ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2016

A Review -Video Streaming over Wireless Networks Using Real Time Adaptive Algorithm

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ABSTRACT: In this paper a real time adaptive algorithm is used for video streaming. A large number of live segmented adaptive HTTP video streaming services exist in the internet today. Managing the Quality-of-Experience (QoE) of video streaming for wireless clients is becoming increasingly important due to the rapid growth of video traffic on wireless networks. How efficiently and cost-effectively utilize multiple links to improve video streaming quality needs investigation. In order to maintain high video streaming quality while reducing the wireless service cost, in this paper, the optimal video streaming process with multiple links is formulated as a Markov Decision Process (MDP). The reward function is designed to consider the quality of service (QoS) requirements for video traffic, such as the startup latency, playback fluency, average playback quality, playback smoothness and wireless service cost. To solve the MDP in real time, we propose an adaptive, best-action search algorithm to obtain a sub-optimal solution.

KEYWORDS: DASH, Markov decision process, video streaming, wireless networks, Adaptive Video Streaming, HTTP protocol.

I. INTRODUCTION

Video streaming is gaining popularity among wireless network users recently. It is a promising trend to use multiple wireless network interfaces with different wireless communication techniques. Utilizing multiple links simultaneously can improve video streaming in several aspects the aggregated higher bandwidth can support video of higher bit rate, when one wireless link suffers poor link quality or congestion, the others can compensate for it. As video data are transmitted over HTTP protocols, the video streaming service can be deployed on any web server. However, the video quality version can only be manually selected by users and such decision can be error-prone. In addition, the buffered unwatched video may be wasted if the user turns off the video player or switches to other videos. Furthermore, progressive download typically does not support transmitting video data over multiple links [1].

To overcome the above disadvantages of progressive download, dynamic adaptive streaming over HTTP (DASH) [2] has been proposed. In a DASH system, multiple copies of re-compressed videos with different resolution and quality are stored in segments. The rate adaptation decision is made at the client side. For each segment, the client can request the appropriate quality version based on its screen resolution, current available bandwidth, and buffer occupancy status. In this project, we formulate the multi-link video streaming process as a reinforcement learning task. For each streaming step, we define a state to describe the current situation, including the index of the requested segment, the current available bandwidth and other system parameters. A finite state Markov Decision Process (MDP) can be modelled for this reinforcement learning task. To solve the MDP in real time, we proposed an adaptive best-action search algorithm to obtain a sub-optimal solution. In this project first, we formulate the video streaming process over multiple links as an MDP problem. To achieve smooth and high quality video streaming, we define several actions and reward functions for each state. Second, depth-first real-time search algorithm. The proposed adaptation algorithm will take several future steps into consideration to avoid playback interruption and achieve better smoothness and quality.

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II. Related Work

The authors K. Tappayuthpijarn, T. Stockhammer, and E. Steinbach [21] proposed to estimate the bandwidth by a statistical method, and they took both the quality contribution and decoding time of each segment into consideration. The K.P. Mok et al. presented a QoE aware DASH system [4]. Their algorithm estimates the available bandwidth by probing with the video data. In order to keep the quality level as smooth as possible, their algorithm will switch the video quality version gradually and will try to maintain the buffer level being stable.

S. Akhshabi [8] designed an evaluation method to test the performance of several existing commercial DASH products, such as Smooth Streaming, Netflix, and OSMF. Next T. Kupka [7] proposed to evaluate the performance of live DASH under on/off traffic and tested four different methods like resource utilization on the sender (server) side, use another TCP congestion control, use longer video segments, avoid the clients request a segment that became recently available at the same time and limit the TCP congestion to improve the performance.

How to reduce unnecessary video quality variations using a probing method to identify the effective available bandwidth was given by C. Mueller, S. Lederer, and C. Timmerer [6]. In [5], [9] Optimal rate adaptation algorithm for streaming scalable video coding (SVC) over HTTP using MDP is designed in With SVC, each video frame is encoded into a base layer and several enhancement layers. Higher video quality can be achieved when more layers are received. Recently, a few approaches have appeared to extend the DASH technique to support multiple links. The authors A. Yaver and G. Koudouridis [15] summarized three typical schemes of utilizing multiple links Re-Selection Rate or Update Frequency, Parallelism and Redundancy. They compared the performance of these schemes through extensive simulations.

