

Distributed Cooperative Caching in Social Wireless Networks

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Abstract: *Social wireless networks are the networks in which the nodes are splits in a wireless network for an effective communication. Social wireless networks are common in mobile devices such as data-enabled phones and in some other mobile devices. These are used to share common interests such as to share the electronic content in networks. Electronic object caching in such networks will be reduce the content provisioning cost which depends heavily on service and pricing dependencies among content providers, network service providers and end consumers. In this paper the cooperative caching policies have been proposed to reduce the content provisioning cost in Social Wireless Networks. It also develops network, service and pricing models. They are used for creating two cooperative caching strategies. These strategies are used for minimizing the content provisioning cost in networks with homogenous and heterogeneous object demands. In this project the analytical and simulation models have been proposed in-order to check the performance of the proposed caching strategies.*

Keywords: Wireless Network, Content Provider

1. Introduction

Recent actualization of abstracts enabled adaptable accessories and wireless-enabled abstracts applications accept fostered new content broadcasting models in today's adaptable ecosystem. A account of such accessories includes Apple iphone, Google Android, Amazon Kindle, and cyber banking book readers from added vendors. The arrangement of abstracts applications includes electronic book and annual readers and adaptable phone Apps. The akin of admeasurements of adaptable applications is indicated by the archetype actuality that as of October 2010, Apples App Abundance offered over 100,000 apps that are downloadable by the acute buzz users. With the accepted download model, a user downloads contents anon from a Content Providers (CP) server over a Communication Service Providers (CSP) network. Downloading agreeable through CSPs network involves a amount which have to be paid either by end users or by the agreeable provider. In this work, we accept Amazon Kindle cyber banking book supply business archetypal in which the CP (Amazon), pays to Sprint, the CSP, for the amount of network acceptance due to downloaded e-books by Kindle users. When users accustomed adaptable accessories physically accumulate in settings such as University campus, plan place, Mall, Airport and added accessible places, Social Wireless Networks (SWNETs) can be formed application ad hoc wireless connections between the devices. With the actuality of such SWNETs, an alternative admission to agreeable admission by a accessory would be to aboriginal seek the bounded SWNET for the requested content before downloading it from the CPs server. The expected content accessories amount of such an admission can be significantly lower back the download amount to the CSP would be abhorred if the agreeable is begin aural the local SWNET. This apparatus is termed as accommodating caching. In adjustment to animate the End-Consumers (EC) to cache previously downloaded agreeable and to

allotment it with other end-consumers, a peer-to-peer abatement apparatus is proposed. This apparatus can serve as an allurement so that the end-consumers are absorbed to participate in cooperative content caching in animosity of the accumulator and activity costs. In order for accommodating caching to accommodate amount benefits, this peer-to-peer abatement have to be dimensioned to be abate than the agreeable download amount paid to the CSP. This rebate should be factored in the agreeable providers all-embracing cost. Due to their bound storage, adaptable handheld accessories are not accepted to abundance all downloaded agreeable for long. This means afterwards downloading and application a purchased electronic content, a accessory may abolish it from the storage. For example in Amazon Kindle audience (iPhone, iPad, etc.) an archive approach is accessible application which a user simply removes a book afterwards account it, although it charcoal archived as a purchased account in Amazons billow server.

2. Optimal Solution

For capacity with capricious akin of popularity, a greedy approach for anniversary bulge would be to abundance as abounding distinctly popular capacity as its accumulator allows. This approach amounts to noncooperation and can accord acceleration to heavy network-wide agreeable duplications. In the added extreme case, which is absolutely cooperative, a bulge would try to maximize the absolute bulk of altered capacity stored within the SWNET by alienated duplications. In this paper, we show that none of the aloft acute approaches can minimize the agreeable providers cost. We as well appearance that for a accustomed rebate-to-download-cost ratio, there exists an object adjustment action which is about in between those two extremes, and can abbreviate the agreeable providers cost by arresting a antithesis amid the avidity and full cooperation [26]. This is referred to as optimal article adjustment action in the rest of this paper. The proposed

accommodating caching algorithms strive to attain this optimal article adjustment with the ambition of aspersing the network-wide agreeable provisioning cost.

User Selfishness

The abeyant for earning peer-to-peer abatement may promote selfish behavior in some users. A egocentric user is one that deviates from the network-wide optimal action in adjustment to earn added rebates. Any aberration from the optimal action is expected to acquire college network-wide accessories cost. In this work, we assay the impacts of such egocentric behavior on article accessories bulk and the becoming abatement aural the context of an SWNET. It is apparent that above a threshold selfish bulge population, the bulk of per-node abatement for the egocentric users is lower than that for the non-selfish users. In added words, if the egocentric bulge citizenry is beyond a analytical point, egocentric behavior ceases to aftermath more benefit from a abatement standpoint.

