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Peer-to-Peer Content sharing for Smart phones over Ad-Hoc Networks.

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Abstract:

The global smart phone audience surpassed the 1 billion mark in 2012 and will total 1.75 billion in 2014. As per our research and expectation smart phone adoption to continue on a fast-paced trajectory through 2017. Nearly two-fifths of all mobile phone users—close to one-quarter of the worldwide population—will use a smart phone at least monthly in 2014. By the end of the forecast period, smart phone penetration among mobile phone users globally will near 50%. With increase of usage of smart phones, there will be an exponential increase in the peer-to-peer data transfer among smart phones.

As a result we need newer methods of connectivity for data transfer among smart phones. In this paper we studying and implementing a method in which content or data in delivered based on three step process. Content discovery, Mobility Prediction and Content delivery are the three basic steps we followed in order to complete the task of connectivity and content sharing among smart phones.

This system is having practical applications where in the need for content is delay tolerant. A hidden Markov model is used to predict an individual's future mobility information. Evaluation based on real traces indicates that with the proposed approach, 87 percent of contents can be correctly discovered and delivered within 2 hours when the content is available only in 30 percent of nodes in the network.

We implement a sample application on commercial smartphones, and we validate its efficiency to analyze the practical feasibility of the content sharing application. Our system approximately results in a2 percent CPU overhead and reduces the battery lifetime of a smartphone by 15 percent at most.

Keywords:

Content Sharing, Smart Phones, Delay Tolerant Networks, Content discovery, Location Prediction.

Introduction:

A Smartphone is a mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, Internet access, and an operating system capable of running downloaded apps.

Aided by affordability of cheap Smartphones and availability of 3G and 4G networks the number of Smartphone users is supposed to reach around 1.75 billion users.

Although the growth rate of mobile phone users has reached a threshold in developing countries, the burgeoning increase of users in Asia Pacific, Middle East & Africa is supposed to drive the number of mobile phone users to 4.5 billion users.

In 2012 around 1.58 billion users used their mobile phones for internet, which is around 67% of internet users. The number of users using mobile phones for internet grew by 21% to 1.91 billion users, which is around 74% of internet users.

This number is further expected to increase by 17% in 2014 to 2.23 billion users, which is around 79% of total internet users.

India is ranked fifth in number of smartphone users and has shown one of the highest year-on-year growth rates (in smartphones). It, however, ranks second in the addition of new users to the Internet over the last five years.

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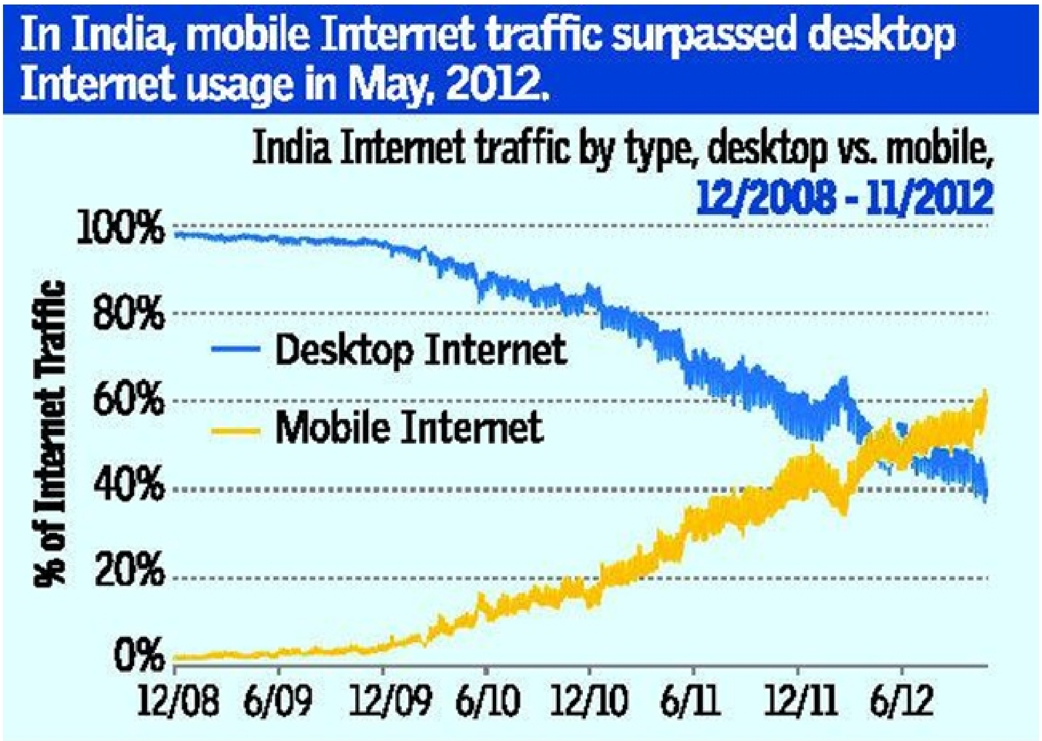

Souce: KPCB's Mary Meeeker report

As smartphones are equipped with large screens, high resolution cameras and with advanced audio codecs, users are increasingly using these phones to share the Audio/Video/Image content.

