

ONLINE VIDEO STREAMING APPLICATIONS IN EDUCATION INDUSTRY

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Abstract—Communication media have become the primary way of interaction thanks to the discovery and innovation of many new technologies. One of the most widely used communication systems today is video streaming, which is constantly evolving. Such communications are a good alternative to face-to-face meetings and are therefore very useful for coping with many problems caused by distance. However, they suffer from different issues such as bandwidth limitation, network congestion, energy efficiency, cost, reliability, and connectivity. Hence, the quality of service and the quality of experience are considered the two most important issues for this type of communication. This work presents a complete comparative study of two of the most used protocols of video streaming, Real-Time Messaging Protocol (RTMP) and the Web Real-Time Communication (WebRTC). The new video streaming applications are also compared with the most popular video streaming applications for Android, and the experimental results of the analysis show that the developed WebRTC implementation improves the performance of the most popular video streaming applications with respect to the steam packet delay.



Figure 1: communication through different mediums

Keywords: streaming, quality of experience, quality of service, WebRTC, RTMP

1. INTRODUCTION:

The consumption of online video is growing rapidly, and the average person will spend half as much time viewing online video as they spend viewing conventional television this year. This rapid increase is partly due to the huge growth in the sales of smartphones over the last few years, as smartphone companies have tried to develop new strategies to improve the Quality of Experience (QoE) and the Quality of Service (QoS) of their systems. The life of people can change with simple streaming applications as some of the uses of this technology can turn people into potential artists who use their systems to broadcast videos over the Internet or use this technology in e-learning. In this work, the most used video streaming protocols and applications are studied. In particular, two video streaming platforms have been developed that implement different video streaming protocols in order to compare both protocols and conclude which of them offers the best results in the scope of web real-time video streaming applications. The analysis of the implemented systems includes different parameters related to the QoS and QoE, namely the connection establishment time and the stream reception time. Although the QoE depends on the users in a subjective way, it depends directly on the QoS because a good QoS helps to obtain a better QoE by the user. For this reason, the parameters analyzed in this work measure the QoS in a direct way, but indirectly influence the QoE. In addition, these two implementations were compared with the most widely used web video streaming applications, which implement those and other protocols. In order to carry out such a comparison, a metric based on the stream delay time was used to know the efficiency of the implemented systems in relation to the most used systems today. The present work is structured as follows. Section 2 describes a brief state-of-the-art. Section 3 introduces two of the most commonly used video streaming protocols, RTMP and WebRTC. The developed implementations are defined and present the comparative studies between the

implemented systems and the most used web and Android applications. Finally, some conclusions and open issues close to the work.



Figure 2: Visualization of the contents

2. COMPARATIVE STUDY

WebRTC is a modern protocol supported by modern browsers. It uses UDP, allowing for quick lossy data transfer as opposed to RTMP which is TCP based. WebRTC has very high security built right in with DTLS and SRTP for encrypted streams, whereas basic RTMP is not encrypted. There are many other advantages to using WebRTC over RTMP, but it's not always the right choice.

For one, many browsers don't yet support WebRTC. As of today, you can see that it gets a bit spotty with Microsoft Edge, and Apple Safari has zero support for it today, not to mention that older browsers like Internet Explorer do not support WebRTC either.

Additionally, most encoders, whether software-based like OBS and Xsplit, or hardware-based like HaiVision products, don't yet support WebRTC, but all support RTMP. If you plan to integrate with third party encoders for your app, you will absolutely need to support RTMP. Both technologies have their own strengths and limitations. RTMP is based on the Transmission Control Protocol (TCP), and it allows data transmission in a given sequence and order with delivery guarantee. Even if it uses more reliable network connection, latency is often

0.5 seconds or more dependent on network settings. On the other hand, WebRTC is based on UDP, and it offers near real-time latency with less than 0.1s. Hence WebRTC is arguably better for two-way conferencing or real time device control.

2.1 Scalability

In terms of scalability, RTMP can be scaled to provide live streaming to thousands or even millions of audiences. In contrast, WebRTC is often used to provide live streaming to a smaller number of audiences,

normally within a thousand limits. However, this is debatable, as some people argue that the Peer-to-Peer nature of WebRTC will not cause scalability issues if implemented properly. But when it comes to scaling, RTMP is definitely taking the lead. For use cases that require live streaming to thousands of viewers, RTMP is the better choice.

