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Efficient File Search for Social Ad-Hoc Networks with Self Replica Allocation Reduction Algorithm

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Abstract: In this paper analysis Social Ad hoc networks (SANETs) have attracted a lot of attention due to the popularity of mobile devices and the advances in wireless communication technologies. A SANET is a peer-to-peer multi-hop social wireless network that has neither a fixed infrastructure nor a central server. Each node in a SANET acts as a router, and communicates with each other. A large variety of SANET applications have been developed. For example, a SANET can be used in special situations, where installing infrastructure may be difficult, or even infeasible, such as a battlefield or a disaster area. A mobile peer-to-peer file sharing system is another interesting SANET application. In reality, however, some nodes may selfishly decide only to co-operate partially, or not at all, with other nodes. These selfish nodes could then reduce the overall data accessibility in the network. This paper examines the impact of selfish nodes in a social ad hoc network from the perspective of replica allocation. This is termed as selfish replica allocation. In particular, a selfish node detection algorithm is developed that considers partial selfishness and novel replica allocation techniques to properly cope with selfish replica allocation. The conducted simulations demonstrate the proposed approach outperforms traditional cooperative replica allocation techniques in terms of data accessibility, communication cost, and average query delay.

Keywords: Social Ad-hoc Network, Social Content, Replication Allocation, Reduction Model, SCF-T

I. INTRODUCTION

The wide usage of portable digital devices and smart the presented system devises novel replica allocation techniques with the developed selfish node detection method. They are based on the concept of a self-centered friendship tree (SCF-tree) and its variation to achieve high data accessibility with low-communication cost in the presence of selfish nodes. The SCF-tree is inspired by our human friendship management in the real world. In the real world, a friendship, which is a form of social bond, is made individually. For example, although A and B are friends, the friends of A are not always the same as the friends of B. With the help of SCF-tree, we aim to reduce the communication cost, while still achieving good data accessibility. The technical contributions can be summarized as follows:

- Recognizing the selfish replica allocation problem: The existing system views a selfish node in a SANET from the perspective of data replication, and recognizes that selfish replica allocation can lead to degraded data accessibility in a SANET.
- Detecting the fully or the partially selfish nodes effectively: It devises a selfish node detection method that can measure the degree of selfishness.
- Allocating replica effectively: It proposes a set of replica allocation techniques that uses the self-centered friendship tree to reduce communication cost, while achieving good data accessibility.
- Verifying the proposed strategy: The simulation results verify the efficacy of the proposed strategy.

Three types of nodes are considered in existing system:

- Type-1 node: The nodes are non-selfish nodes. The nodes hold replicas allocated by other nodes within the limits of their memory space.
- Type-2 node: The nodes are fully selfish nodes. The nodes do not hold replicas allocated by other nodes, but allocate replicas to other nodes for their accessibility.
- Type-3 node: The nodes are partially selfish nodes.. The nodes use their memory space partially for allocated replicas by other nodes. Their memory space may be divided logically into two parts: selfish and public area. These nodes allocate replicas to other nodes for their accessibility.

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The strategy consists of three parts:

- Detecting selfish nodes, allocating replica. At a specific period, or relocation period, each node executes the following procedures:
- Each node detects the selfish nodes based on credit risk scores.
- Each node makes its own (partial) topology graph and builds its own SCF-tree by excluding selfish nodes.
- Based on SCF-tree, each node allocates replica in a fully distributed manner.

II. RELATED WORK

Adriana Iamnitchi, Matei Ripeanu et al [1] discusses that Web caches, content distribution networks, peer-to-peer file sharing networks, distributed file systems, and data grids all have in common that they involve a community of users who use shared data. In each case, overall system performance can be improved significantly by first identifying and then exploiting the structure of community's data access patterns. The authors proposed a novel perspective for analyzing data access workloads that considers the implicit relationships that form among users based on the data they access. They proposed a new structure the interest-sharing graph that captures common user interests in data and justify its utility with studies on four data-sharing systems: high-energy physics collaboration, the Web, the Kazaa peer-to-peer network, and a BitTorrent file-sharing community. They found small-world patterns in the interest-sharing graphs of all four communities. They investigated analytically and experimentally some of the potential causes that lead to this pattern and conclude that user preferences play a major role.

