A Novel Mechanism for Reducing Content Provision Cost in Distributed Social Wireless Networks by Using Co-Operative Caching

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Abstract

Social Wireless Networks (SWNTs) are the devices that are mainly formed by integrated group of several mobile devices, such as data enabled phones, E-Book, Card Readers and a lot more, sharing all the common interests in the form of electronic content, and physically gathering all together in public places. By using this novel method of object caching in SWNTs are shown to be able to reduce the content provisioning cost. In this paper, we mainly designed and analyzed a new caching technique with cooperative mode practically deals with network, service, and pricing models which are then used for creating two object caching strategies for minimizing content provisioning costs in networks with homogenous and heterogeneous object demands. By using this new co-operative caching mechanism the user can be able to get the services more beneficiaries for downloading E-Books or Electronic contents without affording more amount during lost stages. Finally at the end of our research, we construct theoretical and practical simulation models for analyzing the proposed caching strategies in the presence of selfish users along with several end consumers that deviate from network-wide cost-optimal policies.

Keywords

Online Social Network, Cooperative Caching, Content Provisioning Cost, Social Networks.

1. Introduction

Wireless Sensor Networks [1], [2] have rapidly increased its attention from many users during the last decade due to the advances in low-power hardware and the development of appropriate software. A wireless network mainly consists of wirelessly interconnected, that can also interact with their surrounding environment by controlling and sensing ‘‘physical’’ parameters These networks have covered maximum with a huge number of applications, such as environment control and machine surveillance, target tracking in battlefields, and so on. In today’s mobile ecosystems, there was a huge demand with the emergence of these data enabled mobile devices and wireless-enabled based data applications. Some of the best WSN categories includes Apple’s iPhone, Google’s Android, Amazon’s Kindle, and electronic book readers from several other vendors.

By using conventional download model for downloading content by any mobile vendor , a user who wish to download the data from the Service Provider, download's contents directly from a Content Provider's (CPS) Server over a wide Communication Service Provider's (CSP) network. For the first time, CSP will involve a very initial action for the first time data download by taking a small amount of cost for each and every download based on the category of product what he have chosen. This amount may be collected either from the end users directly who wish for that data to be downloaded or sometimes it may charge by content providers who need that initial data from CSP's. To find out this research problem and to find how it works with CSP, we adopted Amazon Kindle E-Book delivery business model in which the Content Provider like (Amazon, Apple), pays to Sprint, who is the CSP, for the cost of network usage based on the downloaded content size each and every Kindle users who wish to download the E-Books for the first time.

Social Wireless Networks (SWNTs) can majorly be formed as a physical setting using ad hoc wireless connections between the mobile devices which is carried by users physically for the places like University campus, work premises, Shopping Mall, Airport, Railway Stations, Hospitals and other public places. Due to the existence of such SWNTs, an alternative approach to content access by a mobile device would be as follows: Initially search the local SWNT for the requested content before downloading it from the Content Provider's server. By doing in this way, the expected content provisioning cost of such an approach can be gradually decreased, since the download cost to the CSP would be avoided when the content is found within the local SWNT. This mechanism is termed as **cooperative caching**.

1.1 Selfish Users

Selfish users are one among the several users who always try to earn more and more money by deviating the network wide optimal policies. Any such deviation by selfish users is always expected to incur higher network-wide provisioning cost[3]. In this current research work, we mainly try to analyze the impacts of such a selfish behavior users on object provisioning cost and the earned rebate within the context of an SWNT. In other words, we can also tell that, when the selfish node population is beyond a certain critical point, selfish behavior ceases to produce more benefit from a rebate standpoint.

1.2 Our Project Contributions

By considering all the assumptions what we have discussed till now, we will try to give following new project contributions for our proposed model.

- First, a new stochastic model for the CP's cost computation is developed based on a practical service and pricing case what we observed.
- Second, a cooperative caching strategy and a Split Cache are proposed, based on networks with homogenous content demands.
- Third, Distributed Benefit based new strategy, is proposed to minimize the provisioning cost in heterogeneous networks.
- Fourth, the impacts of user selfishness on object provisioning cost and earned rebate is analyzed.

Finally, numerical results for all the above strategies are validated using simulation and compared with a series of traditional caching policies and finally in our conclusion we will try to draw a graph for those comparisons based on the technology what we choose for implementing this paper.

