ISSN: 2321-7782 (Online)
Volume 2, Issue 1, January 2014
International Journal of Advance Research in Computer Science and Management Studies
Research Paper
Available online at: www.ijarcsms.com

Era of Adaptive Commercial Video Streaming

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Abstract: As the technology is growing faster so the phone-to-phone communication is in vast demand and the recent developments of 3G networks and smart phones enable users to watch video programs by subscribing data plans from service providers. Due to the ubiquity of mobile phones communication technology, data-plan subscribers can redistribute the video content to nonsubscribers. The service provider has to set a reasonable price for the data plan to prevent such unauthorized redistribution behavior to protect or maximize his/her own profit. In this paper, we analyze the optimal price setting for the service provider by investigating the equilibrium between the subscribers and the secondary buyers in the content-redistribution network. We model the behavior between the subscribers and the secondary buyers as a noncooperative game and find the optimal price and quantity for both groups of users. Such an analysis can help the service provider preserve his/her profit under the threat of the redistribution networks and can improve the quality of service for end users.

Keywords: Game Theory, Mobile Video Streaming, Stackelburg, Redistribution.

I. INTRODUCTION

The increased popularity of wireless networks and mobile devices in the past decade is drawing lots of attentions on ubiquitous multimedia access in the multimedia community. Network service providers and researchers are focusing on developing efficient solutions to ubiquitous access of multimedia data, particularly videos, from everywhere using mobile devices. By subscribing to the data plans from service providers, mobile-phone users can watch video programs on their devices and they can reproduce the video content.

The mobile network service provider are more interested to maximize his/her own profit by setting the content price than protecting copyrights and total profit depends on the total number of subscriptions according to the content price. If the content price is high, mobile users have less incentive to subscribe to the data plan, which might result in less subscription. Because of this reason the content price in the redistribution network may get higher due to less subscribers and more secondary buyers. Even if a subscriber pays more for the video stream, he/she also gets profit by redistributing the data. So even if the content price is higher it does not necessarily reduce the number of subscriptions, and it is not trivial to find the optimal price that maximizes the service provider's utility. The service provider, the data-plan subscribers, and the secondary buyers who are interested in the video data interact with each other and influence each other's decisions and performance. In this situation the game theory is a mathematical tool to the formal study of conflict and cooperation.

Fig 1 An Example of a mobile video stream redistributed network

II. LITERATURE REVIEW

A. Existing System

In the existing system, data-plan subscribers can redistribute the video content to nonsubscribers. Such a redistribution mechanism 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 reasonable price for the data plan to prevent such unauthorized redistribution behaviour to protect or maximize his/her own profit.

B. Proposed System

In proposed system we analyse the optimal price setting for the service provider by investigating the equilibrium between the subscribers and the secondary buyers in the content-redistribution network.

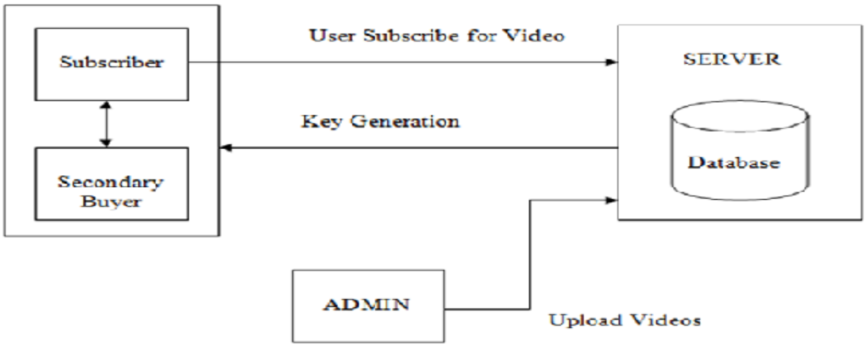

Fig2.1 System Architecture

Such an analysis can help the service provider preserve his/her profit under the threat of the redistribution networks and can improve the quality of service for end users.

III. STREAMING ARCHITECTURE

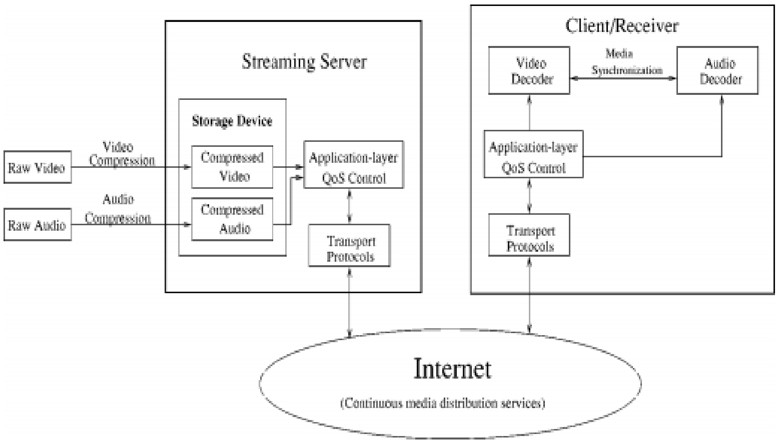

Fig. 3.1: Streaming Architecture

a) *Video compression*:Raw video must be compressed before transmission to achieve efficiency. Video compression schemes can be classified into two categories: scalable and non-scalable video coding. Since scalable video is capable of gracefully coping with the bandwidth fluctuations in the Internet, we are primarily concerned with scalable video coding techniques. We will also discuss the requirements imposed by streaming applications on the video encoder and decoder.