Elizabeth Daly and Mads Haahr [2] stated that the message delivery in sparse Mobile Ad hoc Networks (MANETs) is difficult due to the fact that the network graph is rarely (if ever) connected. A key challenge is to find a route that can provide good delivery performance and low end-to-end delay in a disconnected network graph where nodes may move freely. This paper presents a multidisciplinary solution based on the consideration of the so-called small world dynamics which have been proposed for economy and social studies and have recently revealed to be a successful approach to be exploited for characterising information propagation in wireless networks. To this purpose, some bridge nodes are identified based on their centrality characteristics, i.e., on their capability to broker information exchange among otherwise disconnected nodes. Due to the complexity of the centrality metrics in populated networks the concept of ego networks is exploited where nodes are not required to exchange information about the entire network topology, but only locally available information is considered

Ian F. Akyildiz Tommaso Melodia et al [3] explained the availability of low-cost hardware such as CMOS cameras and microphones has fostered the development of Wireless Multimedia Sensor Networks (WMSNs); networks of wirelessly interconnected devices that are able to ubiquitously retrieve multimedia content such as video audio streams, still images, and scalar sensor data from the environment. In this paper, the state of the art in algorithms, protocols, and hardware for wireless multimedia sensor networks is surveyed, and open research issues are discussed in detail. Architectures for WMSNs are explored, along with their advantages and drawbacks. Currently off-the-shelf hardware as well as available research prototypes for WMSNs is listed and classified. Existing solutions and open research issues at the application, transport, network, link, and physical layers of the communication protocol stack are investigated, along with possible cross-layer synergies and optimizations. Wireless sensor networks (WSN) [12] have drawn the attention of the research community in the last few years, driven by a wealth of theoretical and practical challenges. This growing interest can be largely attributed to new applications enabled by large-scale networks of small devices capable of harvesting information from the physical environment, performing simple processing on the extracted data and transmitting it to remote locations.

Scott Pudlewski, Tommaso Melodia [4] explained about the availability of inexpensive CMOS cameras and microphones that can ubiquitously capture multimedia content from the environment is fostering the development of wireless multimedia sensor networks (WMSNs), i.e., distributed systems of wirelessly networked devices that can retrieve video and audio streams, still images, and scalar sensor data. A new cross-layer rate control scheme for WMSNs is introduced in this paper with a twofold objective: (i) maximize the video quality of each individual video stream; (ii) maintain fairness in the domain of video quality between different video streams. The rate control scheme is based on analytical and empirical models of video distortion and consists of a new cross-layer control algorithm that jointly regulates so quality, and the strength of the channel coding at the physical layer. The end-to-end data rate is regulated to avoid congestion while maintaining fairness in the domain of video quality rather than data rate. Once the end-to-end data rate has been determined, the sender adjusts the video encoder rate and the channel encoder rate based on the overall rate and the current channel quality, with the objective of minimizing the distortion of the received video.

Mirco Musolesi and Cecilia Mascolo [5] describes the validation of mobile ad hoc network protocols relies almost exclusively on simulation. The value of the validation is, therefore, highly dependent on how realistic the movement

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ISO 3297:2007 Certified
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models used in the simulations are. Since there are a very limited number of available real traces in the public domain, synthetic models for movement pattern generation must be used. However, most widely used models are currently very simplistic, their focus being ease of implementation rather than soundness of foundation. Simulation results of protocols are often based on randomly generated movement patterns and, therefore, may differ considerably from those that can be obtained by deploying the system in real scenarios.