2. Background Work

This section mainly deals with network services and pricing model that was used for our proposed model. In this section we will mainly discuss the background work that is processed for developing this application.

2.1 SWNT Network Model

Figure. 1 clearly illustrates an example of Social Wireless Network within a local University campus. End Consumers carrying mobile devices form SWNT partitions, which can be either multi-hop (i.e., MANET) as shown for partitions 1, 3, and 4, or single hop access point based as shown for partition 2. A user mobile device can download an object (i.e., content) from the CP's server using the CSP's cellular network, or from its local SWNT partition.

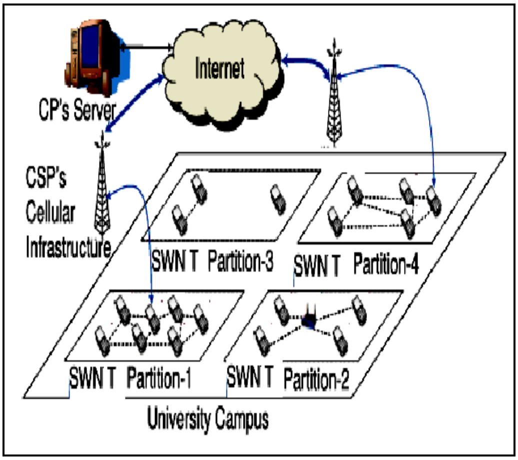


Figure. 1. Content access from an SWNT in a local University Campus.

SWNTs are mainly divided of two types. The first one involves mainly on stationary [5] SWNT partitions. Which means, after a partition is formed, it is maintained for sufficiently long so that the cooperative object caches can be formed and reach steady states. To investigate this effect, caching technique is applied to SWNTs formed using human interaction traces obtained from a set of real SWNT nodes [6].

2.2 Pricing Model

We use a pricing model in assumption similar to the Amazon Kindle business model in which the Content Provider (e.g., Amazon) pays a download cost C_d to the CSP when an End-Consumer downloads an object from the CP's server through the CSP's cellular network not from the local cache [7]. Also, the pricing model is applied whenever an EC provides a locally cached object to another EC within its local SWNT partition, the provider EC is paid a rebate C_r by the CP. Optionally, this paid rebate can also be distributed among the provider EC and the ECs of all the intermediate mobile devices that take part in content forwarding.

Fig. 2 clearly demonstrates the cost and content flow model. As it is shown in Fig. 2, Cd corresponds to the CP's object delivering cost when it is delivered through the CSP's network, and C_r corresponds to the rebate given out to an EC when the object is found within the SWNT (e.g., node A receives rebate C_r after it provides a content to node B over the SWNT). For a given $C_r = C_d$ ratio, the paper aims to develop optimal object placement policies that can minimize the network-wide content provisioning cost.

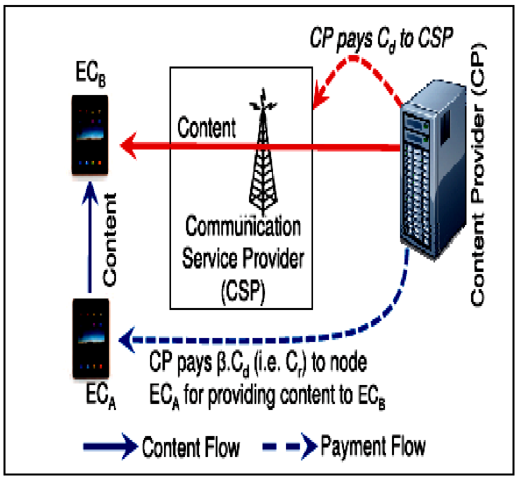


Figure. 2. Content and Cost Flow Model.

