H.264/SVC Streaming in an Adaptive Multimedia Cloud Computing Center

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ABSTRACT: In recent years, multimedia streaming technology has matured, and as network bandwidth and processing capacity of personal handheld devices have improved, the demands for multimedia quality have risen. In order to offer high-quality service, how to split the loading of content servers to enhance streaming quality is a significant issue when delivering multimedia material to a large number of consumers. As the idea of a multimedia cloud network takes shape, the question of how to distribute resources arises. Multimedia streaming service to the media cloud network's nodes This paper discusses it. This research develops an H.264/SVC streaming service for the media cloud computing center, using the most appropriate video. Based on H.264/SVC characteristics (temporal) for client-side quality network bandwidth and scalability (scalability, spatial scalability, and quality scalability). Furthermore, the load balancing and communication methods must be considered. Client-side bandwidth and processing power are debated amongst nodes, with the best node chosen by the evaluating node, for selecting the optimal video streaming route that is utilized to offer quality.a streaming multimedia service According to the findings of the experiments, The bandwidth forecast error rate for typical multimedia network streaming services may be kept at about 6%, while the utilization rate can be kept at around 80%.The multimedia cloud computing center's numerous nodes are kept in Throughout the execution of a multi-streaming service, a balanced state

KEYWORDS: Adaptive multimedia streaming, H.264/SVC, Cloud computing center.

1. INTRODUCTION

The smart phone, with its multimedia-related services, has grown more popular as the internet and hand-held gadgets have quickly evolved. Highly compressed video formats are provided in order to provide viewers with the greatest video quality. Almost all contemporary streaming methods utilize the uncast mode to transmit video of particular quality as needed by each user while using fixed network streaming resources. However, if the number of users grows quickly, the efficiency of video servers is expected to decline, making it impossible to meet the requirements of all users. Adaptive Multimedia Cloud Computing Center was established by the Institute for Computer Sciences, Social Informatics, and Telecommunications Engineering [1]. It has been used in most instances, the video server side stores enormous video data, including many different types of video, and the same video data may be split according to quality, resulting in a very big data volume that requires a lot of storage resources.

Furthermore, the server must function as a streaming server, transferring movies to suitable viewers, making computational resources even more important. As network bandwidth grows and PC computing power grows, all computers can become computing nodes in a network, resulting in the formation of a cloud computing architecture, in which available network nodes are managed for data storage and video streaming, reducing the workload on specific servers. This paper covers H.264/SVC, a novel coding method that utilizes Inter Layer Prediction to significantly decrease file size after coding, and packet analysis/filtering to evaluate video play quality. This research employs the cloud computing mechanism to manage the resource of computing nodes in a media cloud for specific nodes to execute storage and streaming of video data, as well as to dynamically evaluate network bandwidth conditions and computing power of nodes in the media cloud, and to use an Index Node to select storage and streaming nodes, thereby providing users with the best viewing quality. The following are the study's contributions: This part gives a quick overview of multimedia cloud computing and related research, which may assist readers who aren't familiar with the topic grasp the paper's structure. In order to meet user demands for high-quality and diverse multimedia, the cloud center must offer an efficient, flexible, and scalable data processing method for cloud computing multimedia services.

Users are no longer restricted to home network services as a result of the widespread adoption of smart phones and wireless networks; instead, they may access multimedia information and easily enjoy ubiquitous network services by utilizing mobile devices. However, because the current mobile streaming service has a bandwidth bottleneck and different requirements for device performance, cloud computing provides multimedia content suitable for a terminal unit environment, which also considers the overall network environment and dynamically adjusts the transmission frequency of both sides and multimedia transcoding, thus avoiding bottlenecks. A due management architecture control module for a Multimedia Content Cloud was developed in the theses. As a result, a number of research have offered a variety of viewpoints on cloud management architecture. Multimedia encoding and decoding on the cloud may quadruple the efficiency of multimedia services, and there are typically three main services in a Cloud. Information analysis utility for multimedia files. Terminal connection network quality status analysis function.