But this content sharing is still complicated as the data/content that is shared is not directly transmitted from one phone to other, but via various servers, which has various restrictions in terms of registrations etc.

Over the past few years, the number of smart phone users has rapidly increased. As smart phone interfaces are now convenient and user friendly, users can create various types of content. However, content sharing remains troublesome. It requires several user actions, such as registration, uploading to central servers, and searching and downloading contents.

One way to reduce a user's burden is to rely on an ad hoc method of peer-to-peer content sharing. In this method, contents are spontaneously discovered and shared.

The effectiveness of this sharing method depends on the efficiency of sharing and the significance of the shared contents.

In this paper, we mainly focus on the efficiency of content sharing, and we provide suggestions on creating significant content. Although ad hoc networks can easily be constructed with smart phones as they are equipped with various network interfaces, such as Bluetooth and Wi-Fi, the connectivity between smart phones is expected to be intermittent due to the movement patterns of carriers and the signal propagation phenomena.

To overcome this problem, researchers have proposed a variety of store carry- forward routing schemes. In these schemes, a node stores a message and carries it for certain duration until a communication opportunity arises. Local forwarding decisions are independently made using utility functions, and multiple copies of the same message are propagated in parallel to increase the delivery probability.

Therefore, Delay-Tolerant Network (DTN) routing protocols achieve better performance than traditional mobile ad hoc network (MANET) routing protocols.

The advantage of both DTN and MANET routing protocols is the absence of the requirement of a central server. Hence, contents are distributed and stored directly on the smartphones.

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Among the proposed DTN routing protocols, Epidemic routing is a basic DTN routing solution. In Epidemic routing, messages are forwarded to every encountered node that does not have a copy of the same message. Thissolution demonstrates the best performance in terms of delivery rate and latency, but it requires ample resources, such as storage, bandwidth, and energy.

The works, which are proposed following Epidemic routing, are classified into three categories: resource based, opportunity based, and prediction based. In the first category systems employ "data mules" as message ferries that directly deliver messages to destinations. Opportunity-based routing protocols use unscheduled and random encounter opportunities to exchange messages.

In prediction-based schemes sophisticated utility functions are designed using the history of mobility, encounter times, and encounter rates. Each node maintains a utility value for every other node, and this value has been updated using the time between contacts. A node forwards a message copy only to nodes with a higher utility for the message destination. Prediction-based schemes outperform opportunity-based routing protocols both in terms of delivery ratio and delivery latency.

Also, the schemes reduce resource consumption by adequately choosing the number of message replicas. However, most of the existing prediction-based schemes focus on the prediction of whether two nodes would encounter each other in the future and not on when they would encounter each other again. However, Yuan et al. use the time of encounters to accurately predict encounter opportunities. Still, the prediction of encounter opportunities based on the encounter history of nodes is not optimal due to missing communication opportunities. What the need of the hour is an ad hoc network of smart phones for peer-to-peer sharing of the content.

Existing System:

Presently we are using methods to decrease a smartphone consumer's trouble is to depend on an ad hoc network for peer-to-peer sharing of the data/content. In this technique, contents are discovered and shared by the end users.

The efficiency of this sharing technique relies on the competence of sharing and the importance of the shared contents. Consequently, Delay-Tolerant Network (DTN) routing protocols accomplish enhanced performance than traditional mobile ad hoc network (MANET) routing protocols.

Drawbacks of Existing System:

- Primarily focused on limiting search inquiry broadcast but not concentrating on the geographic location.

- Indoor content sharing is still a problem which need a solution as there wont be specific information due to lack of GPS information.

Proposed System:

Discover-Predict-Deliver is an effective Content Sharing method for Smart phones. This method presumes that the interactions among Smartphones occur in specific locations Where Smartphone users hang about for long time.

This method utilizes a Hidden Markov Model And Viterbi Algorithm in order to guess the potential location of users.

Merits of the Proposed System:

- A realistic location (Mobility) learning method for outdoors as well as Indoors.

- Estimation of the proposed method by means of Simulation Tools depending on Real Human Movement Traces.

- Validation of the viability of Content Sharing with DTN by applying a Sample Application on Smart Phones.

Algorithms Used:

Algorithm 1. Utility Computation.

Algorithm 2. Mobility Learning.

