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Contribution of Information Sharing In Wireless Sensor Network With Prune Delay

Jacob Sastry N#1, Anantha Rao .G#2
#1Student of M.Tech (CSE) and Department of Computer Since Engineering,
#2 Department of Computer ScienceDr.Samuel George Institute of Engineering & Technology,
Markapur.

ABSTRACT: The increase in the number of smart phone users has lead to the increase in the peer-to-peer adhoc content sharing. Traditional data delivery schemes are not suitable for such networks due to intermittent connectivity between smart phones. Thus new content sharing mechanisms should be proposed. To share the contents in such a scenario, researchers have proposed store-carry-forward as an efficient content sharing scheme where a node stores a message and carries it for certain duration until a communication opportunity arises and then delivers it to the destination. Previous works in this field focused on whether two nodes would encounter each other and the place and time of encounter and did not consider the activities of malicious peers. This paper proposes discover-predict-deliver as efficient content sharing scheme that enable peers to share contents and also presents distributed algorithms that enable a peer to reason about trustworthiness of other peers based on past interactions and recommendations. Interactions and recommendations among peers are evaluated based on importance, recentness and peer satisfaction parameters.

Keywords— peer-to-peer, store-carry-forward, discover predict-deliver, interaction, recommendation.

I INTRODUCTION

The number of smart phone users has rapidly increased in the past few years [1]. Users can create various types of contents easily using user friendly interfaces available in the smart phones. However content sharing among smart phones is tedious as it requires several actions such as uploading to centralized servers, searching and downloading contents. One easy way is to rely on adhoc method of peer-to-peer content sharing. Unfortunately with the current adhoc routing protocols, contents are not delivered if a network partition exists between the peers when contents are shared. Therefore Delay Tolerant Network (DTN) routing protocols achieve better performance than traditional adhoc routing protocols. These protocols do not require a centralized server. Hence the contents are stored on smart phones itself.

This paper focuses mainly on efficiency of content discovery and its delivery to the destination. Here we propose recommendation based discover-predict-deliver (DPD) as efficient content sharing scheme for smart phone based DTN's. DPD assumes that smart phones can connect when they are in close proximity that is where the smart phone users stay for a longer duration. Previous studies have shown that Smartphone users stay indoors for a longer duration where GPS cannot be accessed [15]. It employs a hidden Markov model and Viterbi algorithm [16] to predict the future location of individuals. Therefore the contents are shared where the connectivity between smart phones is possible.

In the previous work, the open nature of peer-to-peer systems exposes them to malicious activity. Building trust relationships among peers can mitigate attacks of malicious peers. A distributed algorithm is proposed in this work that enables a peer to reason about trustworthiness of other peers based on past interactions and recommendations.

I. RELATED WORK

A delay tolerant network (DTN) is a sparse mobile network where a contemporary sourcedestination path may not exist between a pair of nodes and messages are forwarded in a store-carry-forward routing paradigm [6].

Vahdat et al [2] proposed Epidemic routing as basic DTN routing protocol in which a node forward a message to every encountered node that does not have a copy of the message. The solution demonstrates the best performance terms of delivery rate and latency but wastes a lot of bandwidth.

An alternative solution was resource based [3], [4], where systems employ "data mules" as message ferries that directly deliver message to the destination. Next, opportunity-based routing protocols use history of encounters to deliver a message to the destination [5], [6], [7]. Prediction based schemes [8], [9], [10], [11], [12] use sophisticated utility functions to determine whether to forward a message to the node. Most of the existing prediction based schemes are based on whether two nodes would encounter each other in the future and not on the place and time of encounter. Yuan et al [12] accurately predicted encounter opportunities by using time of encounters.

Pitkanen et al [14] proposed state-of-the-art content sharing scheme in DTN's. They mainly focused on limiting search query propagation and proposed many query processing methods.

Chang et al [13] proposed a method for searching for a node or an object in a large network and limiting search query propagation. Here a class of controlled flooding search strategies where query/search packets are broadcast and propagated in the network until a preset TTL (time-to live) value carried in the packet expires. The goal of our work is to explore to the content sharing problem in Smartphone based DTN's.