Kaspar et al. proposed an approach to implementing DASH over multiple links. In their algorithm, each segment will be transmitted over one link. In their algorithm, each segment will be transmitted over one link. Thus multiple segments can be transmitted at the same time. Thus multiple segments can be transmitted at the same time. To reduce the overhead, they used HTTP pipelining to improve the performance. This approach may lead to the "last-segment problem" due to the link transmission speed difference. To overcome this disadvantage Evensen et al. [17] suggested dividing each segment into small sub-segments, and these sub-segments can be downloaded through different links. Their algorithm estimates the available bandwidth according to the throughput of the previous segment, and selects the video quality version most close to the estimated bandwidth.

Mok et al. [3] investigated the impact of video adaptation on perceived playback quality. They found that users generally prefer gradual quality changes between best and worst quality levels instead of abrupt switching. Motivated by this observation they intentionally switch to an intermediate video quality level rather the target level to avoid sharp quality fluctuation and thus improve users' quality-of-experience. Liu et al. [4] proposed using smoothed HTTP throughput as the metric to detect bandwidth changes. They developed a quality-adaptation algorithm based on the step-wise-increase aggressive- decrease principle to smooth out quality increases and to quickly response to bandwidth drops to reduce playback rebuffring.

In another study, Tian et al. [5] proposed a different approach to rate adaptation – via feedbacks on the client buffer level as opposed to using network bandwidth, to strike the balance between responsiveness to bandwidth fluctuation and video playback smoothness. Beyond network condition and client buffer level, studies by Hao et al. [6] and Riiser et al. [7] further exploited location specific historical traffic statistics of different mobile cells to inform the rate adaptation algorithm. This is especially useful for users with high mobility such as travelling in a car or train. While these existing algorithms can improve streaming Performance, the exact performance, even at an average level, is generally not known in advance. By contrast, the TDRAPSRA framework proposed in this work is designed to address this fundamental challenge in adaptive video streaming.

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III. ANALYSIS OF PROBLEMS

The formulated video streaming process as an optimization problem, our goal is to find the best solution of the problem, which is also the optimal streaming policy. Theoretically, in dynamic programming can be employed to solve the above optimization problem by value iteration. The computation time and the memory consumption of the dynamic programming algorithm are determined by the number of states. With about 50 segments, the computation time and the solution table may exceed one hour and 600 MBs on a high-end desktop, respectively. Therefore, this approach is not suitable for real-time adaptive streaming. To overcome this problem, we aim to develop a real-time best streaming action search algorithm to find a sub-optimal solution for the optimization problem formulated in the previous section [1]. High resilience to bandwidth variation and easy deployment are both important requirements for video streaming applications. Currently, progressive download, one of the most popular and widely deployed streaming techniques, buffers a large amount of video data to absorb the variations of bandwidth. Meanwhile, as video data are transmitted over HTTP protocols, the video streaming service can be deployed on any web server. However, the video quality version can only be manually selected by users and such decision can be error-prone In addition, the buffered unwatched video may be wasted if the user turns off the video player or switches to other videos. Furthermore, progressive download typically does not support transmitting video data over multiple links.

IV. PROPOSED WORK

In recent years much work has been done in the area of adaptive video streaming. The key to adaptive video streaming is the design of its adaptation algorithm, i.e., the algorithm to determine when and what video bit-rate to use for requesting new video segments. Each video will be encoded several times with different quality, bit rate and resolution. All the encoded videos will be chopped into small segments and stored on the server, which can be a typical web server [1]. These small segments will be downloaded to the browsers' cache and played by the client (browser). The video rate adaptation is performed at the client side, which is also called the pull-based approach. The client will determine the quality version of the requested video segment according to its current available bandwidth, resolution and the number of buffered unwatched segments. After the current segment is completely downloaded, the rate adaptation algorithm will be invoked again for the next segment.

In this paper dynamic adaptive streaming over HTTP has been described. In a DASH system, multiple copies of pre-compressed videos with different resolution and quality are stored in segments. We formulate the multi-link video streaming process as a reinforcement learning task. For each streaming step, we define a state to describe the current situation, including the index of the requested segment, the current available bandwidth and other system parameters. A finite state Markov Decision Process (MDP) can be modeled for this reinforcement learning task. The reward function is carefully designed to consider the video QoS requirements, such as the interruption rate, average playback quality, and playback smoothness, as well as the service costs.

A. *SYSTEM MODEL:*

We consider how to utilize multiple wireless access networks together for video streaming, e.g., using a combination of cellular, WiFi, and/or Bluetooth simultaneously. Here, as an example, Bluetooth and WiFi access networks are considered as we do not have end-to-end control over cellular links and our work can be extended when other types of wireless access networks or more than two wireless access networks are used. Since a wireless channel may suffer from time-varying fading, shadowing, interference and congestion, the available bandwidth of a wireless link may vary all the time. In addition, different systems may have different resolution & size. Using these aspects into consideration, the server should store several copies of video with different quality. The videos are encoded with SVC into a base layer and several enhancement layers and chopped into segments and each segment can be played with a fixed duration [20].