III. SELF REPLICA ALLOCATION AND REDUCTION MODEL

The proposed system includes all the existing system implementations. In addition, data items with different length are handled in memory space. In addition, it does identify and handle false alarms in selfish replica allocation. Also query delay is reduced. To implement the scenatrio, in proposed system, P2P based approach is used in which when a node is downloading and viewing media content, it can upload the content simultaneously. In order to efficiently share media content, the project uses segmented media content to avoid the possibility of downloading failure. It enables users to share existing media segments while downloading others. The stable nodes function as brokers to match content requesters and providers. Nodes are treated as stable peers by giving a time threshold and nodes online up to that time is treated as stable node. In addition, the peers online and offline can be maintained. The total number of up time and down time of each peer is also maintained. The following advantages are present in the proposed system.

- Identifies and handles false alarms in selfish replica allocation.
- Peers are classified as high-capability non-selfish peers that handle search or routing, and ordinary peers that act as their clients.
- Time threshold is given to treat the node as stable node.
- Rating the super peer nodes is possible. This helps to add more capability to that node.
- Multimedia content retrieval is efficient and data availability is more.
- Most offline peers can be tracked easily.

IV. REDUCTION METHODOLOGY

A. Access Frequency Of Nodes

In this section, to find selfish replica allocation, first access frequency of nodes is given as input. The example data is given below.

Data	Nodes					
	N_1	N_2	N_3	N_4	N_5	N_6
D_1	0.65	0.25	0.17	0.22	0.31	0.24
D_2	0.44	0.62	0.41	0.40	0.42	0.46
D_3	0.35	0.44	0.50	0.25	0.45	0.37
D_4	0.31	0.15	0.10	0.60	0.09	0.10
D_5	0.51	0.41	0.43	0.38	0.71	0.20
D_6	0.08	0.07	0.05	0.15	0.20	0.62
D_7	0.38	0.32	0.37	0.33	0.40	0.32
D_8	0.22	0.33	0.21	0.23	0.24	0.17
D_9	0.18	0.16	0.19	0.17	0.24	0.21
D_{10}	0.09	0.08	0.06	0.11	0.12	0.09

TABLE 4.1: Access Frequency Of Nodes

B. Selfish Replica Allocation

In this section, selfish replication allocation is shown. Fig. 1 illustrates an existing replica allocation scheme, DCG, where nodes N1, N2, ... ,N6 maintain their memory space M1, M2, ... ,M6, respectively, with the access frequency information in Table 1 (In Fig. 4.1, a straight line denotes a wireless link, a gray rectangle denotes an original data item, and a white rectangle denotes a replica allocated.

In Table 1, the gray colored area shows three data items that are accessed frequently by N3 and N4). As shown in Fig. 4.2, DCG seeks to minimize the duplication of data items in a group to achieve high data accessibility. Let us consider the case where N3 behaves “selfishly” by maintaining M’3, instead of M3, to prefer the locally frequently accessed data for low query delay. In the original case, D3, D9, and D2 were allocated to N3. However, due to the selfish behavior, D3, D5, and D2, the top three most locally frequently accessed items, are instead maintained in local storage. Thus, other nodes in the same group, i.e., N1, N2, and N4, are no longer able to access D9. This showcases degraded data accessibility, since N1, N2, and N4 cannot fully leverage N3’s memory space as intended in cooperative replica sharing.

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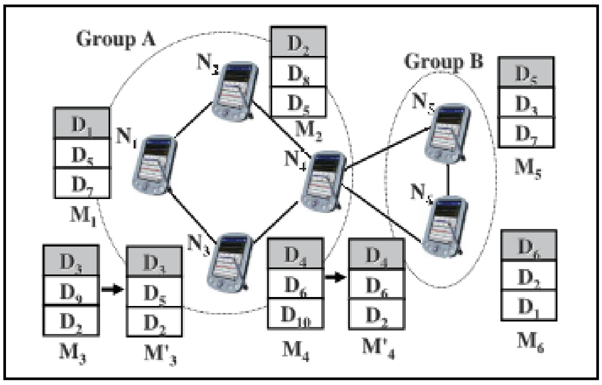

Fig 4.2: Selfish Replica Allocation

As another example, a node may be only "partially selfish" in a MANET. For instance, node N4 may want to locally hold D2, one of the locally frequently accessed data items. In this case, N4 uses only a part of its storage for its own frequently accessed data, while the remaining part is for the benefit of overall data accessibility. Thus, N4 may decide to maintain M'4, instead of M4. Even with only partial selfishness, data accessibility is still degraded, since the other nodes in the same group, i.e., N1, N2, and N3, cannot access D10.