II. CONTENT SHARING

In this section we analyze the problem of content sharing in delay tolerant networks and describe alternative solutions. As stated in the introduction, we focus on mobile opportunistic networking scenarios where the nodes communicate using the DTN bundle protocol [18]. Some devices in the network store content which they are willing to share with others. All nodes are willing to cooperate and supply a limited amount of their local system resources (bandwidth, storage, and processing power) to assist other nodes. Our goal is to allow users to issue queries for content that is stored on other nodes anywhere in the network and assess the chances of such a node to obtain the sought information. To facilitate searching, we assume that nodes are able to perform searches on their local storage and find the relevant results for a given query.

The content sharing process is categorized into two phases: content discovery phase and the content delivery phase. In the content discovery phase, the user inputs in a content sharing application requests for content. The application first searches the content it its own database and if not found, the application generates a query that is forwarded based on the user's request. When the content is found, the content delivery phase is initiated, and the content is forwarded to query originator.

1) *Dynamic Neighbour Discovery*: A Neighbour discovery is an important task for routing protocols. Especially in delay-tolerant networking, efficient neighbour discovery significantly improves the performance of the routing protocols. However, most protocols validated with simulations do not address this issue as these protocols assume that nodes always perceive neighbours with frequent hello messages. In real implementations, frequent hello messages are not acceptable due to high energy consumption. In our implementation, we have found that the content sharing performance can be improved with a simple dynamic neighbour discovery. In dynamic neighbour discovery, each peer node can discover its neighbours by adding their neighbours in the database. This is achieved by adding peer name, port number and system name for each neighbour. Thus neighbours are easily discovered.

2) *Movement Tracking:* In Life Map [19] , the Activity Manager monitors the acceleration vector of a three-axis accelerometer and detects the motion of the user. The motion detector

function of the Activity Manager is basically a classifier M that has two outputs: moving or stationary. When the user is walking, running, or moving in a vehicle, the motion is classified as moving, whereas when the user stays at a certain location, the motion is classified as stationary.

3) *Mobility Learning:* In daily life, people typically visit a number of places, but not all of these are meaningful for learning people's mobility. Indeed, DPD requires the discovery of locations where content sharing can be performed. Content sharing is successfully performed in places where Smartphone users stay long enough, as perceiving the existence of other nodes and message exchanging requires several minutes depending on the size of the message, the bandwidth, and the network interface. Hence, we are basically interested in discovering places where the user stays longer than certain duration (i.e., meaningful places) and the context in user movement (i.e., paths).Currently available location technologies focus on providing geographical information. This information is insufficient to discover meaningful places because the physical location is not exactly generated at the same place despite the fact that a user generally has a similar life pattern every day. In addition, this information cannot distinguish a place that has a similar geocode but different floors. In modern society, places are normally located in multiple floor buildings. Thus, the logical information of meaningful places has more benefit to the proposed scheme as content sharing is conducted in indoor environments.

4) *Discovering and Learning Meaningful Places:* Currently available location technologies focus on providing geographical information. This information is insufficient to discover meaningful places because the physical location is not exactly generated at the same place despite the fact that a user generally has a similar life pattern every day. In addition, this information cannot distinguish a place that has a similar geocode but different floors. In modern society, places are normally located in multiple floor buildings. Thus, the logical information of meaningful places has more benefit to the proposed scheme as content sharing is conducted in indoor environments.

5) *Mobility Prediction:* As DPD uses location information to estimate if a node approaches the destination of the content or diverges from the destination, the prediction of nodes' mobility information is essential.

6) *Trustworthiness of peers:* Here we present distributed algorithms that enable a peer to reason about the trustworthiness of other peers based on past interactions and recommendations. Peers can create their own trust network in their proximity by using local information. Two contexts of trust, service, and recommendation are defined to measure trustworthiness in providing services and giving recommendations. Interactions and recommendations are evaluated based on importance, recentness, and peer satisfaction parameters.

The operations when receiving a recommendation and having an interaction are as follows:

i. Service Trust Metric

ii. Reputation Metric

iii. Recommendation Trust Metric

iv. Selecting Service Providers

Figure 4 shows the operations when receiving a recommendation and having an interaction.

