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A Cost Preserving Cooperative Caching in Social Wireless Networks

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***Abstract*— This paper introduces cost preserving cooperative caching policies for minimizing electronic content provisioning cost in Social Wireless Networks (SWNET). SWNETs are formed by mobile devices, such as data enabled phones, electronic book readers etc., sharing common interests in electronic content, and physically gathering together in public places. Electronic object caching in such SWNETs are shown to be able to reduce the content provisioning cost which depends heavily on the service and pricing responsibilities among various contributers including content providers (CP), network service providers, and End Consumers (EC). Based on the concept of Amazon's Kindle e- book delivery business, we have developed practical network, service, and pricing models which are then used for creating two object caching strategies for minimizing content provisioning costs in networks with similar and diverse object demands. The paper constructs analytical and simulation models for analyzing the proposed caching strategies in the presence of selfish users that deviate from network-wide cost-optimal policies. It also reports results from an Android phone based prototype SWNET, validating the presented analytical and simulation results.**

Keywords*—Social Wireless Networks, cooperative caching, content provisioning, ad hoc networks.*

I. INTRODUCTION

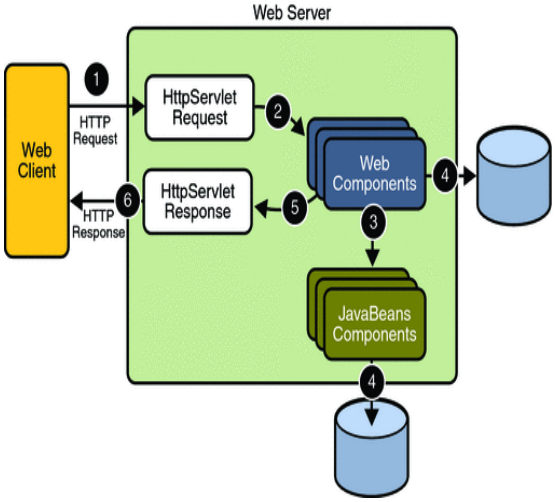
This paper introduces cooperative caching policies for minimizing electronic content provisioning cost in Social Wireless Networks (SWNET). SWNETs are formed by mobile devices, such as data enabled phones, electronic book readers etc., sharing common interests in electronic content, and physically gathering together in public places. Electronic object caching in such SWNETs are shown to be able to reduce the content provisioning cost which depends heavily on the service and pricing dependences among various stakeholders including content providers (CP), network service providers, and End Consumers (EC). Based on the concept of Amazon's
Kindle e-book delivery business, this paper develops practical 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. The paper constructs analytical and simulation models for analyzing the proposed caching strategies in the presence of selfish users that deviate from network-wide cost-optimal policies. It also reports results from an Android phone based prototype SWNET, validating the presented analytical and simulation results.

II. Existing system

With the existence of such SWNETs, an alternative approach to content access by a device would be to first search the local SWNET for the requested content before downloading it from the CP's server. The expected content provisioning cost of such an approach can be significantly lower since the download cost to the CSP would be avoided when the content is found within the local SWNET. This mechanism is termed as cooperative caching. In order to encourage the End-Consumers (EC) to cache previously downloaded content

and to share it with other end-consumers, a peer-to-peer rebate mechanism is proposed. This mechanism can serve as an incentive so that the end-consumers are enticed to participate in cooperative content caching in spite of the storage and energy costs. In order for cooperative caching to provide cost benefits, this peer-to-peer rebate must be dimensioned to be smaller than the content download cost paid to the CSP. This rebate should be factored in the content provider's overall cost. Due to their limited storage, the main server speed could become slow. This means after downloading and using a content, a content to be stored in local cache.

