Relay Streaming System Model to Social Media Platform for Indoor Activity Broadcasting

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Abstract. The purpose of this research is to design a relay streaming model that can be streamed to several social media that provide live streaming services. The research method includes the analysis process which is divided into 4 stages. The first stage is an analysis of live streaming services on a social media. The second step is analysing the need for the server to be able to relay streams. The third stage is an analysis of the integration of the relay server system with live streaming social media services. The last stage is to design a system model based on previous analysis and determine the software requirements specification. The final result of this research is a relay streaming model with a server using Rasberry Pi which is integrated into Facebook and YouTube social media live streaming services. The development of this model is expected to solve the problem of limited indoor wireless networks and video input sources from various recording devices in relay streaming to several live streaming social media services simultaneously.

1. Introduction
One of the marketing strategies used so that an organization known by the community and has a selling value is to promote their activities using web platform. The use of web platform applications can be used to disseminate an activity or information so that the wider community knows it. R D Agustia utilizes a web platform for the distribution of visual learning which results in ease of students in obtaining learning information and improving school quality in the community [1]. According to E S Soegoto, one way to promoting their activities is by utilizing social media on the internet using web platform [2]. The socialization of activities through social media can be in the form of written or video activities, whether recorded in advance or broadcast live in the form of live streaming activities. The potential of this social media service is shown based on the results of a survey conducted by We Are Social [3] in 2019. It mentioned the number of active social media users in Indonesia reaching 150 million people with the order of the top 3 most widely used social media and having live streaming services are YouTube, Facebook, and Instagram. Streaming according to Munir [4] is a process to decode data in the form of audio and video that has been captured and stored in a temporary storage (buffer) that undergoes the process of encoding data using a specific format to overcome the limitations of network bandwidth. In research conducted by Wiegand [5], Codec (encode-decode) which becomes standard in the video coding industry is h264 AVC (audio video coding). Video streaming is divided into 2 ways, on demand and live stream. On demand means that the broadcaster team can first record the activities...
carried out then encoded and archived, the user can do the decoding process at any time as desired, while in the live streaming process, the broadcast team records the activities, videos then encoded, and directly decoded so that the video can appear on the receiver side. Recording can be done using devices that can be integrated with a live streaming social media service system such as a broadcast camera, IP camera or smartphone. So that each device can communicate on different platforms in the streaming process, the RTSP, RTMP, HLS, MMS, and RTP protocols are used [6-7].

YouTube and Facebook social media are platforms that provide free storage and live streaming services. Broadcaster teams from an organization using devices such as smartphones can utilize this live streaming service to socialize the activities that are being carried out. But not always the condition of the place that supports the live streaming process is done, activities carried out indoors can hinder the ability of the smartphone provider signal that affects streaming activities so that streaming cannot be done. Live streaming on social media YouTube and Facebook use the RTMP protocol service as a protocol where video delivery must go through RTMP Broadcaster. RTMP Broadcaster can only send video broadcast to only one social media service and cannot send to multiple social media services simultaneously.

Research on live streaming has been carried out by Wibisana [8] shows the results of the process of distributing information in the form of audio video can help support propaganda activities anywhere. Wahyudi [9] conducted other study on the effectiveness of information distribution using live streaming services. In this study, the instructor recorded teaching materials directly using a webcam and had already had an MPEG4IP broadcast application, then audio video captured will be sent to a web server that has the Darwin Streaming Server (DSS) application installed and then the instructors log in to be able to view the streaming audio video content. Limitations in this system are over-reliance on the use of DSS applications as streaming servers and the absence of a relay system to distribute content outside the scope of the institution.

Way to make the content can be distributed outside the scope of the institution then it needs to build a system that can process relay streaming to several social media that provides live streaming services such as Facebook and YouTube. To support streaming with the RTMP protocol a mini PC will be used using the Raspberry Pi as a streaming server. This is supported by research conducted by Winarto et al [10] who concluded that the use of the RTMP protocol is smaller and faster than using the RTSP protocol. To support the work of raspberry pi, Nginx will be used as a web server that acts as a relay streaming server, this is supported based on research conducted by Susanto et al [11].