2.2 Encoder/Player and Browser Support

Due to the wide adoption of RTMP, it is supported by most encoder software and video players. However, due to the end of life of the Flash player, it starts to lose support by modern browsers. On the other hand, WebRTC has better support by modern browsers with built-in API support in HTML5, and can be played within most modern browsers without installing any software or plugins. In terms of encoder or video player support, lots of software vendors start to recognize the popularity of WebRTC, and start to add WebRTC into their support list.

2.3 Cloud Support

Most cloud providers such as AWS or Alibaba Cloud have video streaming services that can be directly integrated with RTMP. For example, Alibaba Cloud has a service called ApsaraVideo Live that is compatible with RTMP. In contrast, to run video streaming using WebRTC, we will need to install on-premise streaming servers such as Jitsi Meet on to the cloud.

2.4 API Support

When it comes to development, API support is a key factor for choosing your technology. WebRTC is taking the lead for API support, as most modern browsers have native API integrated with WebRTC, and can be called directly using JavaScript. On the other hand, to work with RTMP, we will need to leverage open-source libraries, or use pre-existing software solutions such as OBS.

3. IMPACT IN EDUCATION LIFESTYLE

Although, streaming media and technology in the education industry has been in use since a century ago; film, television, videotapes, video disks, digital desktops and many more. Today, the advancement in technology has also introduced applications for these online classes which are taking place in the ongoing pandemic situation. But as a coin, everything has two sides; the same goes for these media in the education industry. It has both its advantages and disadvantages too.

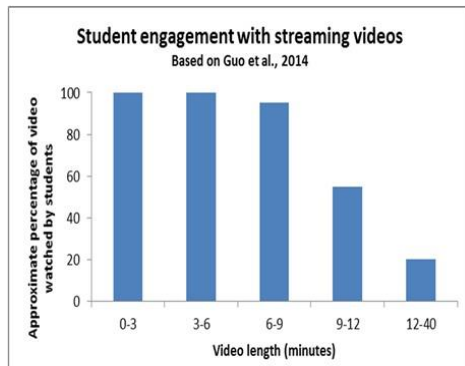


Chart 1- stats of engagement with these apps

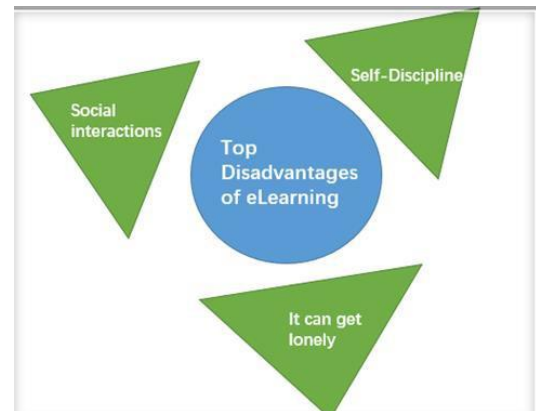


Figure 4: Factors that get disturbed

A. Advantage

The biggest advantage of streaming media is the real interactivity of both -the teachers and the students. Moreover, data flow control is in the hands of teacher until they provide it to the someone else which disable students to wander and allows them to focus on the content which is being discussed. Lastly, as it is very clear and obvious that theoretical things come with great understanding when visualized, streaming media helps in bringing this ideology into implementation.



Figure 3: Advantages of e-learning

B. Disadvantage

The disadvantage starts with adding up the immobility of the users. Teachers and students construct their own resources which creates problems like analogousness which is encounterable. It also gives birth to forgery attendances and cheating in online assessments. Moreover, the major impact on health as most of the day spending time over screens brings our very vital senses and organs in danger.