Multimedia Codec decoding service. When decoding frames in a multimedia format, data dependency issues are common; for example, when decoding frames in H.264/SVC, the frames may be split into I frame, P frame, and B frame. The image data of I-Frame of GOP (Group of Pictures) is used to decode the P frame, and picture data other than I frame and P frame is used to decode the B frame. H.264/SVC scalability may be split into three categories: temporal scalability, spatial scalability, and quality scalability. As a result, entropy decoding (ED), inverse quantization and inverse transform (IQ/IT), intra or inter prediction (PPC), and daglocking may be roughly split into a typical H.264/SVC decoding process (DF). As a result, several studies construct a module for each processor based on the idea of dispersion to a cloud center for computing power parallel processing based on the decoding process, allowing processing to be expedited because the processors share the processing burden. The benefit of this method is that it eliminates data dependency quickly and easily; nevertheless, it has a flaw in that module distribution in cloud computing is restricted to the number of assigned jobs. The suggested H.264/SVC-based multimedia cloud service architecture paradigm, which seeks to offer consumers with real-time and high-quality movies, is described in this chapter. In order to alleviate the excessive burden on conventional multimedia servers, the nodes in a media cloud are separated into Index Node, Content Node, and Streaming Node, based on the layered coding architecture of SVC and the analytical separation of bit stream. Traditional multimedia servers must have on-line management, data storage, and media streaming, all with simultaneous functions, in order to handle the demands of many users, and if the server-side cannot dynamically assign users to nodes with better bandwidth, the overall streaming service quality will suffer. As a result, the total streaming efficiency may be significantly improved when bandwidth for streaming video quality is dynamically allocated to different nodes in the media cloud in order to balance the loading on the nodes [2].

2. DISCUSSION

2.1. APPLICATION:

The suggested central structure in this research is illustrated in Fig. 1; the media cloud has one index node, numerous content nodes, and streaming nodes, and their roles are explained below. It is an index node that records the dynamics of all nodes in the media cloud, including node registration and departure, node type and IP information, and actively sends inquiry or control commands to content and streaming nodes. A content node is a storage location for particular media fragments. When a new video is added to the media cloud, it is split into multiple segments and stored in multiple content nodes throughout the media cloud, avoiding bandwidth bottlenecks caused by all streaming nodes accessing the same video content node. The streaming node captures specific video segments from the content node in response to a user request to the index node for video, and then refers to the streaming node's bandwidth and the lowest bit rate for playing the video segments to determine the level of video stuttering. This chapter explains the practical method of center operation, as well as command communications and data transfer direction among the many nodes. The index node, as stated in the previous chapter, keeps track of the status and information of all the nodes in the media cloud.

As a result, the index node must actively send and execute all command transfers. When the client wishes to watch a video, it first sends a video request to the index node, with step 1 being the appropriate instruction. When the index node receives the client-side request, a series of Loading Balance mechanisms kick in, and the index node sends information to all content nodes in the media cloud, as step 2, Check Available Content. A full video is split into several parts before entering the media cloud for storage in different content nodes of the media cloud, as stated in the previous chapter. This phase identifies which content nodes hold the required video segments after checking which nodes have the video segments to be played. Following that, the index node makes a request to the streaming node asking about bandwidth [3]. In step 3, Check Bandwidth, the index node sends individual requests to all of the streaming nodes in the media cloud questioning about bandwidth for the client-side, and then reports to the index node. The index node then sends bandwidth request queries to the filtered content nodes. The values are then returned to the index node. Step 4 enquires about each streaming node's hardware resource information in order to [4] estimate the work load of each streaming node and rearranges the equilibrium stock assessment. The outputs of the preceding four stages are sent to the loading balance model, which evaluates the entire network and selects nodes.

Following the Loading Balance Mechanism, practical content capture, analysis, separation, and streaming are carried out. In step 5, the index node instructs the chosen streaming node to establish the streaming quality level, which is shown in the image as Set Parameters. The index node passes the selected content node to the streaming node as a parameter, and the streaming node downloads a content based on the information, as shown in step 6, Download Content, and then analyzes and separates the content based on the parameters specified in the Set Parameters command. The packets may be split based on the information contained in the NAL Header due to the layering feature of H.264/SVC coding. Finally, the streaming route is returned to the index node, which then returns the streaming address to the client. Figure 1 discloses the Architecture of Adaptive Multimedia Cloud Computing Center.