Based on these problems, research is conducted so that the content of activities can be distributed live streaming outside the scope of the organization by utilizing very limited network resources. The purpose of this research is to design a relay streaming system model by utilizing the Raspberry Pi mini PC to social media on YouTube and Facebook simultaneously.

2. Method
The method used in this study is quantitative and qualitative approach. Data collection methods used include active and passive participant observation and documentation. In the pre-research study of literature is done through journals, proceedings, and textbooks related to live streaming. The software development method used in this study used two initial stages of the MDLC Luther method, which has been adopted by Sutopo, where the stages include the Concept and Design System. The stages of research conducted in this study can be seen in Figure 1.
1. **Analysis Social Media Live Streaming Services**
   At this stage an analysis is carried out on how a live streaming service can be done directly by accessing related social media that provides live streaming services. This stage is carried out by conducting a literature study on guidelines for the use of related services and collecting data by acting as an active participant observation.

2. **Analysis Relay Server**
   At this stage an analysis is carried out on how the Broadcaster team can manage and stream process using a streaming device that is owned and then forward it to a streaming relay system using a mini PC Rasberry Pi.

3. **Analysis Integration Relay Server to Social Media Live Streaming Services**
   At this stage an analysis will be carried out on how arrangements for integration between the Rasberry Pi relay server can be upstream to social media Youtube and Facebook simultaneously.

4. **Design Model and Functionality of Relay Streaming System**
   At this stage, the design of the relay streaming system architecture model and the functional requirements of the system model will be carried out.

### 3. Results and Discussion

#### 3.1. Concept of Relay Streaming Services

ReTrace stands for relay streaming services application that provides a functional way to continue audio video recording activities carried out by the broadcaster team from smartphone devices or the like that have device IP addresses and are integrated into an encoder application or broadcast application to be forwarded to a relay streaming server. This Relay Streaming server will forward the data back to YouTube and Facebook social media to be streamed simultaneously. Flow Relay Streaming Services System can be seen in Figure 2.

![Figure 2. Flow Relay Streaming Services System](image)

#### 3.2. Analysis Social Media Live Streaming Services

This section analyzes how a live streaming service on a social media can be carried out. Social media that will be used as a basis for analysis is YouTube's social media streaming service. Based on the results of data collection analysis using active participant observation techniques, the process of live streaming services can be done in two ways, namely through the YouTube site using a browser and through a third-party streaming application and then pushed to the YouTube site. The explanation of the stages can be seen in Figure 3 and Figure 4.

![Figure 3. Live Streaming Via Browser Client](image)
3.3. Analysis Relay Server

Relay server is part of a streaming relay system that functions to push audio video data from source media to the live streaming service of several social media simultaneously but before being streamed on social media streaming services, audio video data taken from media sources will be forwarded and encoded in a broadcast application. The broadcast application that will be used in this study is a third-party open broadcast system application. On open broadcast system application, the broadcaster team must determine the video resolution data, bitrate and type of codec so that the push streaming process runs well so that the realtime streaming process can be felt. Determination of the value of these parameters will refer to standards that can be accessed on the Youtube help page with the URL address https://support.google.com/youtube/answer/2853702?hl=en. Referring to the webpage for video resolutions up to 1080p, settings can be made namely video codec using h.264, frame rates up to 60 fps, audio codec using aac or mp3 and bitrate encoding is set at Constant Bit Rate (CBR).

After the open broadcast system is configured, a suitable streaming relay server is required. To avoid providing large resources on the relay server, a raspberry pi mini pc is used. NginX will be applied to Raspberry Pi as a streaming web server that will process the RTMP streaming protocol to forward data from the encoder (broadcaster) to social media.

