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Stackelburg Strategy for Pricing Mechanism of Video Streaming In Content Redistribution Network

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ABSTRACT

With the utilization of mobile devices and with the development of the smart phones and as such the 3G networks, these mobile phones have become the most popular consumer devices. Due to ubiquitous access of mobile phones and its features, data-plan subscribers can redistribute the video content to nonsubscribers and has become a great difficulty for the mobile service provider to trace the given user's high mobility. Thus, it is the sole responsibility of the service provider to set a reasonable price for the data plan in order to prevent from the unauthorized access of the video content in the redistribution network. This paper tried to focus on analyzing the optimal price setting for the service provider by understanding the equilibrium condition between the subscribers and the secondary buyers, and also to model the behaviour between the subscribers and the secondary buyers as a noncooperative game. For this purpose the strategy of Game Theory has been implemented in this paper. 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, pricing.*

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I. INTRODUCTION

Multimedia processing technologies has increased its popularity in ways that video content is delivered to and consumed by end users. Also, the increased usage and popularity of wireless networks and mobile devices is drawing a lot of interest and attentions on ubiquitous access of multimedia content. Network service providers and researchers are focusing on developing efficient solutions to ubiquitous access of multimedia data, particularly videos, from everywhere using mobile devices (laptops, personal digital assistants, or smart phones that can access 3G networks)[1], [2]. The users of mobile phone can watch or subscribe the video programs on their devices by using the data plans from the network service providers. In this paper, scalable video coding techniques [5] are being implemented in order to accommodate heterogeneous network conditions and devices. In the research community, video applications have drawn a lot of attentions in the field of quality measure [7] and error control. It also concentrates on the user interactions in electronic commerce which comprises of the secure transactions [11] and cooperative caching [9], [10].

Along with this, it is required to understand the concept of how end users are consuming video in day to day lives [12]. With such a high popularity and the convenient phone-to-phone communication technologies, it is very possible for data-plan subscriber to redistribute the video content without authorization. For example there are some of the users who do not subscribes to the data plan and henceforth wish to watch television programs and also news programs. Hence, these users have incentives to buy the desired video content from neighboring data subscribers if the cost is lower than the subscription fee charged by the service provider. In comparison to the generic data, multimedia data can be easily retrieved and modified, which carries out the process of video redistribution. Due to the high-mobility, time-sensitiveness, and small-transmission- range characteristics of mobile devices, each redistribution action only exists for a short period of time and is very difficult to track. However, the price of the content must be high as because of lesser number of subscribers and secondary buyers. In such a condition the primary subscriber who is paying more amount for the data plan must be avail his/her win-win situation. Hence, setting the content price higher 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.

So, a strategic decision making must be carried out for overcoming this situation. And as such the Game theory is being implemented for analyzing the strategic interactions among rational decision makers. Recently, the game theory has drawn great attention in multimedia signal processing [13]. We first model the user dynamics in the redistribution network as a multiplayer noncooperative game and obtain the equilibrium price from which all users have no incentives to deviate. Hence, such an equilibrium price will serve as the upper bound for the price set by the network service provider to prevent copyright infringement. Therefore, a robust equilibrium solution is desired for the service provider. Hence, we formulate the video streaming marketing phenomenon as an evolutionary game and derive the evolutionarily stable strategy (ESS) [15] for the mobile users, which is the desired stable equilibrium for the service provider.

II. LITERATURE SURVEY

2.1.Video-Stream Redistribution Game

Since the video-stream redistribution network is a dynamic system, in which all users have very high mobility and users can join and leave at anytime, it is very difficult to control the user behavior by a central authority. On the other hand, since redistributing infringes copyrights, the users (subscribers and secondary buyers) have incentives to not trust one extra person (the central authority) to minimize their risk of being detected by the service provider. Hence, we propose a fully distributed Stackelburg-game-theoretical model to analyze how secondary buyer provide incentives for the subscribers to redistribute the video stream, and what is the optimal price and quantity that the secondary buyers should offer. The ultimate goal of such analysis is to help the content owner, i.e. the service provider to set the price such that the equilibrium of the game between subscribers and the secondary buyers leads to negative payoff, which means the subscribers have no incentive to redistribute the video. We start the analysis by the defining the stages of the game and the utility functions of both types of users in the network.

