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CONTENT CACHING AND SCHEDULING IN WIRELESS NETWORKS WITH ELASTIC AND INELASTIC TRAFFIC

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ABSTRACT

The rapid growth of wireless content access implies the need for content placement and scheduling at wireless base stations. We study a system under which users are divided into clusters based on their channel conditions, and their requests are represented by different queues at logical front ends. Requests might be elastic (implying no hard delay constraint) or inelastic (requiring that a delay target be met). Correspondingly, we have request queues that indicate the number of elastic requests, and deficit queues that indicate the deficit in inelastic service. Caches are of finite size and can be refreshed periodically from a media vault. We consider two cost models that correspond to inelastic requests for streaming stored content and real-time streaming of events, respectively. We design provably optimal policies that stabilize the request queues (hence ensuring finite delays) and reduce average deficit to zero [hence ensuring that the quality-of-service (QoS) target is met] at small cost. We illustrate our approach through simulations.

1. INTRODUCTION

From the last 2 to 3 decades there is a huge growth in usage of hand held devices. These devices maybe electrical or electronics and some are called as smart devices. In the current generation usage of smart devices has been grown vastly. These devices are using different resource in achieving their functionality. While working all these devices will work under the constraints which includes hard and soft constraints. For example if we take streaming applications in which chunks of the file must be received under hard delay constraints, as well as file downloads such as software updates that do not have such hard constraints. Since the core of the Internet is far less bandwidth constrained than access wireless networks, a natural location to implement a content distribution network (CDN) would be at the wireless gateway, which could be a cellular base-station through which users obtain network access. Broadcasting the information to the multiple clients simultaneously is one of the natures further, it is natural to try to take advantage of the inherent broadcast nature of the wireless medium to satisfy multiple clients simultaneously.

Every network will be having the base station where the data will be storing in the cache of each station. These caches are periodically refreshed by accessing the media vault. All the nodes are divided into the clusters which are geographically nearer to each other. The front end will be run on any of the device and the requests which are posed will be under tracking by the system. This paper mainly concentrating on the issues like joint content placement and the problems of scheduling the traffic for both elastic and inelastic wireless networks.

2. STUDY OF EXISTING SYSTEM

The past few years have seen the rise of smart handheld wireless devices as a means of content consumption. Content might include streaming applications in which chunks of the file must be received under hard delay constraints, as well as file downloads such as software updates that do not have such hard constraints. The core of the Internet is well provisioned, and network capacity constraints for content delivery are at the media vault (where content originates) and at the wireless access links at end-users. Hence, a natural location to place caches for a content distribution network (CDN) would be at the wireless gateway, which could be a cellular base station through which users obtain network access. Furthermore, it is natural to try to take advantage of the inherent broadcast nature of the wireless medium to satisfy multiple users simultaneously. There are multiple cellular base stations (BSs), each of which has a cache in which to store content.

The content of the caches can be periodically refreshed through accessing a media vault. We divide users into different clusters, with the idea that all users in each cluster are geographically close such that they have statistically similar channel conditions and are able to access the same base stations. Note that multiple clusters could be present in the same cell based on the dissimilarity of their channel conditions to different base stations. The requests made by each cluster are aggregated at a logical entity that we call a front end (FE) associated with that cluster.

DISADVANTAGES OF EXISTING SYSTEM: The wireless network between the caches to the users has finite capacity.

Refreshing content in the caches from the media vault incurs a cost.

3. PROPOSED SYSTEM ELASTIC AND INELASTIC TRAFFIC

In this paper, we develop algorithms for content distribution with elastic and inelastic requests. We use a request queue to implicitly determine the popularity of elastic content. Similarly, the deficit queue determines the necessary service for inelastic requests. Content may be refreshed periodically at caches. We study two different kinds of cost models, each of which is appropriate for a different content distribution scenario. The first is the case of file distribution (elastic) along with streaming of stored content (inelastic), where we model cost in terms of the frequency with which caches are refreshed. The second is the case of streaming of content that is generated in real-time, where content expires after a certain time, and the cost of placement of each packet in the cache is considered.

ADVANTAGES OF PROPOSED SYSTEM: It stabilizes the system load within the capacity region.

Minimizes the average expected cost while stabilizing the deficit queues.