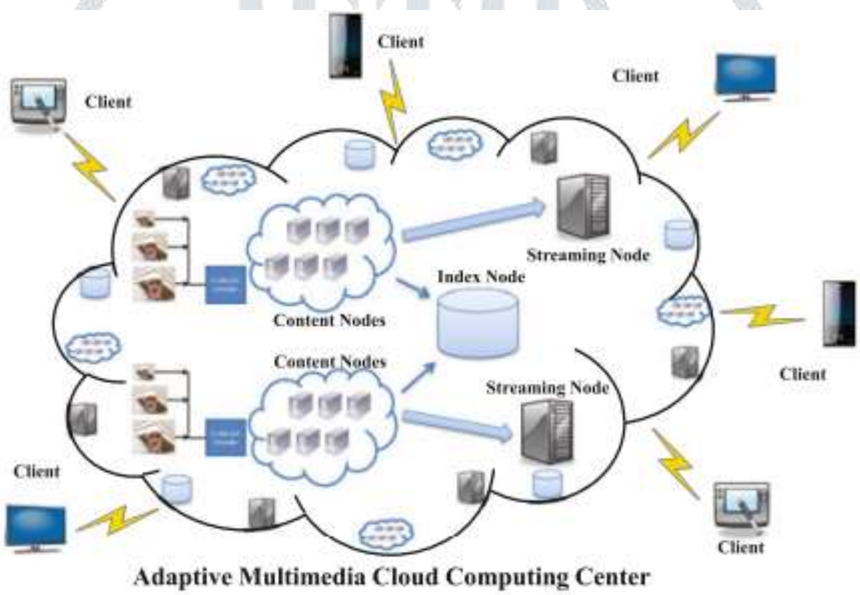

Figure 1: The Architecture of Adaptive Multimedia Cloud Computing Center.

2.2. ADVANTAGE:

Because bandwidth prediction must rely on substantial historical data and a self-designed mathematical model is utilized to forecast future bandwidth, the authenticity of bandwidth has a major impact on bandwidth prediction. As a result, the accuracy of the total bandwidth forecast model is heavily influenced by the filing and validity of previous data. This research examines and predicts the bandwidth results obtained at different endpoints in order to build the client-side bandwidth prediction model of a streaming node. First, the video segment length is set to n seconds and divided into m segments; therefore, the quality level of the No. 1 video segment must be determined during the playback of No. 0 segment; thus, this study divides every k seconds into data groups, which are analyzed and polynomial regression is used to calculate the regression polynomial curve in order to predict the data distribution pattern of data p. Eq. 1 describes polynomial regression, where is an error constant[5].

+ amxm + y = a0 + a1x + a2x2 + y = a0 + a1x + a2x2 + y = a0 + a1x + a2x2 + y (1)

Extend the data into multidimensional data distribution according to the polynomial regression curve derived from Eq. 1, where the polynomial curve may be represented and the data distribution pattern is similar to Eq. 1. Eq. 2 is a matrix expression for the distribution of polynomial curves of multidimensional data. Finally, the simplified findings may be written in vector form as Eq. 3. y1... yn +

1XT y = a = (XT X) (3) Use the polynomial curves obtained from An1 to An5 in the X-coordinate of an to obtain a corresponding Y value, which is the predicted bandwidth, and the mathematical expression; use the polynomial curves obtained from An1 to An5 in the X-coordinate of An to obtain a corresponding Y value, which is the predicted bandwidth, and the mathematical expression. However, since an is a computed value rather than a measured value, a second revision is necessary, as indicated in Eq. 4. To get the new value, an rev, we may average the An est. derived through polynomial regression and the An rel of a real bandwidth measurement device in order 20 W.-T. Cho and C.-F. Lai. Finally, a rev is replaced in another regression prediction curve to keep the regression prediction curve in constant revision for accurate prediction. Streaming Node Selection and Balancing Mechanism The loading balancing model's main goal is to keep the Work Loading of all nodes in the media cloud constant while improving the viewing quality on the client side. As a result, with the operation architecture illustrated in Fig. 3, the index node analyzes the current state of the streaming node, including the bandwidth of the client-side streaming node, the computational power of the streaming node, and the bandwidth of the content node for the streaming node [6].

2.3. WORKING:

The suggested central structure in this research is illustrated in Fig. 1; the media cloud has one index node, numerous content nodes, and streaming nodes, and their roles are explained below. It is an index node that records the dynamics of all nodes in the media cloud, including node registration and departure, node type and IP information, and actively sends query or control instructions to content and streaming nodes. A content node is a storage location for particular media fragments. When a new video is uploaded to the media cloud, it is split into several segments and stored in different content nodes across the media cloud, eliminating bandwidth constraints caused by all streaming nodes accessing the same video content node. The streaming node captures specific video segments from the content node in response to a user request to the index node for video, and then refers to the streaming node's bandwidth and the lowest bit rate for playing the video segments to determine the level of video stuttering. This chapter explains [7] the practical method of center operation, as well as command communications and data transfer direction among the many nodes. The index node, as stated in the previous chapter, keeps track of the status and information of all the nodes in the media cloud.