b) *Application-layer QoS control:* To cope with varying network conditions and different presentation quality requested by the users, various application-layer QoS control techniques have been proposed. The application-layer techniques include congestion control and error control. Their respective functions are as follows. Congestion control is employed to prevent packet loss and reduce delay. Error control, on the other hand, is to improve video presentation quality in the presence of packet loss. Error control mechanisms include forward error correction (FEC), retransmission, error-resilient encoding, and error concealment.

c) *Streaming Server:* Streaming servers play a key role in providing streaming services. To offer quality streaming services, streaming servers are required to process multimedia data under timing constraints and support interactive control operations such as pause/resume, fast forward, and fast backward. Furthermore, streaming servers need to retrieve media components in a synchronous fashion. A streaming server typically consists of three subsystems, namely, a communicator, an operating system, and a storage system.

d) *Continuous media distribution services:* In order to provide quality multimedia presentations, adequate network support is crucial. This is because network support can reduce transport delay and packet loss ratio. Built on top of the Internet (IP protocol), continuous media distribution services are able to achieve QoS and efficiency for streaming video/audio over the best-effort Internet. Continuous media distribution services include network filtering, application-level multicast, and content replication.

e) *Media synchronization mechanisms:* Media synchronization is a major feature that distinguishes multimedia applications from other traditional data applications. With media synchronization mechanisms, the application at the receiver side can present various media streams in the same way as they were originally captured. An example of media synchronization is that the movements of a speaker's lips match the played-out audio.

f) *Protocols for streaming media:* Protocols are designed and standardized for communication between clients and streaming servers. Protocols for streaming media provide such services as network addressing, transport, and session control. According to their functionalities, the protocols can be classified into three categories: network-layer protocol such as Internet protocol (IP), transport protocol such as user datagram protocol (UDP), and session control protocol such as real-time streaming protocol (RTSP). The remainder of this paper is devoted to the exposition of the above six areas. Section II discusses video compression techniques. We present application-layer QoS control mechanisms for streaming video. Continuous media distribution services. We discuss key issues on design of streaming servers various media synchronization mechanisms, we overview key protocols for streaming video summarizes this paper and points out future research directions.

IV. Algorithm

The Stackelberg model in economy consists of a leader firm which moves first and a follower firm which moves after. The Stackelberg model is solved by finding the sub game perfect Nash equilibrium1 of the game. To calculate SPNE we first need to find the best reaction of follower to any quantity of its leader, thus we use backward induction to solve this kind of game. In a Stackelberg game the leader announces its strategy and follower responds to it rationally, as far as the leader knows the follower cost function, it can compute follower's reaction to all of its strategies.

The timing of a Stackelberg game is as follows:

1. Leader chooses a quantity $q1 > 0$
2. Follower observes q1 and then chooses a quantity $q2 > 0$
3. Payoff for player i is:

$$ui(qi, qj) = [P(qi + qj) - Ci(qi)]qi$$

A sub game perfect Nash equilibrium (SPNE) is a set of strategies {si, i = 1, . . . , n} such that for each sub game g, the set of induced strategies {si(g), i = 1, . . . , n} forms a Nash equilibrium for this sub game. Price for firms is P(q1 + q2) which is simply the function of total output. Moreover, we suppose that firm i has cost function as Ci(qi). We use backward induction to solve a Stackelberg game, thus first we need to calculate the follower best response to an arbitrary quantity of leader.

$$\max_{q2>0} u2\,(q1, q2) = [P\,(q1 + q2) - C2\,(q2)]\,q2$$

The values of q2 satisfying this response is follower's best response. For the best responses of the leader we need to find the follower best responses as a function of the leader possible actions, R2(q1), and then maximize the leader utility:

$$\max_{q1>0} u1\,(q1, R2\,(q1)) = [P\,(q1 + R2\,(q1)) - C1\,(q1)]\,q1$$

These two maximizations can easily be found by just a derivation of each utility with respect to its given quantity and put the result equal to zero and find the respective value that satisfies the resulting expression.

V. Methodology

Our system is broadly divided into four stages:

a) The redistribution behaviour has been modelled as a Stackelburg game, and we have analysed the optimal strategies of both subscribers and secondary buyers.

b) In this stage subscriber choose video and download the video from service providers. Subscribers pay the amount to service provider. Service provider provides that video key to subscriber. So subscribers watch the video using video key. Also subscriber, redistribute the video to another user such as using blue tooth or Wi-Fi technologies.

c) In this stage secondary buyers easily getting the video from subscriber using Wi-Fi or blue tooth technologies. If the secondary buyer doesn't pay any amount then he will not receive the video key and will not be able to watch the video.

d) In this stage admin upload the video to database. Also view the subscriber details and user details. Admin find the redistribute details. Also who send the video and receive the video.

VI. ADVANTAGES

a) Easily identified the secondary buyers.

b) Only subscriber watches the video from service provider.

c) Only authorized user only downloads the videos.

VII. APPLICATIONS

a) Business Presentations

b) Town Hall Meetings

c) Distance Learning

VIII. CONCLUSION

A. Concluding Remarks

We have set the optimal pricing for mobile video data. We first analyze the equilibrium price of the video stream redistributed by the subscribers given the number of subscribers and secondary buyers. Consequently, the results provide a guideline for the content owner to prevent the redistribution behavior and to maximize the service provider's profit. The redistribution behavior is modeling as a Stackelburg game, from the simulation results; a secondary buyer will tend to buy more power from subscribers with better channel to maximize his/her utility.

B. Future Work

In the extended model, we model the dynamics between the content owner and the users who are interested in the video content, and how the content owner (the service provider) sets the price for the data plan to maximize his/her overall income. Further, we will provide more security for videos by watermarking the videos.

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