4. CONCLUSION

This work includes a complete analysis of the most used video streaming protocols, impact in the education industry, paying special attention to RTSP and WebRTC protocols. Moreover, two new streaming platforms have been developed to compare both protocols and optimize their operation. These implementations have been built taking into account the most common schemes and conditions of use of Android applications. The analysis of the QoE and the QoS of both platforms was performed using two metrics: the establishment connection time and the stream reception time. From the experiments, it is concluded that WebRTC over RTSP for both communication establishment time and package sending time. Moreover, the implemented systems have been compared with the most common commercial applications through two experiments. On the one hand, the new implemented platforms have been compared with the most common smartphone to web video call applications, using external software because the code of such proprietary applications is not accessible. In this experiment, both the new Direct WebRTC platform and the Hangouts application showed similar and better behaviour than the other compared systems. On the other hand, the implemented Direct WebRTC platform was compared to the most common smartphone to smartphone Android video call applications, using the aforementioned external software because the code of these proprietary applications is not accessible either. In that experiment, the implemented Direct WebRTC system again showed a good response, and together with the Google Duo application, showed the best results of the comparison. Therefore, at this point, it is possible to confirm that the use of the WebRTC protocol provides better QoE and QoS than other protocols, and that the implemented Direct WebRTC system offers good results, according to the performed experiments. This work may lead in the future to new works where the knowledge system offers good results, according to experiments performed. This work may lead in the future to new works where the knowledge obtained in the study and

implementation of the two protocols discussed here would help to study and implement adaptive streaming protocols to further improve the proposed video streaming platforms. Moreover, the study of new metrics to compare the presented streaming platforms with the commercial ones would make sure that the presented study could cover other aspects. Finally, a study on how video resolution and quality affect bitrate, QoE and QoS of the video streaming applications could be added when the adaptive video streaming platforms are developed.



Figure 5: Attributes of Learning

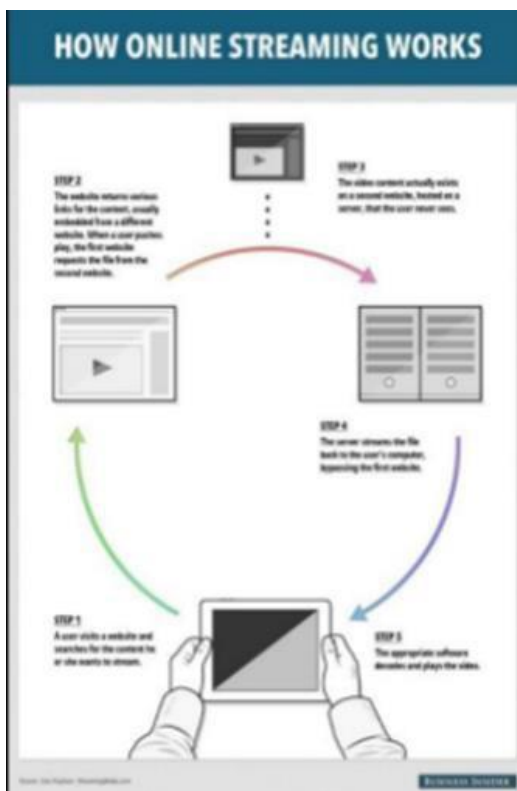


Figure 6: How does video streaming work

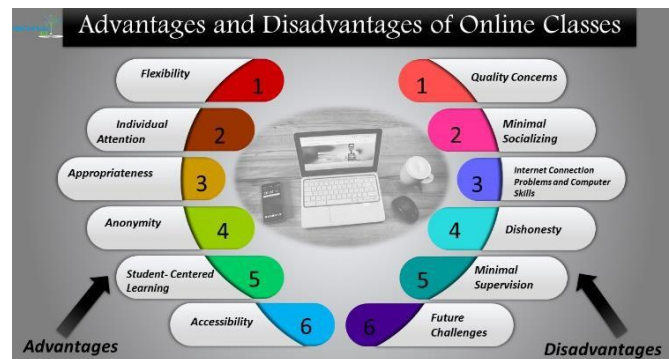


Figure 7: Pros and Cons of E-learning

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BIOGRAPHIES



Dr Supreet Kaur Sahi is having more than 12 years of experience in teaching and industry. She is UGC NET qualified and has PHD(CS), MPhil (CS), MCA, PGDIT, BSc(H)CS degrees. She has more than 25 publications in different National and International journals. Her area of research includes Cloud Computing, Digital Marketing and Software Engineering.



Bhoomika Gupta is a highly skilled and research-oriented person. She always looks upon new tasks with great zeal. She is a very enthusiastic person and good at managing tasks.



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