C. Detect Selfish Nodes

In this module, the algorithm to detect selfish nodes is executed. selfish nodes Algorithm describes how to detect selfish nodes. At each relocation period, node N_i detects selfish nodes based on nCR^k_i. Each node may have its own initial value of Pk_i as a system parameter. Interestingly, the initial value of Pk_i can represent the basic attitude toward strangers.

For instance, if the initial value equals zero, node N_i always treats a new node as a nonselfish node. Therefore, Ni can cooperate with strangers easily for cooperative replica sharing. Replicas of data items are allocated by allocation techniques. After replica allocation, N_i sets ND^k_i and SS^k_i accordingly. Recall that both ND^k_i and SS^ki are estimated values, not accurate ones. The estimated values are adjusted at query processing time, according to Update Algorithm

/* N_i detects selfish nodes with this algorithm */
detection(){
for (each connected node N_k){
if (nCR_i^k < = N_k is marked as non-selfish;
else N_k is marked as selfish;}
wait until replica allocation is done;
for (each connected node N_k){
if (N_i has allocated replica to N_k){
ND_i^k = the number of allocated replica;
$SS_i^{k=}$ the total size of allocated replica;}
else{
ND_i^k = 1;
SS_i^k = the size of a data item;
} } }

D.Update Selfish Features

In this section, the algorithm to update selfish features is executed. In Algorithm 2, N_i maintains its ND^k_i, SS^k_i, and P^k_i during each query processing phase. When N_i issues a query, Ni awaits the response from the expected node N_k during the predefined wait time w, where w is the expected maximum time taken to exchange one round of request-response message across the entire network. Whenever Ni detects the selfish behavior of N_k, it modifies P^k_i, ND^k_i, and SS^k_i accordingly. If N^k serves the query as expected, however, only P^k_i will be decreased, while ND^k_i and SS^k_i remain unchanged.Note that, in case an unexpected node N_j replies to N_i's request, N_i will modify ND^j_i and SS^j_i accordingly, while not affecting P^j_i, P^k_i, ND^k_i, and SS^k_i . That is, the reply from unexpected nodes does not affect the selfish features of expected nodes. Note also that N_i may receive multiple replies from unexpected and/or expected nodes. In this case, N_i modifies P^k_i, ND^k_i, and/or SS^k_i accordingly for each reply based on Algorithm 2. If N_i does not receive any reply from expected node N_k during w, it observes N_k's selfish behavior andmodifies P^k_i ,ND^k_i, and SS^k_i accordingly.

/* When Ni issues a query */
update_SF(){
while (during the predefined time @){

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ISO 3297:2007 Certified
Vol. 6, Issue 10, October 2017

if (an expected node N_k serves the query)
decrease P_i^k;
if (an unexpected node N_j serves the query){
$ND_i^j = ND_i^j + 1$;
$SS_i^j = SS_i^j$ + (the size of a data item);
} }
if (an expected node N_k does not serve the query){
increase P_i^k;
$ND_i^k = ND_i^k - 1$;
$SS_i^k = SS_i^k$ - (the size of a data item);
} }

F.Peer To Peer File Shaering

- SET SERVER IP ADDRESS

o In this form, the server machine IP address (the main application running node's IP address) is saved in to the 'ServerIPAddress' table.

- PEER DETAILS

o In this form, the node id and IP address (the client application running node's IP address) is saved in to the 'Nodes' table.