4. EXPERIMENTAL RESULTS

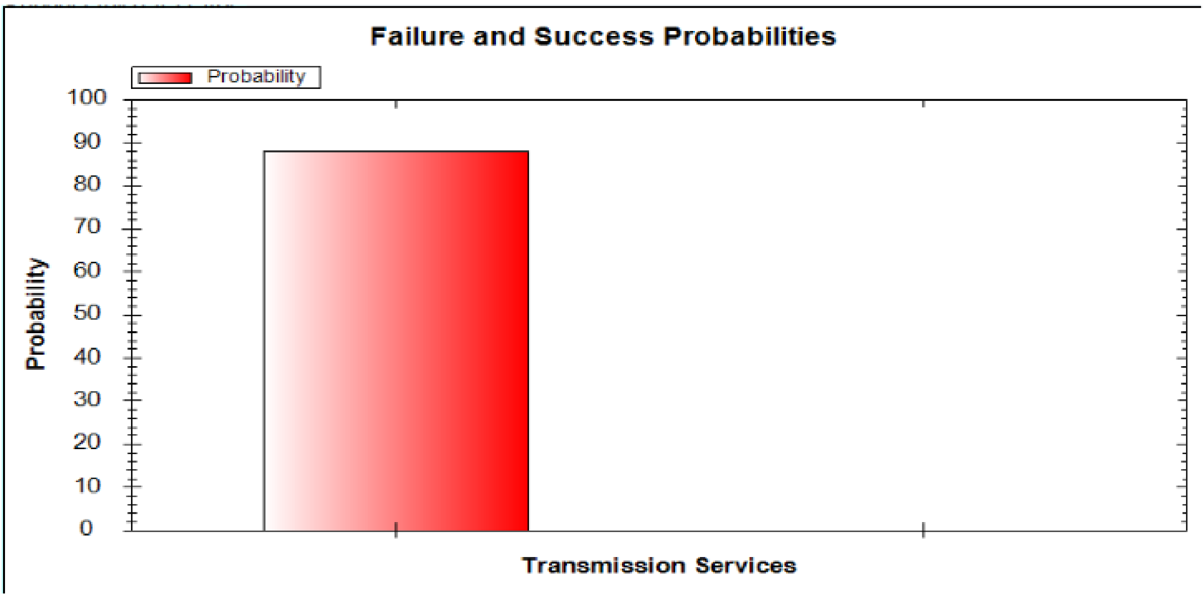
Creating System Model:

- ✓ In this module, we create the System model, with Socket programming technique
- ✓ Create Wireless Nodes (Base Stations) with Cache
- ✓ Media Vault
- ✓ There are multiple cellular *base stations* (BSs), each of which has a cache in which to store content.

- ✓ Users can make two kinds of requests, namely: 1) elastic requests that have no delay constraints, and 2) inelastic requests that have a hard delay constraint.

Content Caching System Module:

- ✓ In this module we design Scheduling methodology that is what is to be broadcasted from caches. In this module we also develop Content caching methodology, which is what to be loaded in caches.
- ✓ The content of the caches can be periodically refreshed through accessing a *media vault*. We divide users into different *clusters*, with the idea that all users in each cluster are geographically close such that they have statistically similar channel conditions and are able to access the same base stations. Note that multiple clusters could be present in the same cell based on the dissimilarity of their channel conditions to different base stations. The requests made by each cluster are aggregated at a logical entity that we call a *front end* (FE) associated with that cluster. The front end could be running on any of the devices in the cluster or at a base station, and its purpose is to keep track of the requests associated with the users of that cluster.



	Packet Success Rate	
	Elastic Traffic (in Sec)	Inelastic Traffic (in Sec)
Energy Level Consumption	61.938	974.025
	61.5109	974.596
	61.441	974.478
	61.31	974.342
	61.128	974.179
	61.847	974.065
	499.5	974.944
	499.542	300.699
	499.473	300.767
	499.208	300.893

Elastic Traffic Module:

- ✓ In this module, we develop elastic traffic module, where there should be No delay constraint.
- ✓ Stored in Request Queues at frontends.
- ✓ Elastic requests are stored in a *request queue* at each front end, with each type of request occupying a particular queue. Here, the objective is to stabilize the queue, so as to have finite delays.

Inelastic Traffic Module:

