



A Survey on open Source Protocols SIP, RTP, RTCP, RTSP, H.264 for Video Conferencing System

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ABSTRACT

The transporting, controlling and streaming media protocols such as RTP(Real-time Transport Protocol), RTCP(RTP Control Protocol) and RTSP(Real-Time Streaming Protocol), SIP(Session Initiation Protocol) is the basic protocol of the video conferencing system. A video conferencing system based on SIP, RTP, RTCP and RTSP is designed in this paper. The video conferencing system uses the SIP protocol to connect the client and the server, and provides the service of the multimedia data transmission between them with the RTP/RTCP and RTSP protocol. The video images of the conferencing system is encoded by H.264 video coding standard. The play of the video data is based on H.264 coding standards

Keywords

SIP, RTP, RTCP, RTSP, H.264, Video conferencing

I. INTRODUCTION

Video conferencing system, is a comprehensive system which is advanced, safe and with strong preventive ability. [1]. Along with the fast development of computer, network, image processing and transmission technology, digital video conferencing system has evolved into today's network video conferencing system [2]. Streaming media technology is the basic of the network video conferencing system. The transporting, controlling and streaming media protocols which include SIP, RTP, RTCP and RTSP provide the service of connecting the client and the server as well as the multimedia data transmission between them. SIP is a client/server protocol using the text mode which is intended to facilitate the development of new IP-based services [3]. SIP is a protocol for real-time communications application and it is developed by the IETF working group. RTP is a protocol developed by the IETF working group, it is used for providing end-to-end real-time transmission services for multimedia data such as audio, video in network [4]. RTP provides end-to-end transmission for real-time applications, but does not provide any guarantee of service quality. Quality of service is provided by RTCP. RTCP is an whole part of the RTP protocol, it mainly provides the monitoring and feedback of the service quality during the RTP packet transmission [5]. RTSP protocol is used to provide control services for streaming media data transmission on the network [6]. RTSP also provides remote control capability for audio and video such as play, stop, fast forward, and so on. The H.264 video coding standard is used for encoding the video images of the conferencing system. The H.264 standard is widely used in various fields for its high efficiency of the compress technology of coding and better adaptability on network.

In this paper first analyze the basic architecture of the video conferencing system, and then focuses on the modules of the system. And finally, the conclusion is also presented.

II. STRUCTURE AND PROCESS OF THE VIDEO CONFERENCING SYSTEM

A. Structure of the video conferencing system

Fig. 1 shows the structure of the video conferencing system. This conferencing system uses the client-server structure in the process of designing.

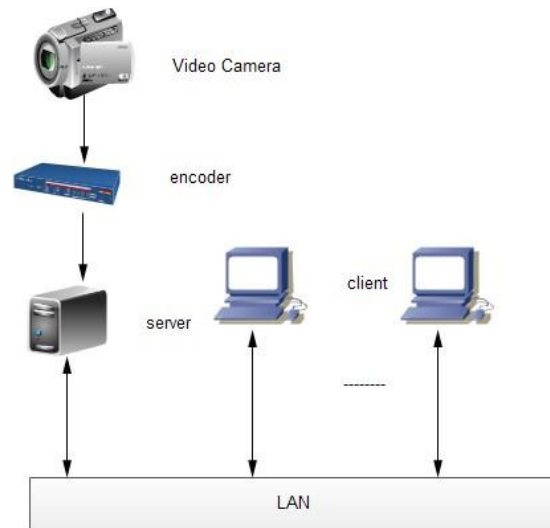


Fig. 1 structure of the video conferencing system [figure 1]

The server side is composed of the video camera, encoder and the server. The client connects with the server and receives the video data.

As shown in fig. 2, the video camera collects the real-time video signal in the monitored zone. The encoder (H.264) will encode the video images collected by the video camera with the H.264 video coding standards. The multimedia data encoded by the encoder will be transmitted to the server and the server of the video conferencing system will receive the multimedia data. After the corresponding data processing, the server of the conferencing system will transmit the multimedia data to the client.