2.2 Equilibrium Analysis

The video-stream redistribution game is with perfect information: the game is composed of two stages; the subscribers make decisions first, 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, the secondary buyer knows each subscriber's strategy. As a result, each information set in this game contains only one node, which shows the video-stream redistribution game is with perfect information? According to backward induction, a game with perfect information has at least one equilibrium. Therefore the optimal strategies for both the secondary buyer and subscribers exist and can be obtained by solving the optimal decision for each stage in the backward manner.

III. SYSTEM MODEL

In this section, we will introduce the channel, transmission, and video rate distortion models for the transmission of video streams over wireless networks. The system model is shown in Fig 1. There are N_s subscribers in the network, who are trying to sell the video content to N_b secondary buyers. Here, we assume that the content is redistributed through direct links between the subscribers and the secondary buyers, i.e., these mobile users form an ad hoc network. Given the current technology, such direct link can be Bluetooth or Wi-Fi. At the beginning, each subscriber sends his/her own price per unit transmission power, as well as the probing signal to secondary buyers. Since the price information contains only a few bits, we assume that it can be immediately and perfectly received. The probing signal enables secondary buyers to estimate the maximal achievable transmission rate. A secondary buyer has to decide how much power he/she wants to buy from each subscriber. Since scalable video coding [5] is widely used in mobile video streaming. Assume that the jth secondary buyer purchases a part of the video stream from subscriber S_i with transmission power $P_i^{(j)}$. We assume that there is a channel dedicated for transmissions among users [17] and this channel is a slow-fading channel with channel gain H_{ij}; the distance between them is d_{ij}, and the variance of the additive white Gaussian noise at the receiver's side is σ^2.

Let $N^{'}$ be the set of subscribers from whom the secondary buyers purchase the video. Assume that the total bandwidth available for the video redistribution network is W, which will be evenly allocated to all $N^{'}$ subscribers from whom secondary buyers purchase the video stream. The signal-to-noise ratio (SNR) and the maximal achievable bit rate of the video stream between S_i and B_i are being used. The content subscribers and the secondary buyers who are interested in the video data interact with each other and influence each others' decisions and performance. Both groups of users will reach agreement at the equilibrium price that all users have no incentive to deviate. Hence, such an equilibrium price will serve as the upper bound for the price set by the network service provider.

The system model has been explained in the following figure:

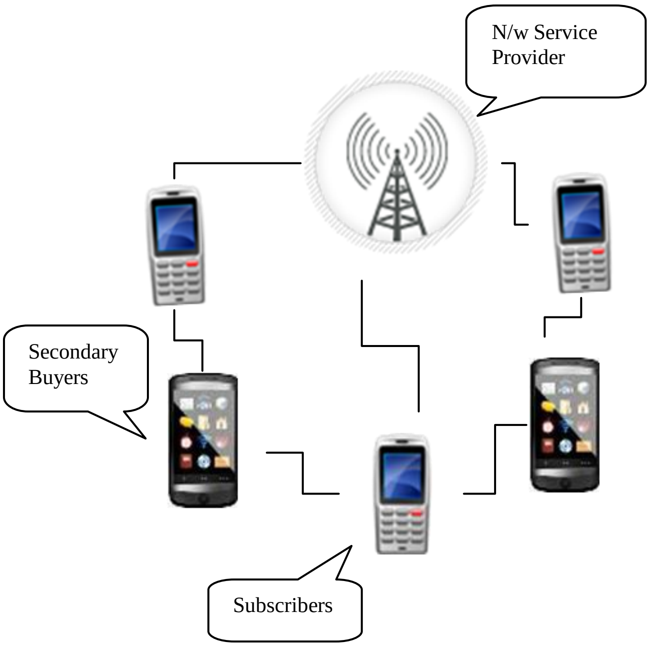

Fig 1: System Model

Thus, the signal-to-noise ratio (SNR) and the maximal achievable bit rate of the video stream between S_i and B_i are

$$SNR_{ij} = \frac{Pi\,(j)\,Hij}{\sqrt{dij}\,\sigma 2}$$

$$R_{ij} = W\frac{W}{N^{'}+1}\log_2(1+\frac{SNRij}{\gamma}) \qquad \text{--------- (1)}$$

where γ is the capacity gap.