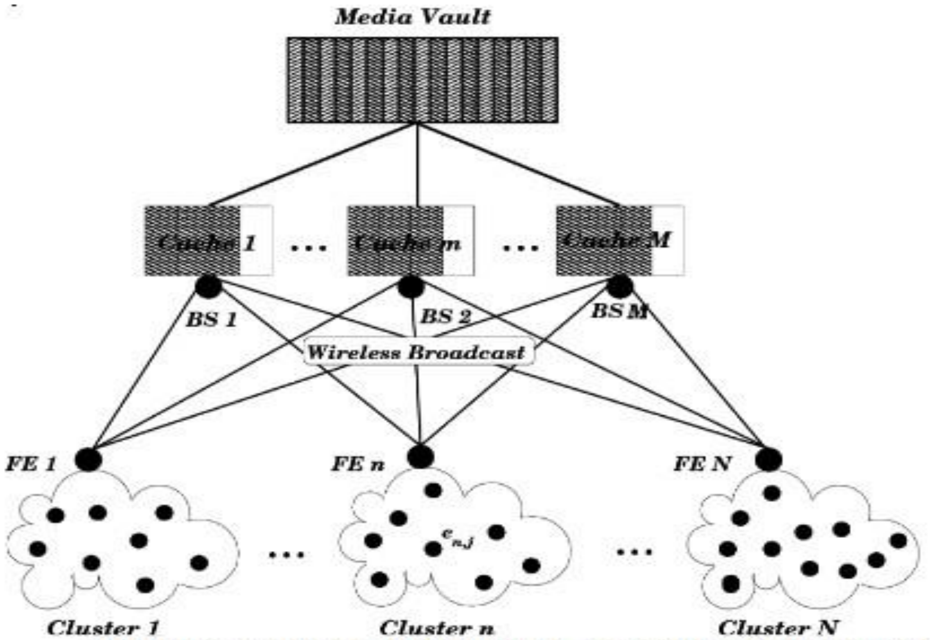
- ✓ In this module, we develop Inelastic traffic module for Hard Delay Constraint.
- ✓ Drop if not served by the deadline.
- ✓ Need a minimum delivery ratio.
- ✓ For inelastic requests, we adopt the model proposed wherein users request chunks of content that have a strict deadline, and the request is dropped if the deadline cannot be met.

Joint elastic-inelastic scenario

In this section, we study the general case where elastic and inelastic requests coexist in the system. Recall that the elastic requests are assumed to be served through unicast communications between the caches and front ends, while the base stations broadcast the inelastic contents to the inelastic users. We further assumed servers can employ OFDMA method to simultaneously transmit over their single broadcast and multiple unicast channels. Although these two types of traffic do not share the access medium, all the content must share the common space in the caches. Consequently, we require an algorithm that jointly solves the elastic and inelastic scheduling problems. In this section, we first determine the general capacity region of the system, and then present our algorithm.

5. SYSTEM MODEL:

In this paper, we are keen on comprehending the joint substance arrangement and planning issue for both flexible and inelastic activity in remote systems. In doing along these lines, we will likewise focus the estimation of anticipating the interest for diverse sorts of substance and what sway it has on the configuration of reserving algorithms. We utilize a solicitation line to verifiably focus the prevalence of versatile content. It gives Energy productivity nodes. Minimum cost. The base stations utilize numerous entrance plans (e.g., OFDMA), and thus every base station can bolster numerous synchronous unicast transmissions, and additionally a solitary telecast transmission. It is likewise conceivable to study other situations (e.g., multicast transmissions to subsets of clients) utilizing our system. We receive a moderate blurring bundle eradication model for the remote channels. As needs be, the channel between cache and client u (or front end n) is displayed as a stochastic We expect that all pieces of content have the same size, and we call the unit of storage and transmission as a lump. At the point when a channel is ON, it can be used to transmitter most one lump (every opening). Substance is apportioned into two disjoint arrangements of inelastic content I and flexible substance E. We mean the set of inelastic users by u 2 U. toward the starting of every edge k, every inelastic user u makes at most one appeal au (k) 2 {0, 1}.



Wireless content distribution a media vault is used to place content in caches at wireless BSs, which can broadcast content. Users are grouped into clusters, each of whose requirements are aggregated at FEs.

The idea is that an inelastic appeal must either be fulfilled by the end of the casing, or dropped. Inelastic solicitations are served using broadcast transmissions. In this paper, we accept there are just demands for elastic substance. As noted in the keep going area, these solicitations are to be served utilizing unicast interchanges. For notational comfort, we accept that transmissions are between base stations and front closures, instead of to the real clients making the demands. We first focus the limit area, which is the situated of all possible demands.

CONCLUSION

In this paper, we studied algorithms for content placement and scheduling in wireless broadcast networks. While there has been significant work on content caching algorithms, there is much less on the interaction of caching and networks. Converting the caching and load balancing problem into one of queueing and scheduling is hence interesting. We considered a system in which both inelastic and elastic requests coexist. Our objective was to stabilize the system in terms of finite queue lengths for elastic traffic and zero average deficit value for the inelastic traffic. We showed how an algorithm that jointly performs scheduling and placement in such a way that Lyapunov drift is minimized is capable of stabilizing the system. In designing these schemes, we showed that knowledge of the arrival process is of limited value to taking content placement decisions. We incorporated the cost of loading caches in our problem with considering two different models. In the first model, cost corresponds to refreshing the caches with unit periodicity. In the second model relating to inelastic caching with expiry, we directly assumed a unit cost for replacing each content after expiration. A max-weight-type policy was suggested for this model, which can stabilize the deficit queues and achieves an average cost that is arbitrarily close to the minimum cost.

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