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Game-Theoretic Pricing for Streaming Videos in Mobile Networks

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Abstract: The main aim of project is to develop an application that prevents the unauthorized user to access the video content. It provides functionality that each registered user will access the video content by paying some amount and unregistered user not able to see this video. For this purpose, each user is provided a login account with login ID and password access.

Keywords: Video-Stream Redistribution Game, Equilibrium Analysis, H.264/AVC video and AAC LC audio.

I. INTRODUCTION

The explosive advances of multimedia processing technologies are creating dramatic shift in ways that video content is rendered to and consumed by end users. Also, the increased popularity of wireless networks and mobile devices are drawing lots of attentions on ubiquitous multimedia access in the multimedia community in the past ten years. Network Service providers and researchers are focusing on developing efficient solutions to ubiquitous access of multimedia data, especially videos, from everywhere using mobile devices (laptops, personal digital assistants, or smart phone devices that can access 3G networks). Mobile phone users can watch video programs on their devices by subscribing to data plan from network service providers and they can easily use their programmable hand devices to retrieve and regenerate the video content. To accommodate heterogeneous network conditions and devices, scalable video coding is also widely used in mobile [1] video streaming. Video applications over mobile devices have drawn lots of attentions in the research community, like quality measure and error control. There is also a rich body of literature on user interactions in electronic commerce of wireless networks like cooperative content caching in wireless ad hoc network and secure transactions. Hence, it is important to understand end users' possible actions in order to provide better ubiquitous video accessing services.

According to a survey conducted on the popularity of mobile devices, almost every person has at least one mobile phone in developed countries, and video (visual) consumption over mobile devices is an emerging trend. With such a high popularity and the easy phone-to-phone communication technologies, it is very possible for data-plan subscriber to redistribute the [2] video content without authorization. For example, some users who do not subscribe to the data plan also may wish to watch television programs while in public transportation, and some of these might want to check news from time to time. Therefore, these users have incentives to buy the desired video content from other data subscribers if the price is lesser than the subscription price charged by the service provider. Unlike generic data the multimedia data can be easily extracted and modified, which enables the redistribution of video content. Also,subscribers also have incentives to redistribute content with price greater than their transmission cost, as long as such an action will not be identified by the content owner.

Due to the high mobility, time-sensitiveness, and small-transmission- range capabilities of mobile devices, each redistribution action only exists for a short period and is very hard to track. Consequently, a better way to prevent copyright infringement is to set a pricing mechanism such that subscriber will not have the incentive to redistribute the video.

Nevertheless, the mobile network service provider is more interested in setting the content price to maximize his/her own profit than protecting copyrights. The service provider's profit can be estimated as the total number of subscriptions times the content price. If the content price is more, mobile users have less incentive to subscribe to the data plan, which might result in less subscription.

However, on the other hand, the content price in the redistribution network may get higher due to less subscribers are there than secondary buyers. In such a case, although a subscriber pays more for the video stream, he/she also gets more compensation by redistributing the data(Videos). Therefore, setting the content price higher does not necessarily reduce the number of subscriptions, and it is not easy to find the best price that maximizes the service provider's utility.

The service providers, the data-plan (Internet) subscribers, and the secondary buyers who are interested in the video data interact with others and influence each other's decisions and performance. In such a scenario, this game theory is a mathematical tool for modeling and analyzing the strategic interactions among rational decision makers.

Recently, the game theory has got great attention in multimedia signal processing. We first model the user dynamics in the redistribution network as a multiplayer none of the cooperative game and obtain the equilibrium price from which all users have no incentives to deviate.

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Therefore, such an equilibrium price will serve as the upper bound for the price set by the network service provider for preventing copyright infringement. Due to the small coverage area and the limited power of each mobile device, one subscriber can only sell the content to secondary buyers within his/her transmission range, and the distance between users and the channel conditions influence users' decisions.

Then, we add the service provider as a player to game so as to analyze the optimal pricing for the service provider in the video streaming marketing network. But the mobile users can change their decisions on subscribing or presubscribing, the content owner is interested in the number of users/subscribers that is stable over the time. Therefore, a robust equilibrium solution is desired for the service provider. Therefore, we made the video streaming marketing phenomenon as an evolutionary game and derive the evolutionarily stable strategy for the mobile users, which is the desired stable equilibrium for the service provider.

II. LITERATURE SURVEY

A. Video-Stream Redistribution Game

Since the video-stream redistribution network is a dynamic system, in which all users will have high mobility and users can join and leave at any time, it is very difficult to control the user behavior by a central authority. But, since redistributing infringes copyrights, the users that are the subscribers and secondary buyers, have incentives to not trust any extra person (the central authority) to minimize their risk of being detected by the service provider.

Therefore, we propose a fully distributed Stackelburg-game-theoretical model to analyze how secondary buyer provide incentives to the subscribers to share the video stream, and what is the optimal price and quantity that the secondary buyers should provide. The ultimate aim of such analysis is to help the content owner, i.e. the service provider to fix the price such that the equilibrium of the game between subscribers and the secondary buyers leads to not positive payoff, which means the subscribers have no incentive to redistribute the video. We start the analysis by defining stages of the game and utility functions of both types of users in the network.