Without loss of generality, in this paper, we use the two-parameter rate-distortion model, which is widely employed in a medium-to-high bit rate situation, and the analysis for other models is similar. The two-parameter rate-distortion model is given as follows:

$$\text{Distortion} = \alpha e^{-\beta R} \qquad \text{--------- (2)}$$

Where α and β are two positive parameters determined by the characteristics of the video content and R is the rate of the video. Note that a secondary buyer is able to purchase the video from different subscribers in two different ways. The total bandwidth for the redistribution network is W, which is equably shared among the subscribers who are going to transmit.

The total bandwidth for the redistribution network is W, which is equably shared among the subscribers who are going to transmit. Hence, when the number of subscribers from whom the secondary user purchases,i.e., $N^{'}$, increases, the bandwidth for transmitting each layer is smaller. Given the bit rate in (1), the mean square error (MSE) of the video stream reconstructed by the secondary buyer B_j is:

$$MSE_j = \alpha \exp(-\beta \textstyle\sum_{i} Rij)$$

$$= \alpha \exp(-\beta\frac{W}{N^{'}+1} \textstyle\sum_{i} \log 2(1 + \frac{SNRij}{\gamma}))$$

-------- (3)

IV. SINGLE-SECONDARY BUYER CASE

This section explains about the scenario where there is a single secondary buyer, i.e., $N_B = 1$. Here the strategy involves Stackelburg game [22] in order to model the behavior between the subscribers and the secondary buyer or primary subscribers and secondary subscribers. Since the case deals with only one secondary buyer, we can remove superscript j for the secondary buyer index and have the SNR and $R_{i,}$ and along with that the mean square error is being evaluated:

$$SNR_i = \frac{Pi\ Hi}{\sqrt{di}\ \sigma 2},$$

$$R_i = W\frac{W}{N^{\cdot}+1} \log_2(1+\frac{SNRi}{\gamma})$$

and

$$\begin{aligned} MSE &= \alpha \exp(-\beta \textstyle\sum_{\cdot} Ri) \\ &= \alpha \exp(-\beta\frac{W}{N^{\cdot}+1} \textstyle\sum_{\cdot} \log 2(1+\frac{SNRi}{\gamma})) \end{aligned} \quad \text{---------- (4)}$$

The strategy generally involves the following stages:

4.1 Game Formulation

In case of the video-stream redistribution network, it constitutes high mobility and the users can join and leave at any point of time. For such a reason, it becomes a problem for a central authority to exist and control the user's behavior. In addition to this, since this redistribution network is not legal and also unauthorized, thus the participating users, i.e the subscribers and the secondary buyers, have no incentives to trust either on the central authority and the service provider, and hence a distributed strategy must be implemented. Since the fact lies in the case of a single secondary buyer, thus we propose a stackelburg game model to look over the concept of how the secondary buyer provides the incentives for the subscribers, in order to redistribute the video content in the redistribution network and also to set the optimal price for the subscribers and as such for the secondary buyers, The ultimate goal of this analysis is to help the content owner to set an appropriate subscription fee such that the equilibrium of the game between the subscribers and the secondary buyers leads to negative payoffs. In case of the video-stream redistribution network, it constitutes high mobility and the users can join and leave at any point of time. For such a reason, it becomes a problem for a central authority to exist and control the user's behavior. In addition to this, since this redistribution network is not legal and also unauthorized, thus the participating users, i.e the subscribers and the secondary buyers, have no incentives to trust either on the central authority and the service provider, and hence a distributed strategy must be implemented. Since the fact lies in the case of a single secondary buyer, thus we propose a stackelburg game model to look over the concept of how the secondary buyer provides the incentives for the subscribers, in order to redistribute the video content in the redistribution network and also to set the optimal price for the subscribers and as such for the secondary buyers, The ultimate goal of this analysis is to help the content owner to set an appropriate subscription fee such that the equilibrium of the game between the subscribers and the secondary buyers leads to negative payoffs.

4.1.1 Game Procedure

Before the implementation of the game, each of the participating users, i.e the subscribers and the secondary buyers must declare his/her presence to all other users within his/her transmission range. The procedure involves the game steps and the utility function of the secondary buyers. In the case of the game steps, the first step is the use of the subscribers. For each subscriber say i, he/she will set his/her unit price p_i per unit transmission power, along with his/her maximal transmission power $p_i^{(max)}$. In the second step of the game, the secondary buyer will decide from whom to buy the video content and also how much power he/she wants the subscriber to transmit. And based on this the secondary buyer pays based on the price set by the subscribers in the first step.

