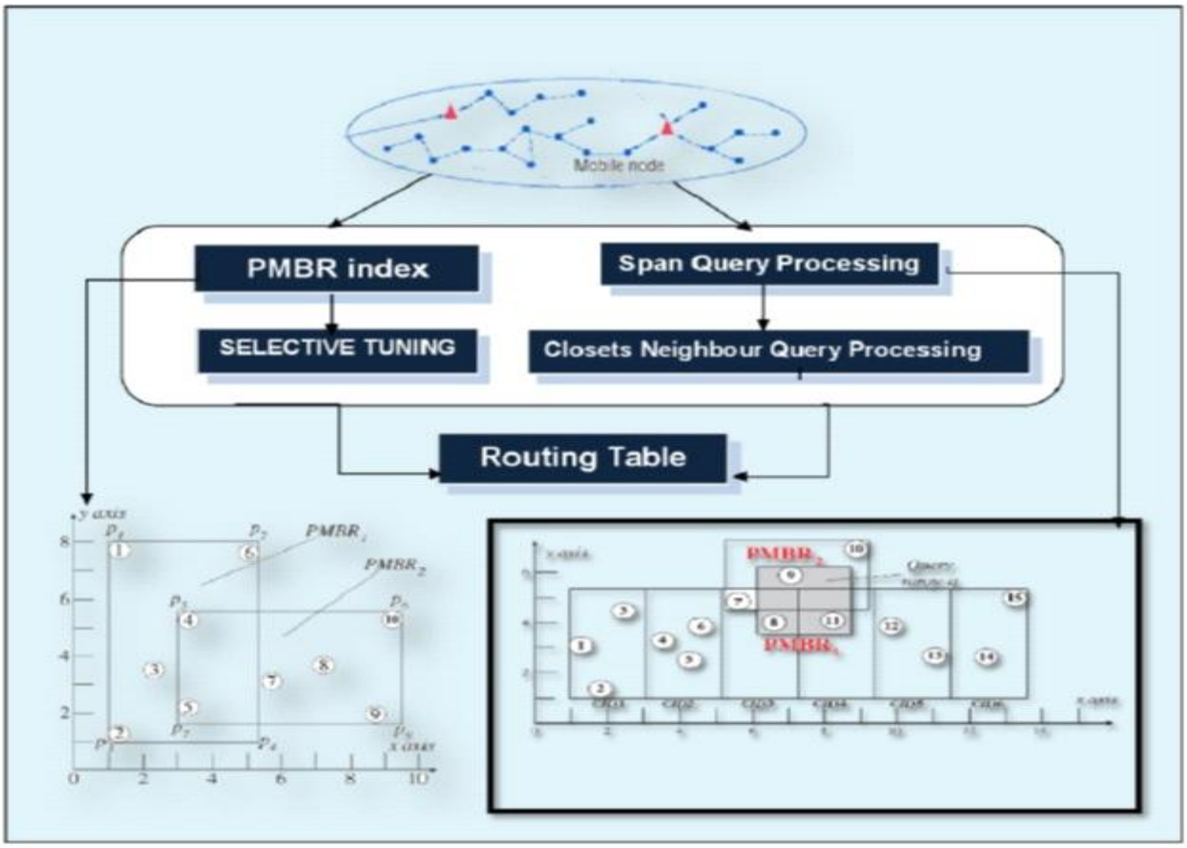

Fig. 2. System Architecture

- PMBR Index Module: This section explains the implementation details of the module containing the indexing structure i.e. PMBRs created by every node in P2P environment. These PMBRs will be tuned by each node whenever they want some information for their need or want to share the information with their neighboring nodes. The tuning will done by using selective tuning algorithm.
- Span Query Processing Module: This part discusses implementation of the algorithm for range query processing. Using this algorithm user will be able to get the answers to the queries which will have range constraints specified by him. E.g. No of Coffee Shops available within 10km area
- Selective Tuning Model: This part explains about the implementation of Selective tuning algorithm which will give every user the ability to selectively tune to the particular broadcast channel to get the desired information. Using this approach the user will save the time of unnecessarily contacting to nodes which of neither interest.
- Closest Neighbor Query Processing Module: This part describes the implementation details of Nearest Neighbor Algorithm. If any user wants to share the information with its neighboring node then it can share it using this technique. In this case another user will get the information available easily without contacting to the server. E.g. a User wants to share the information about the places he is visiting in foreign countries with his friend.

VIII. CONCLUSION

The proposed the architecture system uses an energy efficient scheme i.e. PMBR Indexing. Initially the system defines algorithms for Closest Neighbor and Span Queries for efficient communication between the nodes. Client can selectively connect to the node and gets tuned from other

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nodes with the help of PMBR index. This index will help client to get desired information and if desired information is not present client can switch to other node‘s broadcast channel. Client can also foresee the arrival timing of information of interest by acquiring the index first. The proposed scheme will provides advantages such as less traffic overheads, energy saving by providing selective access, fast Response time due to selective connect and also can be extended to support other types of queries such as m-closest neighbor and consecutive geographic queries.

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