We design a pull-based algorithm for video streaming, as shown in Fig. (A). After initialization, the client will request the video information which includes video resolutions, bitrates and qualities from the server through both the WiFi and Bluetooth links. The rate adaptation agent will request a video segment of appropriate quality version based on the current queue length and estimated available bandwidth. Once the request decision is made, HTTP requests over both WiFi and Bluetooth will be issued to download the video segment. This process will continue until the completion of downloading the last segment or the termination of the video streaming by the user [1].

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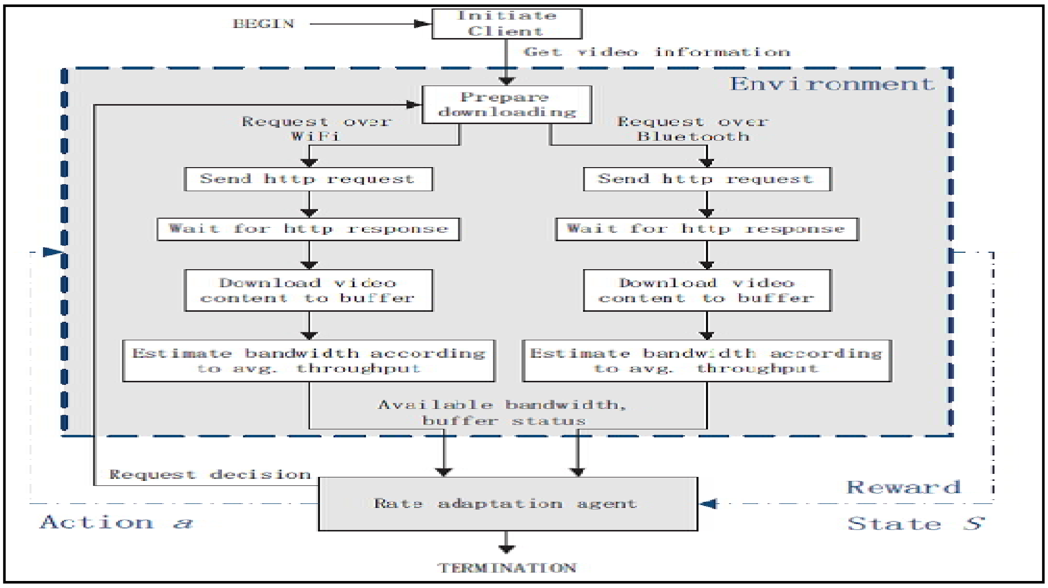

Fig.1. Matching pairs identified between the image1 and image2

B. *MARKOV DECISION PROCESS:*

A finite state Markov Decision Process (MDP) can be modeled for this reinforcement learning task [16]. To solve the MDP in real time, we proposed an adaptive best-action search algorithm to obtain a sub-optimal solution. MDP problem is formulated in video streaming process over multiple links. According to [17], the MDP can be viewed as a decision tree. The current state represents the root of the decision tree, and the future possible actions and states form the node and leaves. Since the recursive search will not try the next action until it reaches the leaves. Thus, our real-time search algorithm is a depth-first algorithm. There is no need to store all the states and actions in the stack while searching the tree, so the memory consumption of our recursive search algorithm is not high [16].

C. *PRACTICAL ALGORITHM DESIGN:*

Rapid network load changes and short-term outages are difficult to predict, and the resultant available bandwidth for a session becomes a time-varying random process. Thus, instead of using a homogeneous Markov chain to estimate the available bandwidth, in our work, a heterogeneous and time-varying Markov model is used to estimate the future bandwidth. The bandwidth of each link will be divided into several regions. Each region will represent a state of the Markov channel model, and the total number of the states is equal to the number of regions.

In dynamic programming considers all the possible future steps to obtain the optimal solution, it results in an extremely long computation time. If only parts of the future steps are considered, a sub-optimal solution can be obtained. Based on this idea, we develop a real-time recursive best-action search algorithm, which is shown in Algorithm 1. To meet the requirement of the real-time search, an important issue is to reduce the search duration for each state to an acceptable value. We achieve this goal by setting a small search depth D to invoke the search algorithm. For the current state s, all the possible actions A(s) will be enumerated. The recursive reward search algorithm is invoked to obtain the reward of state s with action a by enumerating all the possible future states S_ and their associated actions A’(s). The search depth can determine how good the search result is, and a larger value of depth will achieve a better result. Meanwhile, with the increment of the search depth, the search time to obtain the action for a segment will be increased exponentially. Therefore, the search depth can be viewed as a trade-off between the video quality and the search time [1].