In order to make audio video data obtained from sending an open broadcast system is sent to the web server, it will require port settings using the http protocol, after the data is received on the webserver (relay server) it will be forwarded again using the RTMP protocol to be pushed on social media streaming services. YouTube's Social Media supports the RTMP protocol while for Facebook RTMP will be replaced by RTMPS so that the streaming process can be done. Software and Hardware need For Relay Streaming Server can be seen in table 1 and table 2. Configuration NginX server can be seen in table 3.

| Software | Information |
|----------|-------------|
| Nginx    | Web Server which acts as live streaming server relay |
| Nginx-RTMP-Module | The module used supports Nginx to implement the RTMP protocol |
| Stunnel  | Supports Nginx to be able to send data to RTMPS |
| Leafpad  | Text editor application on the server |
| Build-Essentials | Module for the compilation process of Nginx and Nginx-RTMP-Module |
Table 2. Hardware need For Relay Streaming Server

| Hardware   | Information                                      |
|------------|--------------------------------------------------|
| CPU        | 1.4GHz Cortex-A53 64-bit quad-core processor     |
| RAM        | 1 GB                                             |
| SD Card    | 16 GB                                            |
| Wifi Card  | 2.4 GHz dan 5 GHz dual-band wireless LAN          |
| Bluetooth  | Bluetooth 4.2/BLE                                 |
| NIC        | Faster Ethernet, Power-over-Ethernet support      |

Table 3. NginX Configuration

| Protocol | Information                   |
|----------|-------------------------------|
| HTTP     | Listen Port : 8080            |
|          | Audio Codec : .m3u8           |
|          | Video Codec : .ts             |
| RTMP     | Listen Port : 1935            |
|          | Chunk Size : 4000             |
|          | Live, HLS : On                |
| RTMPS    | Listen Port : 443             |

3.4. Analysis Integration Relay Server to Social Media Live Streaming Services

In order to make relay server, it can be integrated and pushed into the live streaming social media service, the relay server must be given permission to access the rtmp URL and streaming key on the intended social media. To get the rtmp URL and key stream, the user must be registered in the social media environment as a member and request access to stream the account which is forwarded through the RTMP protocol. RTMP URL and Stream Key information for Youtube can be obtained on the https://www.youtube.com/my_live_events page, while for Facebook it can be obtained on the https://www.facebook.com/live/create page. URL RTMP and key stream on Youtube can be seen in figure 5 and URL RTMP and key stream on Facebook can be seen in figure 6.

Figure 5. URL RTMP and key stream Youtube

Figure 6. URL RTMP and key stream Facebook
Based on analysis the value of rtmp URL and youtube key stream is a fixed value based on each user's social media account, whereas for facebook the key stream value will change unless the user sets the key stream to be a fixed value. After the rtmp URL and key stream are obtained the settings are made on the Nginx side to push rtmp to social media youtube and facebook. To simplify the next streaming process, the broadcaster team needs a web management to enter the user's profile in the form of rtmp URL and key stream.

3.5. Design Model and Functionality of Relay Streaming System
Design Model system can be seen in figure 7.

![Design Model System](image)

Figure 7. Design Model System

3.5.1. Functional Software Requirement
The specifications for functional software requirements are software requirements as a result of the analysis process carried out in software development. Analysis of software requirements specifications is needed to make use case descriptions. Analysis of functional software requirements can be seen in table 4.

| Code   | Specification Requirement                                      |
|--------|---------------------------------------------------------------|
| SRS-F01| The system can validate account                               |
| SRS-F02| The system can do register account                            |
| SRS-F03| The system can send forgot password                           |
| SRS-F04| The system can encode data streaming                          |
| SRS-F05| The system can push stream to social media                    |
| SRS-F06| The system can manage profile streaming                       |
| SRS-F07| The system can verified an account                            |
| SRS-F08| The system can stream data streaming                          |

3.5.2. Use Case Diagram
Based on the functional system that has been outlined in the previous SRS, a use case diagram system will be designed. Figure 8 describes Use case Diagram of the system to be built.
4. Conclusion

The final results of this study to design a relay streaming system model that can process live streaming input from various sources (multisource) and then publish simultaneously to several desired social media in this case YouTube and Facebook. The use of relay streaming is expected to overcome the limitations of live streaming carried out for indoors activity broadcasting. The next research will be integrating how streaming can be done for services that provide key streams dynamically per broadcast event such as Instagram.

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