B. Equilibrium Analysis

The video-stream distribution game is with perfect information: the game is composed of two stages; the subscribers make decisions first, then followed by the secondary buyer. Since each subscriber's action is setting pi, and he/she has to enclose the price to the secondary buyer and then the secondary buyer knows each subscriber's strategy. As a result, each information set in this game containing only one node, which shows the video-stream redistribution game is with perfect information? According to backward induction, any game with perfect information has at least one equilibrium.

Therefore, the optimal strategies for the secondary buyer and subscribers exist and can be obtained by solving the optimal decision for each stage in the backward manner.

C. Existing System

In existing system mobile phones are among the most famous consumer devices, and the recent developments of 3G networks and smart phones enable users to watch video programs by subscribing data plans(internet) from service providers. Due to the ubiquity of mobile phones and phone-to-phone communication technologies, data-plan subscribers are able to redistribute the video content to nonsubscribers. Such a [4] redistribution staregies is a potential competitor for the mobile service provider and is very difficult to trace given users' high mobility. The service provider has to set a proper price for the data plan to prevent such unauthorized redistribution behavior to protect or maximize his/her own profit.

III. SYSTEM DESIGN

A. Proposed System

In proposed system we analyze the best price setting for the service provider by investigating the equilibrium between the subscribers and the secondary buyers who are in content-redistribution network. We model the behavior between the subscribers and the secondary buyers as a non-cooperative game and find the best price and quantity for both groups of users. Secondary buyer would be paying again for the same video as we are generating a video key to the subscriber to watch the video. The video key would be mandatory for secondary buyer to watch the video. Such an analysis can help the [5] service provider preserves his/her profit under the threat of the redistribution networks and can improve the quality of service for end users. Also the admin can check the redistribution of video.

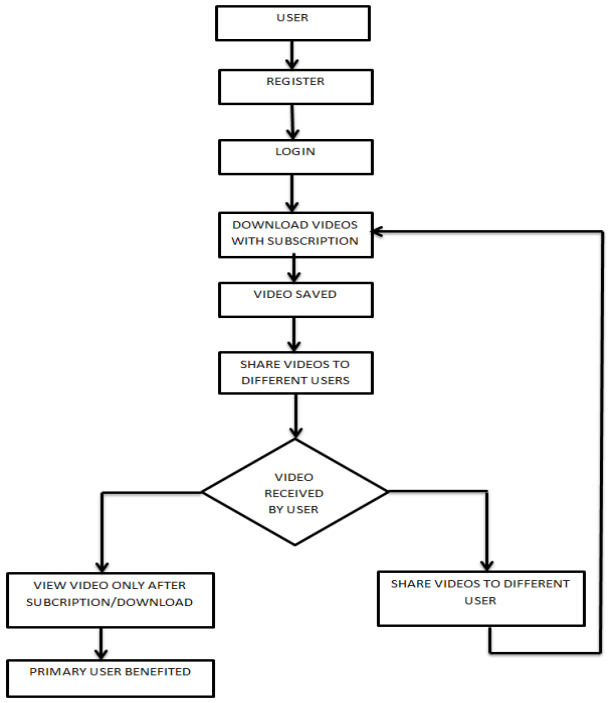

Fig. 1

B. Flowchart

Figure 1 depicts the overall steps in the system. The user register in the application. This user must login using the username and password created during the registration

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process. Now the user has subscribed to the system's service. This primary user can now download videos using subscription by paying the amount of the video. Now this user can share this video to other users (secondary). These secondary users will be only able to watch the videos after subscription or download using the proposed system. These users (secondary) will need to pay the amount for the video. Now the secondary user can actually send/share the videos to other users of the system. In this way, he also can be benefited from the sharing of the videos. In this way, video will get promoted and promoters and the admin will be benefited from this act.

IV. FUTURE SCOPE

In Future, we can present a streaming system that utilizes interleaved transmission for real time H.264/AVC video and AAC LC audio in the 3G wireless environment to prevent the redistribution of videos.

The emergence of next generation network technologies and increased uptake of bandwidth-intensive apps has led to a surgeon in the data traffic. Riding on 3G technology, data services are expected to be the important areas for Indian telecom service over the next five years. Mobile data traffic in the country is likely to increase nearly hundred times by 2015 and consumers will stream nearly 600 hours of video content every second.

This java application is for video in future can be implemented for applications.

V. CONCLUSION

From the detailed study of the paper, proposed model has tried to describe the best pricing for mobile video data by influence the video redistribution network between the data(internet) plan subscribers and non- subscribers. From the paper, the proposed model gives a large elaboration about the analysis of balanced price of the video stream shared by the subscribers and secondary buyers.

In the whole process, it helped to understand the phenomena of strategic decision making by the usage of evolutionary Game Theory and by which the strategy known as Stackelburg model can be used for providing the cost-effective pricing system for the redistribution of the video content. Nevertheless, the admin as service provider should always offer high-quality video stream to avoid the illegal redistribution of video.

Next, we have extended this strategi by including the content owner in the game and allowing the mobile phone users decide whether to subscribe in to the data plan. In the extended model, we desing the dynamics between the content owner and the users who are interested in the video content, and study how the content owner (admin) sets the price for the data plan to maximize his/her overall income.

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