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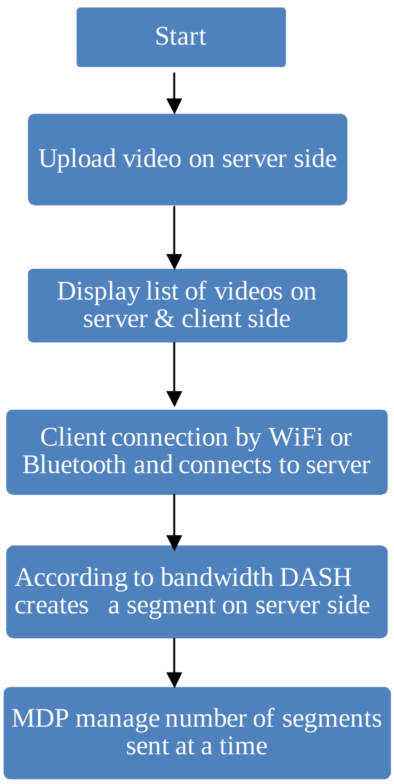
Algorithm 1 Real-Time Best-Action Search Algorithm

```
procedure GETBESTACTION(s)
    Initialize action ← −1, Q_max ← −∞
    Generate all possible actions A(s) for state s
    for all Action a ∈ A(s) do
        q ← REWARDSEARCH(s, a, 0)
        if q > Q_max then
            Q_max ← q, action ← a
        end if
    end for
    return action
end procedure

procedure REWARDSEARCH(s, a, d)
    q ← reward of (s,a)
    if d ≥ D then
        return q
    end if
    Generate all possible next states S' of (s,a)
    for all s' from S' do
        Q_max ← −∞
        Generate all possible actions A'(s) for state s'
        for all Action a' ∈ A'(s) do
            Q_t ← REWARDSEARCH(s', a', d + 1)
            if Q_t > Q_max then
                Q_max ← Q_t
            end if
        end for
        q ← q + γ P_ss' Q_max
    end for
    return q
end procedure
```

Fig.2. Real time best action search algorithm

D. FLOW DIAGRAM:



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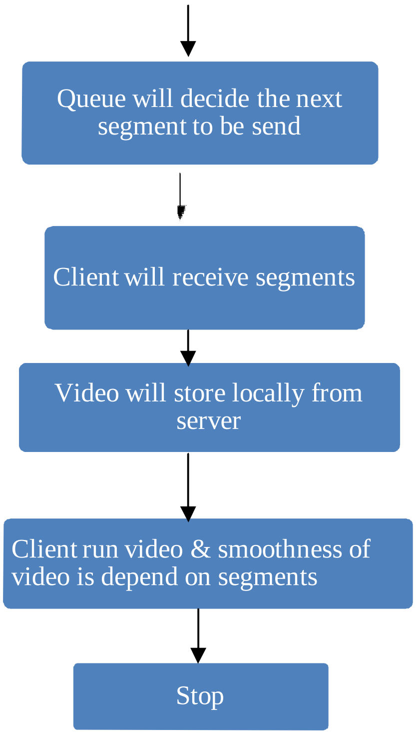

Fig.3. flow diagram

V. Applications

A. *ONLINE BUSINESS:*

Adding video streams to your online business is one of the best things an entrepreneur can do to recover and develop their website. For instance, an electronic gadget shopping website with video clips of how to use electronic items is much more interesting and engaging than a simple website that only have relevant information.

B. *E-LEARNING:*

The field of e-learning has been a precursor in using the video streaming over the Internet. Both the synchronous and the asynchronous options have been explored over the last decade, with the asynchronous one becoming the dominant paradigm in recent years.

C. *TWO WAY CONFERENCING:*

Live Video Streaming is coming as a great future for corporate world as it provides facility for two-way video web conferencing facility.

D. *BROADCAST TV :*

Streamed Video can also be used for much more than just playing broadcast-television-like clips over the Internet.