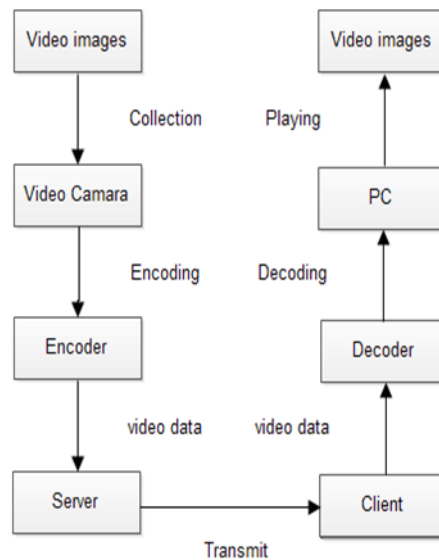


Fig.2 process of the video conferencing system [figure 2]

After the client of the video conferencing system receives the multimedia data from the server, it will decode the data with the H.264 coding standard. after some corresponding data processing. Then the video images can be presented.

B. Process of the communication between the client and the server

Fig. 3 shows the processes of the communication between the client and the server. The communication between the client

and the server is mainly composed of two parts, the first part is the connection established between the server and the client through the SIP protocol. The SIP server will send the metadata document which contains the address of the video requested by the client and some other information to the client. The second part is the communication between the media client and the media server. The transmission of multimedia data between server and client is completed in this part.

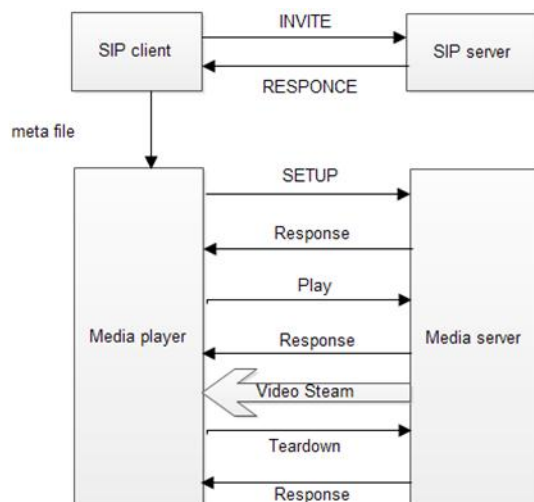


Fig. 3 process of the communication between client and server.[figure 3]

In first part of the video conferencing system, the SIP client sends the invite message to request video files from the server side. Then the SIP server will response to the client and send the metafile to the SIP client. The metafile contains the address of the multimedia data which is needed for the media server to transmit data.

In second part of the system, the multimedia data is transmitted. The SIP client transfers the metafile to the media player to request the video data. The RTSP client of the media player will send Setup message to the RTSP server of the media server to establish a connection. After receiving the response from the media server, the RTSP client will request the video data by sending Play message relying on the address of the video data in the metafile. The media server uses RTP, RTSP protocol to send the video stream to the media player. After the media player receives the video data, it will decode the data and play it on the client side. The RTSP client can send the Teardown message to disconnect with the media server.

III. THE DESIGNING MODULES OF THE VIDEO CONFERENCING SYSTEM

A. Collection and encoding of the video data

The collection of the video data is the main part of the video conferencing system. The video camera is responsible for the collection of the video images. After collecting the video images, the video camera will transmit the video data to the encoder.

The encoder is responsible for the video data encoding. As shown in fig. 4, the H.264 encoder encodes the video data collected from the video camera with H.264 video coding standard.

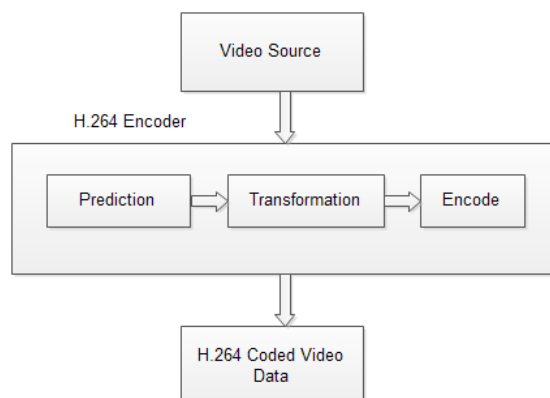


Fig. 4 process of encoding video data [figure 4]

The H.264 coding process is divided into three parts. Prediction, transform and encoding the video data stream [7]. Compared with other video coding standards such as MPEG-2 and MPEG-4, H.264 provides higher data compression ratio. And H.264 video coding standard provides video images with high quality and also improves the network adaptability. So, the video data coded with H.264 video coding standard is very suitable for the video conferencing system.