4.1.2 Utility Function

The utility function is another important step in the process of the game formulation. This utility function has been defined for two cases, i.e one for secondary buyers and the other for the subscribers.For Secondary Buyers, the utility function for the secondary buyer has been defined and this utility function generally explains about his/her optimal action.

Let the secondary buyer be denoted by B, and this secondary buyer B receives the video with a certain quality and thus gains rewards. Again B has to pay for the power based on the subscribers that they use for transmission. Let P_i be the power that the secondary buyer B decides to purchase from the ith subscriber S_i, the channel gain between S_i and B is H_i, and the distance between them is d_i. Therefore, given the video rate-distortion model, the utility function of the secondary buyer B_i can be defined as:

$$\pi_B = g_Q(PSNR_B\text{-}PSNR_{max})\text{-}g_D(D_B\text{-}Dq(\frac{K+1}{M}))\text{-}(\sum pi\,Pi - po) \qquad \text{--------- (5)}$$

where D_B is formulated, g_Q is a user-defined constant that measures the received reward for the secondary buyers if the PSNR of the reconstructed video is improved by 1 dB, and gD is a constant measuring the user's loss if the video stream is further delayed by 1 s. $PSNR_{max}$ is defined as the maximal PSNR of the video that can be obtained by subscribing to the service, and is the price set by the content owner. If the secondary buyer has subscribed to the data plan, then he/she will receive the video with the maximal PSNR, the delay of the video stream will only be the network delay, and the number of network users who are using the data service will be K+1 in this case. The first term reflects the visual quality difference between the subscriber's video stream and the service provider's video stream. The second term considers the delay difference between the subscriber's video stream and the service provider's video stream. D_B was defined, and $Dq(\frac{K+1}{M})$ is the delay profile if the secondary buyer subscribes to the data plan and becomes an extra subscriber in the network. The third term indicates the price difference. The two constants g_Q and g_D control the balance between the gain and the loss of the secondary buyer. For the subscribers, the utility function can be defined for the subscribers and for each subscribers say S_i can be considered as a seller, who mainly concentrates on getting the payment for the transmission cost and also to gather some extra rewards. For this purpose we introduce the parameter c_i, i.e., the cost of power for relaying data, which is determined by the features of the device that subscriber S_i uses. Hence, the utility of S_i can be defined as

$$\pi_{Si} = (p_i\text{-}c_i)P_i \qquad \text{--------------- (6)}$$

where P_i is the power that subscriber i uses to transmit to the secondary buyer. Thus, subscriber S_i will choose price p_i that maximizes his/her utility π_{Si}. The choice of the optimal price p_i is affected by not only the subscriber's own channel condition but also other subscribers' prices, since different subscribers noncooperatively play and they compete to be selected by the secondary buyer. Thus, a higher price may not help a subscriber improve his/her payoff.

4.2 Equilibrium Analysis

The video-stream redistribution game provides a game with perfect information and therefore a method is being applied which is termed as backward induction that has one equilibrium. In the case of finding the optimal strategies of the secondary buyer, it has been analyzed the game by using the backward induction and first study the secondary buyer's optimal strategy for a given price list from the subscribers.

Let $P=[P_1,P_2,\ldots,P_{Ns}]$ be the corresponding power\ vector, where P_i is the power that the secondary user purchases from subscriber i. We can find the optimal power vector $P_N^{(K)}$ for subset $S_N^{(k)}$ by making the first-order derivative of π_B with respect to P_i be zero, i.e.,

$$\frac{\partial \pi B}{\partial Pi} = g'_Q \frac{W\ln 2}{N'+1}\frac{Ai}{1+AiPi} - p_i \qquad \text{-------------- (7)}$$

for all S_i belongs to L, where $A_i = \sqrt{di}\ \sigma 2\ \gamma$ / H_i , and thus if the secondary buyer purchases from any N' subscribers with the same maximal processing delay the the required condition will be given by the following:

$$P_i\,(S_{N'}^{(k)}) = \frac{g'QW\ \ln 2}{pi\,(N'+1)} - \frac{1}{Ai} \qquad \text{---------------- (8)}$$

for all S_i belongs to L

In the case of finding the optimal strategies of the subscribers for having the best strategies, it has been analyzed that the optimal price p_i^* (H_i, d_i) must satisfy:

$$\frac{\partial \pi Si}{\partial pi} = P_i^* + (p_i - c_i)\frac{\partial Pi}{\partial pi} = 0 \qquad \text{---------------- (9)}$$

such that $c_i <= p_i$ for all I belongs to L, which means that $p^*_i = c_i$. Therefore, a subscriber's claimed price must be higher than his/her cost.