VI. Conclusion

In this paper, we proposed a real-time adaptive best-action search algorithm for video streaming over multiple wireless access networks. To meet the requirement of the real-time search, an important issue is to reduce the search duration for each state to an acceptable value. First, we formulated the video streaming process as an MDP. To achieve smooth video streaming with high quality, the reward function is designed. Second, with the proposed rate adaptation algorithm, we can solve the MDP to obtain a sub-optimal solution in real time.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

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REFERENCES

1. Min Xing , Siyuan Xiang and Lin Cai,, "A Real-Time Adaptive Algorithm for Video Streaming over Multiple Wireless Access Networks," IEEE Journal On Selected Areas In Communications, Vol. 32, No. 4, April 2014.
2. K. Tappayuthpijarn, T. Stockhammer, and E. Steinbach, "HTTP-based scalable video streaming over mobile networks," in IEEE ICIP'11, pp. 2193–2196,2011.
3. R. Mok, X. Luo, E. Chan, and R. Chang, "QDASH: a QoE-aware DASH system," in ACM MMSys'12, 2012, pp. 11–22.
4. S. Xiang, L. Cai, and J. Pan, "Adaptive scalable video streaming in wireless networks," in ACM MMSys'12, 2012, pp. 167–172.
5. C. Mueller, S. Lederer, and C. Timmerer, "A proxy effect analyis and fair adatpation algorithm for multiple competing dynamic adaptive streaming over HTTP clients," in IEEE VCIP'12, 2012, pp. 1–6.
6. T. Kupka, P. Halvorsen, and C. Griwodz, "Performance of on-off traffic stemming from live adaptive segmented HTTP video streaming," in IEEE LCN'12, pp. 401–409, 2012.
7. S. Akhshabi, S. Narayanaswamy, A. C. Begen, and C. Dovrolis, "An experimental evaluation of rate-adaptive video players over HTTP," Signal Processing: Image Communication, vol. 27, no. 4, pp. 271–287, 2012.
8. S. Xiang, "Scalable Video Transmission over Wireless Networks," Ph.D. dissertation, University of Victoria, 2013.
9. L. Cai, S. Xiang, Y. Luo, and J. Pan, "Scalable modulation for video transmission in wireless networks," IEEE Trans. Veh. Technol., vol. 60, no. 9, pp. 4314–23, 2011.
10. S. Xiang and L. Cai, "Transmission control for compressive sensing video over wireless channel," IEEE Trans. Wireless Commun., vol. 12, no. 3, pp. 1429–37, 2013.
11. M. Kobayashi, H. Nakayama, N. Ansari, and N. Kato, "Robust and efficient stream delivery for application layer multicasting in heterogeneous networks," IEEE Trans. Multimedia, vol. 11, no. 1, pp. 166–176, 2009.
12. R. Zhang, R. Ruby, J. Pan, L. Cai, and X. Shen, "A hybrid reservation/contention-based mac for video streaming over wireless networks," IEEE J. Sel. Areas Commun., vol. 28, no. 3, pp. 389–398, 2010.
13. T. Luan, L. Cai, J. Chen, X. Shen, and F. Bai, "Engineering a distributed infrastructure for large-scale cost-effective content dissemination over urban vehicular networks," IEEE Trans. Veh. Technol., 2013.
14. A. Yaver and G. Koudouridis, "Utilization of multi-radio access networks for video streaming services," in IEEE WCNC'09, pp. 1–6, 2009.
15. D. Kaspar, K. Evensen, P. Engelstad, and A. Hansen, "Using HTTP pipelining to improve progressive download over multiple heterogeneous interfaces," in IEEE ICC'10, pp. 1–5, 2010,
16. H. Wang and N. Moayeri, "Finite-state Markov channel-a useful model for radio communication channels," IEEE Trans. Veh. Technol., vol. 44, no. 1, pp. 163–171, 1995.
17. Q. Zhang and S. A. Kassam, "Finite-state Markov model for Rayleigh fading channels," IEEE Trans. Commun., vol. 47, no. 11, pp. 1688–1692, 1999.
18. X. Hou, P. Deshpande, and S. Das, "Moving bits from 3G to metroscale WiFi for vehicular network access: An integrated transport layer solution," in IEEE ICNP'11, 2011, pp. 353 –362.
19. I. Kofler, R. Kuschnig, and H. Hellwagner, "Implications of the ISO base media file format on adaptive http streaming of h. 264/svc," in IEEE CCNC'12, 2012, pp. 549–553.
20. M. Xing, S. Xiang, and L. Cai, "Rate adaptation for video streaming over multiple wireless access networks," in IEEE Globecom '12, 2012, pp. 5745-5750.
21. T. Stockhammer, "Dynamic adaptive streaming over HTTP –: standards and design principles," in ACM MMSys'11, 2011, pp. 133–144.