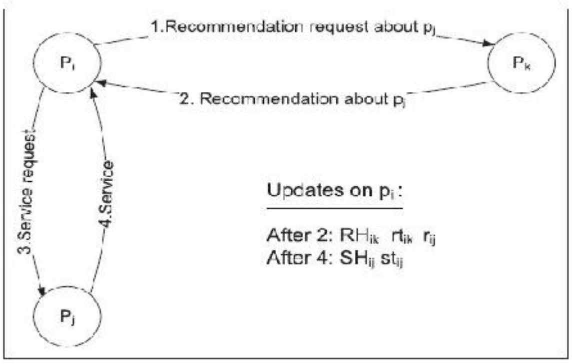

Fig.4 Operations when receiving a recommendation and having an interaction.

i. Service Trust Metric:

When evaluating an acquaintance's trustworthiness in the service context, a peer first calculates competence and integrity belief values using the information in its service history. Competence belief represents how well an acquaintance satisfied the needs of past interactions .Let friend request denote the competence belief of p_i about p_j in the service context. Average behaviour in the past interactions is a measure of the competence belief. A peer can be competent but may present erratic behaviour. Consistency is as important as competence. Level of confidence in predictability of future interactions is called integrity belief. Let I b_{ij} denote the integrity belief of p_i about p_j in the service context. Deviation from average behaviour (cb_{ij}) is a measure of the integrity belief.

ii. Reputation Metric

The reputation metric measures a stranger's trust worthiness based on recommendations. In the following two sections, we assume that p_j is a stranger to p_i and p_k is an acquaintance of p_i. If p_i wants to calculate r_{ij} value, it starts a reputation query to collect recommendations from its trustworthy acquaintances and requests their recommendations. Let η_max denote the maximum number of recommendations that can be collected in a reputation query and jS_j denote the size of a set S. In the algorithm, p_i sets a high threshold for recommendation trust values and requests recommendations from highly trusted acquaintances first. Then, it decreases the threshold and repeats the same operations.

iii. Recommendation Trust Metric:

Facebook has an incredible audience, 950 million strong and counting. This audience is immensely attractive to Brands and Marketers around the world. We've seen explosive growth in brand pages, types of advertising and other fun ways to monetize this audience. Don't invent new metrics, use online versions of Reach and GRPs to measure success. The value of Facebook in "spreading word of mouth," "getting your brand in front of friends of fans," and "engaging fans with five to seven posts a week on your fan page."They closed with the Facebook Insights tool (which is quite nice). This blog post is about the above recommendations, and their merit.

Assume that p_i wants to get a particular service. P_j is a stranger to p_i and a probable service provider. To learn p_j's reputation, p_i requests recommendations from its acquaintances. Assume that p_k sends back a recommendation to pi. After collecting all recommendations, p_i calculates r_{ij}. Then, pi evaluates p_k's recommendation, stores results in RH_{ik}, and updates rt_{ik}. Assuming p_j is trustworthy enough, p_i gets the service from p_j. Then, p_i evaluates this interaction and stores the results in SH_{ij}, and updates st_{ij}.

iv. Selecting Service Providers:

When p_i searches for a particular service, it gets a list of service providers. Considering a facebook application, either post share the links to other peer .Connecting the all people with recommendation of multiple peers, checking integrity is a problem since any part of the file downloaded from an uploader might be inauthentic. Service provider selection is done based on service trust metric, service history size, competence belief, and integrity belief values.

When p_i wants to download a file, it selects an uploader with the highest service trust value.

III.CONCLUSION

Information-centric network has been drawn more and more attentions both in the academia and industry. Designing an efficient content retrieval scheme in large-scale delay-tolerant mobile ad hoc networks is one of its biggest challenges. Current ICN approaches generate excess transmission cost that causes scalability issues when network and content number grows. In this paper, we propose STCR, a social-tie based content retrieval scheme that is highly scalable in delay tolerant mobile information-centric networks. The STCR generates the social-tie based routing structure in order to support an efficient Interest and content forwarding. We use K-mean clustering algorithm to build the social level forwarding scheme in order to reduce the transmission cost. We also propose some novel methods to compute social metrics considering both the frequency and freshness of encounters, and balanced connectivity with all other nodes to improve the delivery rate. We implemented our scheme in NS-3 simulator and show that STCR scheme is effective in providing efficient content retrieval in delay tolerant MANETs.

IV. REFERENCES

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AUTHORS:

Jacob SastryN is a student of Computer Science Engineering from Dr.Samuel George Institute of Engineering &Technology,Presently pursuing M.Tech (CSE) from this college. He received B.Tech from JNTUK in the year Of 2012.

Anantha Rao .G is a Associate Professor of Dr.Samuel George Institute of Engineering & Technology ,MARKAPUR.He received M.Tech in Software Engineering from JNTU Kakinada University..Hegained 6years Experience on Teaching . He is a good Researcher in Image Processing, Algorithms', Computer Networks. He attended Various National and International Workshops and Conferences.