V. EXTENSION OF SINGLE SECONDARY BUYER CASE

In this section, we will extend the optimal strategy for the single-secondary-buyer case to the scenario with multiple secondary buyers. The strategy generally involves the following two strategies that includes the game steps and also the mixed equilibrium strategies.

5.1 Game Model

Assume that there are N_s subscribers and N_b>1 secondary buyers. The first two stages of the game are the same as the single-secondary-buyer scenario, i.e., each subscriber declares the price per unit energy p_i, and then, each secondary buyer B_j chooses the transmission power vector $P^{(j)}=[P_1^{(j)}, P_2^{(j)},....., P_{Ns}^{(j)}]$, where $P_i^{(j)}$ is the power that the secondary buyer j plans to purchase from subscriber i. With multiple secondary buyers, each subscriber i may receive several power purchase orders from different secondary buyers. In our paper, we let one subscriber transmit to one secondary buyer only. Thus, in the multiple secondary-buyer scenarios, the game model has an additional stage in which each subscriber i chooses the secondary buyer B_j who purchases the largest $P_i^{(j)}$ among all the N_b secondary buyers.

5.2 Mixed-Strategy Equilibrium

Given the aforementioned definition of the utility functions, our next step is to find the subscribers and the secondary buyer's optimal decisions ($\{P^{(j)*\}},\{p_i^*\}$), from which no one in the system has the incentive to deviate. For the subscribers' price list $\{p_i\}$, for a secondary buyer B_j, the choice of the optimal power quantity $P^{(j)*}$ is not only influenced by the channel conditions and the distances between subscribers and the secondary buyer B_j but also depends on the number of subscribers from whom B_j can purchase the video stream.

VI. STACKELBURG STRATEGY ON NON-ZERO SUM GAMES

The properties of the stackelburg solution in static and dynamic non-zero sum two player games are investigated, and along with that the necessary and sufficient conditions for the existence are derived. Several game problems, such as games where one of the two players does not know the other's performance criterion or games with different speeds in computing the strategies are best modeled and solved within this solution concept. In the case of dynamic games, linear quadratic problems are being formulated and solved in a Hilbert space setting. As a special case, non-zero sum linear quadratic differential games are treated in detail, and the open-loop Stackelburg solution is obtained in terms of Riccati-like matrix differential equations. For example, in a two-player game, if the first assumption does not hold and one player does not have the information about the other's performance function, then it is no longer possible for this player to calculate his Nash strategy.

6.1 Definition and properties of Stackelburg Srategy

Let U_1 and U_2 be the sets of admissible strategies for players 1 and 2, respectively. Let the cost functions $J_1(u_1,u_2)$ and $J_2(u_1,u_2)$ be the two functions mapping $U_1\times U_2$ into the real line such that Player1 wishes to minimize J_1 and Player2 wishes to minimize J_2. The player that selects his strategy first is called the leader and the player that selects his strategy second is called the follower. Thus, if there exist a mapping $T:U_2\text{->}U_1$ such that, for any fixed u_2 belongs to U_2, $J_1(Tu_2,u_2)<=J_1(u_1,u_2)$ for all u_1 belongs to U_1, and if there exist a u_{2s2} belongs to U_2 such that $J_2(Tu_{2s2},u_{2s2})<=J_2(Tu_2,u_2)$ for all u_2 belongs to U_2, then the pair (u_{1s2},u_{2s2}) belongs to $U_1\times U_2$, is called a Stackelburg strategy pair with Player2 as leader and Player 1 as follower.

6.1.1 Static Games

Static games are the games that do not evolve over time. In this section, a class of static games in which the cost functions $J_1(u_1,u_2)$ and $J_2(u_1,u_2)$ are real-valued continuous functions defined over a sunset or all of the Euclidian space$R^{m1}\times R^{m2}$, where m1 and m2 are positive integers, will be considered. Unlike matrix games, the Stackelburg solution in static games need not always exist. In these games the Nash solution may exist, but the stackelburg solution may not exist.