Architecture Diagram:



III. Proposed System

An electronic book system which consist of text, images or both is used in Amazon's Kindle electronic book delivery business, Based on this concept in this paper we have developed three models. The the three models are practical network, service, and pricing models. Based on these models we have developed two object caching strategies for controlling content providing costs in networks with homogenous and heterogeneous object requirements. The paper creates accurate and replica models for analyzing the proposed caching strategies in the presence of selfish users that deviate from network-wide cost-optimal policies. Based on a practical service and pricing mode, a presumptive model for the content provider's cost computation is developed. A cooperative caching strategy, Split Cache, is derived, numerically studied, and theoretically proven to provide optimal object placement for networks with similar type of content demands. A benefit-based strategy, Distributed Benefit, is proposed to reduce the provisioning cost in different networks consisting of nodes with different content request rates and patterns.

IV. IMPLEMENTATION MODULES

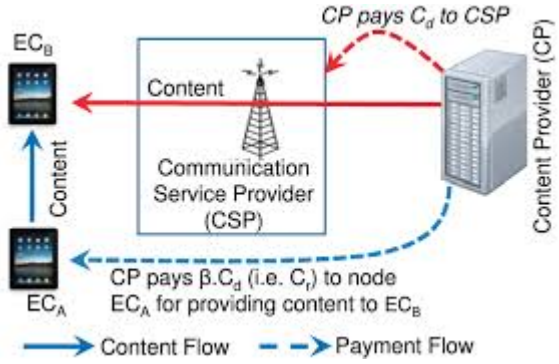
1. Network Model
2. Search Model
3. Pricing Model

Network Model:

We have created two ways of Social Wireless Networks(SWNETs). The first one is stationary SWNET partitions. That is after creation of partition, it is maintained for efficient time so that the Cooperative object caches can be formed and can reach steady states. We also examine over the second type to look into what happens when the stationary assumption is relaxed. To examine on these conditions, caching is applied to SWNETs maintained using human interaction traces formed from a set of actual Social wireless networks nodes.

Search Model:
In this model we try to find out the file means, we first search it in the local cache. If we fail to find it in local cache than it search the object within its SWNET partition by the help of limited broadcost message. If the search fails to find the file in partition also than the object is downloaded from the content providers(CP's) server. Here we have modeled objects such as e-books,files etc., which are time non changing, and therefore cache consistency is not a big issue. If the object is most frequently searched than we will assign a popularity-tag for that object which indicates its universal popularity. It will also indicates the probability that an arbitrary request in the network is formed forthis particular object.

Pricing Model:
The pricing model which we use here have similarities with the Amazon Kindle business model. In this model the content provider pays to the service providers when the EC gets the file or object from the CP's server from the service providers network. At the same time the object is stored in the local cache. Whenever a new user wants to get the similar object it will be provided to the EC from local SWNET cache. At that time the provider EC of object will get a rebate from the CP. Actually this rebate will be shared between all the ECs whose mobile devices are used in the process of content forwarding between the SWNET. The original selling price of the object is paid to the CP by an end consumer through a secure payment process. We need a digitally signed rebate framework so that the rebate recipient ECs can validate securely and get the rebate from CP.



V. CONCLUSION

The main objective of this work was to develop a cost preserving cooperative caching strategy for providing with less cost in Social Wireless Networks. The main goal is to is to develop the perfect cooperative caching for providing lower cost where the presence of similar content requirements is in higher demands. It will also remove redundancy in object storing and will provide object security. It will require ideal split among object duplication and uniqueness. Such a split replacement policy was proposed and evaluated using ns2 simulation and on an experimental test bed of seven android mobile phones. Apart from these, we practically (using simulation) and systematically estimated the algorithm's execution in the presence of selfish users. It was proven that selfishness can increase user rebate from CP only when the number of selfish nodes in a social network is not more than a critical number. It was shown that with diverse requests, a benefit based heuristics strategy provides good results when compared to split cache which is proposed mainly for similar kind of object demand.
Ongoing work on this topic includes the evolution of an powerful algorithm for the diverse object request demand conditions, with the aim of narrowing the execution gap between the Benefit Based heuristics and the centralized greedy mechanism. Removal of the no-collusion assumption for user selfishness is also being worked on.

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