As a result, the index node must actively send and execute all command transfers. The center operation flow is shown in Figure 2. When the client wishes to watch a video, it first sends a video request to the index node, with step 1 being the appropriate instruction. When the index node gets the client-side request, a series of Loading Balance processes kick in, and the index node transmits information to all content nodes in the media cloud, as step 2, Check Available Content. A full video is split into several parts before entering the media cloud for storage in different content nodes of the media cloud, as stated in the previous chapter. This phase identifies which content nodes hold the required video segments after checking which nodes have the video segments to be played. Following that, the index node makes a request to the streaming node asking about bandwidth. In step 3, Check Bandwidth, the index node sends individual requests to all of the streaming nodes in the media cloud questioning about bandwidth for the client-side, and then reports to the index node. The index node then sends bandwidth request queries to the filtered content nodes. The values are then returned to the index node. Step 4 enquires about each streaming node's hardware resource information in order to estimate the work load of each streaming node and rearranges the equilibrium stock assessment. The outputs of the preceding four stages are sent to the loading balance model, which evaluates the entire network and selects nodes [8]. Following the Loading Balance Mechanism, practical content capture, analysis, separation, and streaming are carried out. In step 5, the index node instructs the chosen streaming node to establish the streaming quality level, which is shown in the image as Set Parameters. The index node passes the selected content node to the streaming node as a parameter, and the streaming node downloads a content based on the information, as shown in step 6, Download Content, and then analyzes and separates the content based on the parameters specified in the

Set Parameters command. The packets may be split based on the information contained in the NAL Header due to the layering feature of H.264/SVC coding. Finally, the streaming route is returned to the index node, which then returns the streaming address to the client. This section discusses the loading balancing model, which attempts to keep the work load of all nodes in the media cloud constant while improving streaming quality for clients. The loading balance model has two components: (1) a client-side prediction model for streaming node bandwidth, and (2) a streaming and content node selection and balancing method. Figure 2 discloses the Selection model of loading balance [9].

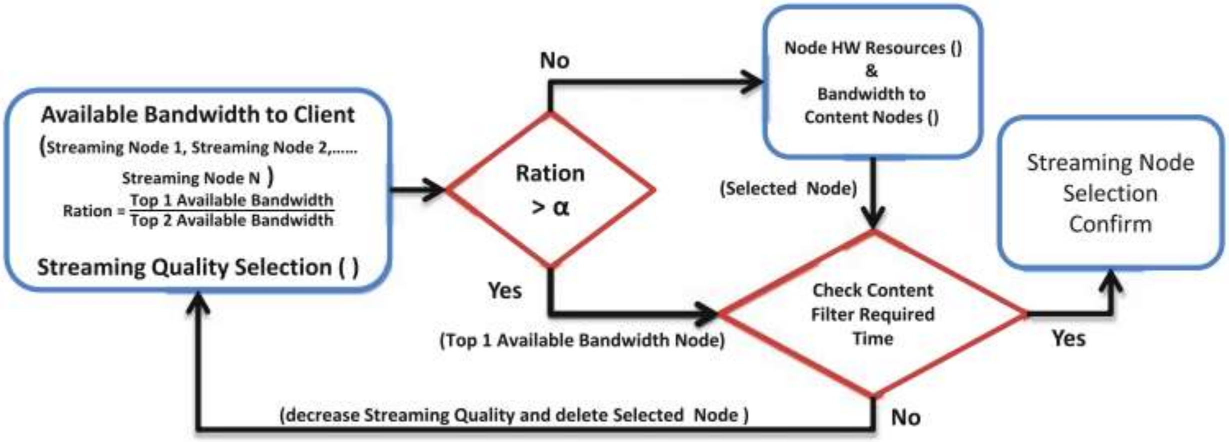

Figure 2: Selection model of loading balance

3. CONCLUSION

This research creates a video quality scalable streaming mechanism for the media cloud computing center, as well as communication and management mechanisms for the media cloud, such as a bandwidth measurement center and load monitoring mechanisms for specific nodes, and a balancing mechanism for node resources in the media cloud. During testing and analysis, we looked at the error rate and client-side delay time of a bandwidth prediction model with different bandwidths, as well as the multimode balancing mechanism's real operational impacts. In the event of variable bandwidths, the bandwidth prediction model's accuracy is determined by the video's average delay time on the client side. The streaming node's selection and balancing mechanism assesses overall efficiency based on each node's time belt average service rate, and examines the usefulness of the balancing mechanism by calculating the utilization rate and standby time. Because the bandwidth prediction model obtains the bandwidth prediction curve using polynomial regression, the denser the samples, the closer the prediction curve is to the real value. Because there is typically a fast delay in the transmission of large files across a network, bandwidth transmission becomes stable after a period of time; therefore, the bandwidth measurement device needs time for the measured data to approach the network's bandwidth values. As a result, the sample time and the measurement time for bandwidth must be matched [10].

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