6.1.2 Dynamic Games

Dynamic games are the games that evolve over time. Their description is usually done in terms of dynamic equations that describe the evolution of the state of the game in response to control variables selected by the players from the sets of allowable controls. Linear-quadratic games are generally represented by a linear state equation and quadratic cost functions. In this section,
linear-quadratic games defined over real Hilbert spaces are treated. This formulation includes several dynamic games, such as continuous time, discrete time, etc., that are of interest to control engineers.

6.1.3 Linear-Quadratic Differential Games

Recently, linear-quadratic differential games have received considerable interest in the differential games literature. These games have significant importance in studying the local behavior of corresponding nonlinear differential games. The dynamics of the game considered here are assumed to obey the linear differential equation:

$$X = Ax + B_1u_1 + B_2u_2, \quad x(t_0)= x_0 \qquad \text{------------------ (10)}$$

VII. CONCLUSION

From the detailed study of the paper, the proposed model has tried to describe the optimal pricing for mobile video data by analyzing the video redistribution network between the data plan subscribers and non-subscribers. From the paper, the proposed model provides a vast elaboration about the analysis of the equilibrium price of the video stream redistributed by the subscribers and secondary buyers. In the entire process, it helped to understand the phenomena of strategic decision making by the utilization of evolutionary Game Theory and from which the strategy known as Stackelburg Strategy can be used for providing the efficient pricing mechanism for the redistribution of the video content. Nevertheless, the service provider should always offer high-quality video stream to prevent the illegal redistribution of video. Next, we have extended the model by including the content owner in the game and letting the mobile phone users decide whether to subscribe to the data plan. In the extended model, we model the dynamics between the content owner and the users who are interested in the video content, and study how the content owner (the service provider) sets the price for the data plan to maximize his/her overall income.

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REFERENCES

[1] G. Gualdi, A. Prati, and R. Cucchiara, “Video streaming for mobile video surveillance,” IEEE Trans. Multimedia, vol. 10, no. 6, pp. 1142–1154, Oct. 2008.

[2] H. Ibaraki, T. Fujimoto, and S. Nakano, “Mobile video communications techniques and services,” in *Proc. SPIE*, 1995, vol. 2501, p. 1024.

[3] T. Schierl, T. Stockhammer, and T.Wiegand, “Mobile video transmission using scalable video coding,” *IEEE Trans. Circuits Syst. Video Technol.*, vol. 17, no. 9, pp. 1204–1217, Sep. 2007.

[4] M. Ries, O. Nemethova, and M. Rupp, “Video quality estimation for mobile H.264/AVC video streaming,” *J. Commun.*, vol. 3, no. 1, pp. 41–50, Jan. 2008.

[5] N. Dimokas, D. Katsaros, and Y. Manolopoulos, “Cooperative caching in wireless multimedia sensor networks,” *Mobile Netw. Appl.*, vol. 13, no. 3/4, pp. 337–356, Aug. 2008.

[6] C. Y. Chow, H. V. Leong, and A. Chan, *Peer to-peer cooperative caching in mobile environments*, pp. 528–533, 2004.

[7] S. Banerjee and S. Karforma, “A prototype design for DRM based credit card transaction in e commerce,” *Ubiquity*, vol. 9, no. 18, pp. 1–9, 2008.

[8] K. O’Hara, A. S. Mitchell, and A. Vorbau, “Consuming video on mobile devices,” in *Proc. SIGCHI Conf. Human Factors Comput. Syst.*, 2007, p. 866.

[9] I. Ahmad and J. Luo, “On using game theory for perceptually tuned rate control algorithm for video coding,” *IEEE Trans. Circuits Syst. Video Technol.*, vol. 16, no. 2, pp. 202–208, 2006.

[10] J. M. Smith, *Evolution and the Theory of Games*. Cambridge, U.K.: Cambridge Univ. Press, 1982.

[11] A. Nosratinia, T. E. Hunter, and A. Hedayat, “Cooperative communication in wireless networks,” *IEEE Commun. Mag.*, vol. 42, no. 10, pp. 74–80, 2004.

[12] M. J. Osborne and A. Rubinste, *A Course in Game Theory*. Cambridge, MA: MIT Press, 1994.

[13] W.S.Lin and K.J.Ray Liu, “Pricing game and evolution dynamics for mobile video streaming,” in *Proc. IEEE Int. Conf.Acoust., Speech, Signal Process.*, May 2011.

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