- SET STABLE NODE TIME THRESHOLD

o In this form, the stable node time settings threshold is saved in to the 'StableNodeThreshold' table. When a client application is started and runs up to this duration, then this node is said to be stable node.

- CONTENT
- UPLOAD CONTENT

o In this form, the date/time, title and description, the file path to be uploaded, and file type (extension such as .doc, .mp3, etc) are saved into 'Uploads' table.

- VIEW CONTENTS (ALL PEERS)

o In this form, using data grid view control, all the records in 'Peers' table are fetched from database and displayed.

- VIEW CONTENTS (STABLE PEERS)

o In this form, using data grid view control, all the records in 'Peers' table with 'StableNode' column's value set to 1 are fetched from database and displayed. When the node is selected, the files kept in that node are displayed.

- VIEW CONTENTS (ONLINE NOW)

o In this form, using data grid view control, all the records in 'Peers' table with 'OnlineNow' column's value set to 1 are fetched from database and displayed. When the node is selected, the files kept in that node are displayed.

- FIND
- PEERS ONLINE

o In this form, using data grid view control, all the records in 'Peers' table with 'OnlineNow' column's value set to 1 are fetched from database and displayed.

- PEERS OFFLINE

o In this form, using data grid view control, all the records in 'Peers' table with 'OnlineNow' column's value set to 0 are fetched from database and displayed.

- QUERY STABLE NODE

o In this form, using data grid view control, all the records in 'Peers' table with 'StableNow' column's value set to 1 are fetched from database and displayed.

- RETRIEVE
- RETRIEVE MULTIMEDIA CONTENT

o In this form, the search word is given and records having description matching with the search word are fetched and displayed. When the file is selected, the nodes having that record/file are displayed. When 'Download Content' button is clicked, the file's segments are retrieved from those systems.

- REPORT BROKEN STABLE NODE
- In this form, the stable nodes if not connected to the given node, then it is displayed.
- RATE STABLE NODES BASED ON CAPABILITY
- In this form, all stable nodes running for very long duration are displayed in the data grid view control.

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V. EXPERIMENTAL RESULTS

The following Table 5.1 describes experimental result for proposed system error rate analysis. The table contains social member sending file and average percentages for existing and proposed system in sensor node detection are shown.

Table 4.1 Reduced Error Rate For Existing And Proposed System

Social Member	Existing System (%)	Proposed System (%)
8	72.54	78.62
12	76.13	78.11
16	82.42	83.13
24	86.66	84.67
30	88.13	89.78
32	80.44	82.66
38	78.33	80.21
42	87.22	89.76
46	79.22	80.65
50	91.22	92..62

The following Figure 4.1 describes experimental result for proposed system error rate analysis. The table contains social member node sending file and average percentages for existing and proposed system in social replication file detection are shown.

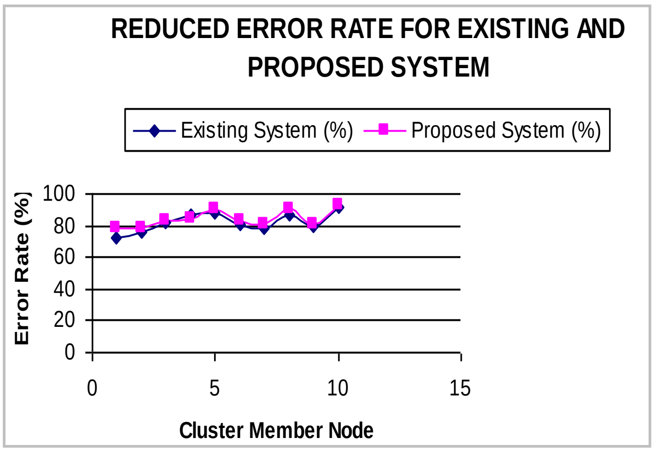

Fig 4.1 Reduced Error Rate For Existing And Proposed System

The table 4.2 contains number of social group communication and given time interval to calculate average numbers of energy reduction group details are shown.