3. Proposed Tree Optimization Technique

In this section, we initially consider the sub problem of finding the optimal positions of relay nodes for a routing tree given assuming that the topology is fixed. We assume the topology is a directed tree in which the leaves are nothing but sources and the root nothing but as the sink. We also assume that separate messages cannot be compressed or merged, that is, suppose if two distinct messages of lengths m_1 and m_2 use the same sink node (s_i, s_j) on the path from a source node or leaves to a sink node , the total number of bits that must traverse link (s_i, s_j) is $m_1 + m_2$

```
procedure OPTIMALPOSITIONS(U^0)
    converged ← false;
    j ← 0;
    repeat
        anymove ← false;
        j ← j + 1;
        ▷ Start an even iteration followed by an odd iteration
        for idx = 2 to 3 do
            for i = idx to n by 2 do
                (u_i^j, moved) ← LOCALPOS(o_i, S(s_i), s_i^d);
                anymove ← anymove OR moved
            end for
        end for
        converged ← NOT anymove
    until converged
end procedure
```

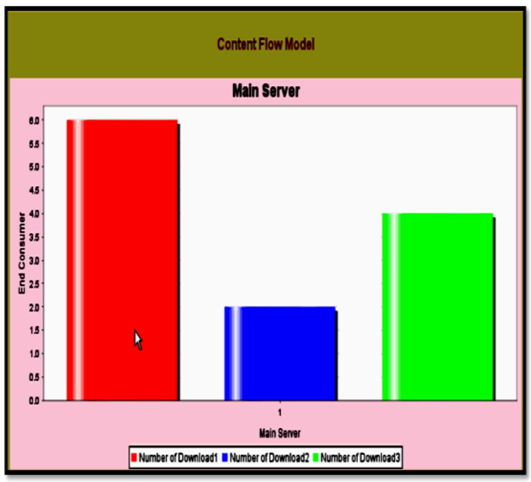
Fig.3. Centralized algorithm to compute the optimal positions in a given tree

Our above algorithm in figure 3, starts by an odd/even labeling step followed by a weighting step. To obtain very best consistent labels for nodes, we start the labeling process from the root using a breadth first traversal of the tree. The root gets labeled as even. Each of its children gets labeled as odd. Each subsequent child is then given the opposite label of its parent. We define m_i , the weight of a node s_i , to be the sum of message lengths over all paths passing through s_i. This computation starts from the sources or leaves of our routing tree. Initially, we know $m_i = M_i$, for each source leaf node s_i. For each intermediate node s_i, we compute its weight as the sum of the weights of its children.

4. Experimental Results

In this section we will show the experimental results what we have observed by implementing the proposed techniques in this paper. For obtaining these results we have used Java as programming language for implementing this proposed new cooperative caching technique. The following are the results what we obtain after implementing the algorithm. As users try to download the data from both Content Providers and Content Service Providers, we get the following chart obtained from Admin point of view.

Content Flow Model Window



In the above window, we will find out the content flow model graph between End Consumers and Main server through which number of downloads takes place.

5. Conclusion

In this paper, we proposed a very new approach to minimize the total energy consumed by both mobility of relay nodes and wireless transmissions. Our proposed new approach improves the initial configuration of our nodes using two iterative schemes. The first scheme inserts new nodes into the tree. The second scheme computes the optimal positions of relay nodes in the tree given a fixed topology. This algorithm is appropriate mainly for a variety of data-intensive wireless sensor networks.Our simulation results tell that our proposed method is substantially reduces the energy consumption by up to 43%.

6. References

[1] Akyildiz, I., Su, W., Sankarasubramaniam, Y., & Cayirci, E. (2002). A survey on sensor networks. IEEE Communications magazine, 40(8), 102–114.

[2] Karl, H., & Willig, A. (2006). Protocols and architectures for wireless sensor networks. New York: Wiley.

[3] M. Taghizadeh, A. Plummer, A. Aqel, and S. Biswas, "Optimal Cooperative Caching in Social Wireless Networks," Proc. IEEE Global Telecomm. Conf. (GlobeCom), 2010.

[4] S. Banerjee and S. Karforma, "A Prototype Design for DRM Based Credit Card Transaction in E-Commerce," Ubiquity, vol. 2008,2008.

[5] M. Zhao, L. Mason, and W. Wang, "Empirical Study on Human Mobility for Mobile Wireless Networks," Proc. IEEE Military Comm. Conf. (MILCOM), 2008.

[6] "Cambridge Trace File, Human Interaction Study,"http:// www.crawdad.org/download/cambridge/haggle/Exp6.tar.gz, 2012.

[7] E. Cohen, B. Krishnamurthy, and J. Rexford, "Evaluating Server- Assisted Cache Replacement in the Web," Proc. Sixth Ann. European Symp. Algorithms, pp. 307-319, 1998.

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