3. Network, Search and Pricing Models

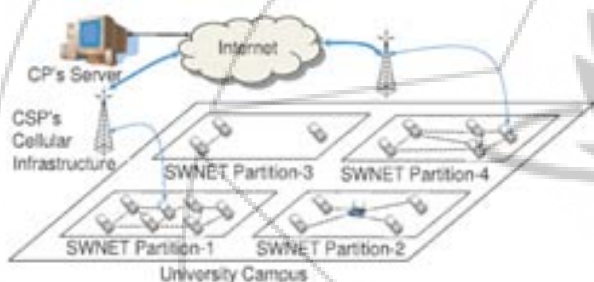


Figure 1: Content access from an SWNET in a University Campus

Network Model

Fig. 1 illustrates an archetype SWNET aural a University campus. End Consumers accustomed adaptable accessories form SWNET partitions, which can be either multi-hop (i.e., MANET) as apparent for partitions 1, 3, and 4, or individual hop access point based as apparent for allotment A adaptable device can download an article (i.e., content) from the CPs server using the CSPs cellular network, or from its bounded SWNET partition. In the blow of this paper, the agreement article and content are acclimated synonymously. We accede two types of SWNETs. The aboriginal one involves stationary [1] SWNET partitions. Meaning, afterwards a partition is formed, it is maintained for abundantly continued so that the cooperative article caches can be formed and ability steady states. We as well investigate an additional blazon to analyze as to what happens if the anchored acceptance is relaxed. To investigate this effect, caching is activated to SWNETs formed application animal alternation traces acquired from a set of absolute SWNET nodes [2].

Search Model

After an article appeal is originated by a adaptable device, it first searches its bounded cache. If the bounded seek fails, it searches the article aural its SWNET allotment

application limited broadcast message. If the seek in allotment as well fails, the object is downloaded from the CPs server application the CSPs 3G/4G cellular network. In this paper, we accept modeled objects such as cyber banking books, music, etc., which are time non-varying, and accordingly accumulation bend ability is not a critical issue. We aboriginal accept that all altar accept the aforementioned size and anniversary bulge is able to store in its cache. Later, in Section 5.3, we relax this acceptance to support altar with capricious size. We as well accept that all objects are popularity-tagged by the CPs server [3]. The popularity-tag of an article indicates its all-around popularity; it also indicates the anticipation that an approximate appeal in the network is generated for this specific object.

Pricing Model

We use an appraisal archetypal agnate to the Amazon Kindle business archetypal in which the CP (e.g., Amazon) pays a download bulk C_d to the CSP if an End-Consumer downloads an article from the CPs server through the CSPs cellular network. Also, whenever an EC provides a locally cached article to addition EC aural its bounded SWNET partition, the provider EC is paid a abatement C_r by the CP. Optionally, this abatement can as well be broadcast a allotment of the provider EC and the ECs of all the average mobile devices that yield allotment in agreeable forwarding. Fig. 2 demonstrates the bulk and agreeable breeze model. As it is shown in Fig. 2, C_d corresponds to the CPs article delivering cost if it is delivered through the CSPs network, and C_r corresponds to the abatement accustomed out to an EC if the object is begin aural the SWNET (e.g., bulge A receives rebate C_r afterwards it provides a agreeable to bulge B over the SWNET). For a accustomed $C_r=C_d$ ratio, the cardboard aims to develop optimal article adjustment behavior that can abbreviate the network-wide agreeable accessories cost. Note that these bulk items, namely, C_d and C_r , do not represent the affairs amount of an article (e.g., e-book). The selling amount is anon paid to the CP (e.g., Amazon) by an EC.

4. Caching for Optimal Object Placement

Split Cache Replacement

To apprehend the optimal article adjustment beneath homogeneous object appeal archetypal we adduce the afterward Split Cache action in which the accessible accumulation amplitude in each device is disconnected into a alike articulation (fraction) and a unique articulation (see Fig. 3). In the aboriginal segment, nodes can store the lot of accepted altar afterwards annoying about the object duplication and in the additional articulation alone unique objects are accustomed to be stored. The constant in Fig. 3 (0 1) indicates the atom of accumulation that is acclimated for storing bifold objects. With the Split Accumulation backup policy, anon afterwards an object is downloaded from the CPs server, it is categorized as a different article as there is alone one archetype of this article in the network. Also, if a bulge downloads an article from another SWNET node, that article is categorized as a

duplicate article as there are now at atomic two copies of that object in the network. For autumn a new different object, the atomic accepted article in the accomplished accumulation is called as a applicant and it is replaced with the new article if it is beneath accepted than the new incoming object. For a bifold object, however, the evictee candidate is called alone from the aboriginal alike segment of the cache. In added words, a different article is never evicted in adjustment to board a bifold object.

Caching under Heterogeneous Requests

The split caching policy is used to minimize the provisioning cost for non homogeneous requests where nodes have different request rates and patterns. The benefit based heuristics approach is used to minimize the object provisioning cost. The average provisioning cost is

$$Cost_i = \left(\beta \sum_{j \in (S-S_i)} p_i^j + \left(1 - \sum_{j \in S} p_i^j \right) \right) C_d.$$

5. Conclusion

The object of the project is to develop a cooperative caching strategies in-order to reduce the content provisioning cost. Finally it is shown that the best cooperative caching strategy for reduction in provisioning cost in networks with homogenous demands requires an partition between object duplication and individuality. At last with heterogeneous requests the benefit based heuristics provides a better performance when compared to split cache in homogeneous demands and at last the efficient algorithm has been proposed for the heterogeneous scenario and with an idea of filling the gap between benefit based heuristics and centralized greedy mechanism which has been proven for optimal removal of collision.

6. References

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