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Algorithm 1. Utility Computation
Input: Mobility Information $\mathbb{M}_d, \mathbb{M}_i$ Time t, Remaining Content Lifetime T, Radio Range R
Output: Utility Function $U_i(d)$

$P_s \leftarrow 0; P_g \leftarrow \infty; w \leftarrow 0; k \leftarrow \lceil \frac{T}{\delta} \rceil$
$\mathbb{M}_d \Leftarrow \{l_{d,t}, l_{d,t+\delta}, \ldots, l_{d,t+k\delta}\}$
$\mathbb{M}_i \Leftarrow \{l_{i,t}, l_{i,t+\delta}, \ldots, l_{i,t+k\delta}\}$
for $m = t$ **to** $t + k\delta$ **step** δ **do**
  if $|l_{i,m} - l_{d,m}| \leq R$ **then**
    $P_s \leftarrow P_s + \frac{t}{m}$
  end if
end for
if $P_s \neq 0$ **then**
  $U_i(d) \leftarrow P_s$
else
  for $m = t$ **to** $t + k\delta$ **step** δ **do**
    if $|l_{i,m} + l_{d,m}| \leq P_g$ **then**
      $P_g \leftarrow |l_{i,m} - l_{d,m}|$
      $w \leftarrow m$
    end if
  end for
  $U_i(d) \leftarrow (-\frac{P_g}{R} \cdot \frac{t}{w})$
end if
return $U_i(d)$

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Algorithm 2. Mobility Learning

Input: Stride Length γ, Last Location $l_t o$, Meaningful Places $\mathbb{L}$, Path Information $\mathbb{P}$

Output: Learning Meaningful Places and Paths

$t_0 \leftarrow Time; s \leftarrow 0; \vec{v}_t \leftarrow 0;$

$T_{stationary} \leftarrow 0; T_{moving} \leftarrow 0;$

while *true* **do**

  $\vec{v}_t \leftarrow$ *get accelometer readings*

  if $\mathcal{M}(\vec{v}_t)$ *is moving* **then**

    if $\vec{v}_t \geq \mu(\vec{v}_{t_0}, \ldots, \vec{v}_t) + \sigma(\vec{v}_{to}, \ldots, \vec{v}_t)$ **then**

      $s \leftarrow s + 1; \vec{v}_{t_p} \leftarrow \vec{v}_t$

      $T_{moving} \leftarrow T_{moving} + (t - t_0)$

      $T_{stationary} \leftarrow 0; t_0 \leftarrow t$

    end if

    if $T_{moving} \geq \delta$ **then**

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$GPS \leftarrow get\ GPS\ readings\ \{lat, long\}$
$\epsilon \leftarrow s \cdot \gamma$
if $GPS \neq \emptyset$ **then**
$l_t \Leftarrow \{GPS, \emptyset, \epsilon\}$
else
$l_t \Leftarrow \{l_t o + \epsilon, \emptyset, \epsilon\}$
end if
$\mathbb{P} \cdot updatePath(p(l_{t_0}, l_t))$
$l_{t_0} \leftarrow l_t$
end if
else
$t_0 \leftarrow Time$
$T_{stationary} \leftarrow T_{stationary} + (t - t_0)$
if $T_{stationary} \geq \delta$ **then**
$GPS \leftarrow get\ GPS\ readings\ \{lat,\ long\}$
$\epsilon \leftarrow s \cdot \gamma$
$\mathcal{A} \leftarrow scan\ and\ get\ WiFi\ access\ points$
if $GPS \neq \emptyset$ **then**
$l_{new} \Leftarrow \{GPS, \mathcal{A}, \epsilon\}$
else
$l_{new} \Leftarrow \{l_{t_0} + \epsilon, \mathcal{A}, \epsilon\}$
end if
for all L **in** $\mathbb{L}$ **do**
if $\mathcal{S}(L, l_{new})$ is *true* **then**
$\mathbb{L}.update(L, l_{new})$
goto 41
end if
end for
$\mathbb{L}.addPlace(l_{new})$
$T_{moving} \leftarrow 0; l_{t_0} \leftarrow l_{new}; t_0 \rightarrow t$
end if
end if
end while

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    end if
end while
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Source for Algorithms: Elmurod Talipov, Yohan Chon, and Hojung Cha, Content Sharing over Smartphone-Based Delay-Tolerant Networks, IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 12, NO. 3, MARCH 2013.

Conclusions:

In this paper we have projected a competent content sharing method for Smartphones. We have worked on the discover-predict-deliver as a content sharing technique that discovers the content and transmits it to the intended user. The method as well gives the mobility information of users. We have tried to use the best available technologies of present day Smartphone in the market. We have also suggested a method that equips a user to reason about the trustworthiness of other users.

This helps users to moderate attacks of malicious activity. We learned that contents indeed have geographical and temporal validity, and we proposed a scheme by considering these characteristics of content. For example, distributing queries for content in an area 20 miles from the location of the content searcher has only a 0.3 percent chance to discover the content while generating 20 percent extra transmission cost. Also, the time limitation on query distribution reduces transmission cost.

Most important, the proposed protocol correctly discovers and delivers 87 percent of contents within 2 hours when the contents are available only in 30 percent of nodes in the network. The implementation of our system on Android platform indicates that the scheme results only in a 2 percent CPU overhead and reduces the battery lifetime of a smartphone by 15 percent at most. Finally, we believe our system still has room for improvement.

Specifically, the use of asymmetric multicore processors and efficient sensor scheduling is needed to reduce the energy consumption of smartphones' sensors.

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