The following Fig 4.2 describes experimental result for differences between existing and proposed Scheme for successive communication social group and average number of replication reduction file details analysis. The table contains number of file communication and given time interval to calculate average numbers of file replication reduction file details are shown

Table 4.2 Accuracy of Replica Reduction Node Analysis

S.NO	NUMBER OF SOCIAL GROUP	ACCURACY OF REDUCTION NODE [%]	
		Existing Model	Proposed Model
1	20	40.01	55.01
2	40	35.03	42.51
3	60	41.01	45.01
4	80	35.02	48.75
5	100	39.03	47.01
6	120	42.51	46.66
7	140	44.28	48.57
8	160	46.25	50.01
9	180	46.11	47.22
10	200	43.51	45.52

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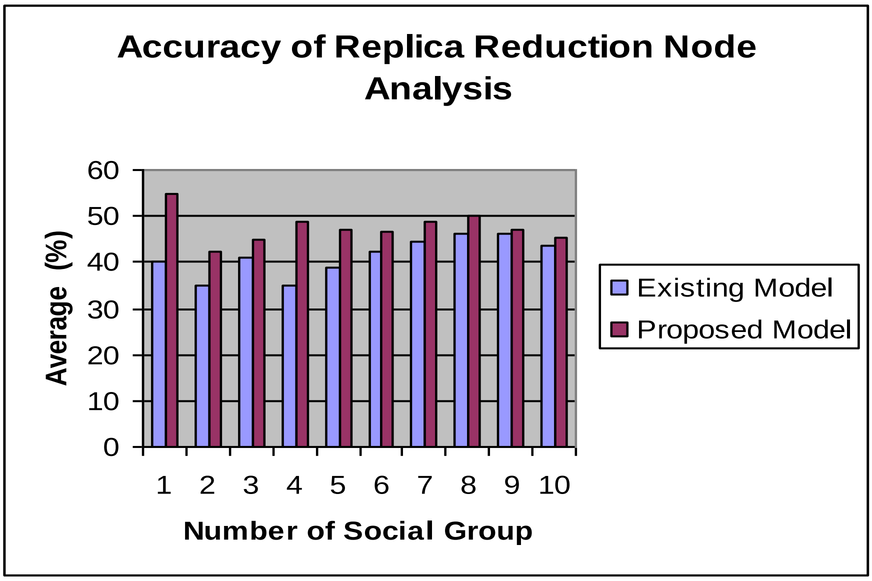

Fig 4.2 Accuracy of Replica Reduction Node Analysis

V. CONCLUSION

In contrast to the network viewpoint, the project addressed the problem of selfish nodes from the replica allocation perspective. It termed this problem selfish replica allocation. The proposed work was motivated by the fact that a selfish replica allocation could lead to overall poor data accessibility in a SANET. We have proposed a selfish node detection method and novel replica allocation techniques to handle the selfish replica allocation appropriately. The proposed strategies are inspired by the real-world observations in economics in terms of credit risk and in human friendship management in terms of choosing one's friends completely at one's own discretion. We applied the notion of credit risk from economics to detect selfish nodes. Every node in a SANET calculates credit risk information on other connected nodes individually to measure the degree of selfishness. Since traditional replica allocation techniques failed to consider selfish nodes, it also proposed novel replica allocation techniques. It is believed that almost all the system objectives that have been planned at the commencement of the software development have been net with and the implementation process of the project is completed. A trial run of the system has been made and is giving good results the procedures for processing is simple and regular order. The future strategies may outperform existing representative cooperative replica allocation techniques in terms of data accessibility, communication cost, and query delay. Future work will be on the impact of different mobility patterns. The new system is designed such that those enhancements can be integrated with current modules easily with less integration work.

1. To improve server performance at more client requests.
2. To ensure reliability in ever growing client count.
3. Multitasking can be performed.
4. If developed as web service, it can be accessed from anywhere.

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