B. Connection and authentication of the client with server

Fig. 5 shows the connection and authentication of the client with the server through SIP protocol. The SIP protocol is a protocol for real-time communications application. SIP protocol is divided into three stages like establishing a session, communication stage and terminating sessions. The video conferencing system uses the SIP protocol to complete the authentication and connection between the client and server.

To connect the server, the client should send the userId to the server. The server will check the identity of the client based on the userId received from the client. If the userId is invalid, then server will refuse to connect with the client. If the userId is valid, then server will response to connect with the client. After authentication, client could request to the server for the video data. Then the server will send the metafile to the client. The metafile is a very small file which contains the address of the video data and some other information to receive the video data needed.

To achieve the video data, the client must be authenticated in order to ensure the security of the video conferencing system.

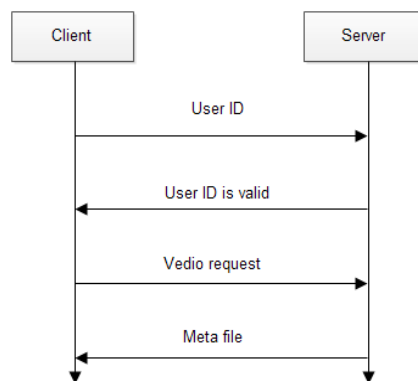


Fig. 5 connection and authentication of the client with server [figure 5]

C. Transmission of the multimedia (Audio, Video) data

Fig. 6 shows the process of the transmission of the multimedia data. The transmission of the multimedia data is based on RTP, RTCP and RTSP protocol. RTSP protocol is responsible for the control of the data transmission [8] Video data is packaged in the RTP packets. When the client sends the connection request, the server will create an RTSP session and save the client's information. The RTSP session will keep on and the client send the video information received from the metafile to the server to request for video data. The server will send RTP packets which include the video data to the client.

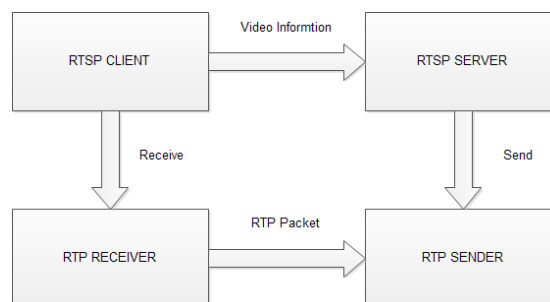


Fig. 6 Transmission process of the multimedia data [figure 6]

The video data is transmitted in RTP packets and the service quality during the RTP packets transmission is provided by the RTCP protocol [9]. In the process of transmission of the RTP packets, RTCP packets are transmitted on the network on period bases. The server will adjust the transmission rate of the RTP packets to adapt to the current network according to the related information of RTCP packets.

D. Decode and play the video data

Video data received from the server of the video conferencing system is in encoded form, the client side should decode the video data before playing. The client of the video conferencing system uses the H.264 coding format to decode the video data and play the video.

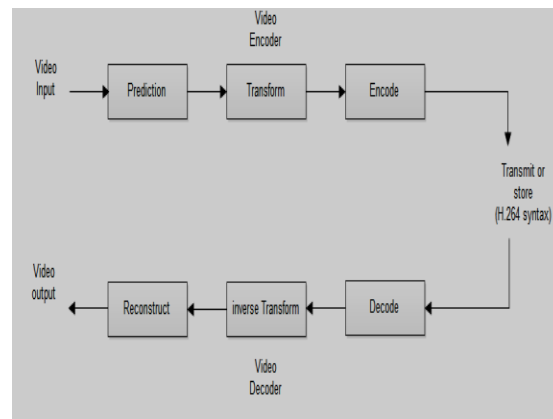


Fig. 7 Decoding and Playing process of multimedia data

IV. CONCLUSION

In this paper, designing of video conferencing system based on H.264 video coding standard and transporting, controlling, streaming protocols are SIP, RTP, RTCP and RTSP. The conferencing system uses H.264 video coding standard to encode the video data in order to lower the bit rate to improve the network adaptability. The system realize the connection and authentication between the client and the server with the SIP protocol and also effectively realizes the real-time transmission, playing of the video images with the RTP, RTCP and RTSP protocol. This conferencing system provides good video quality and adaptability of the network conditions.

There are many phases worthy of further study for this video conferencing system. System can be extended to the wireless network to satisfy the mobile users with different operating system. And quality-of-services option is open because we have to improve QoS as much as possible.

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