TELKOMNIKA, Vol. 13, No. 4, December 2015, pp. 1352~1360
ISSN: 1693-6930, accredited A by DIKTI, Decree No: 58/DIKTI/Kep/2013
DOI: 10.12928/TELKOMNIKA.v13i4.2738

Transmission of Real-time Video Signal with Interference Density and Human Traffic

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Abstract

The use of mobile phone as a communication tool rapidly increases, as well as various types of functions therein. Among of the many applications on the mobile phone, which are used skype android-based for teleconferencing via mobile phone. Things can not be separated from these applications is the need of qualified internet network access for these applications can be felt up function. One of the network access to the Internet is widely used today's society is a wi-fi network. Access to the Internet does not always provide the best performance, this is due to many factors, one of which is the presence of interference. In this study, we tested transmission of video signals in real-time using an application skype on the mobile phone. Skype run on wi-fi network, which is influenced by the presence of interference or objects such as human traffic in the network. Wireshark were used to obtain data reliability wi-fi network, known as QoS. While evalvid used to obtain the data QoE restricted only get the data PSNR (Peak Signal To Noise Ratio) and MSE (Mean Square Error).

Keywords: *Human Traffic Interference, QoS, QoE, Video Streaming Quality*

1. Introduction

Video call at this time is so very popular in the community, preceded by either his popular smartphone based on Android, iOS, Blackberry, and Windows Phone. This encourages the emergence of a variety of video call/chat applications running on the mobile phone platform, despite emerging new applications, but Skype is an application video calls most popular. according to predictions that have been released previously by GigaOM Project [1], in 2015 consumer video calls will reach 142.9 million users, with a total of video calls as much as 29.6 billion. Access to the Internet by wi-fi so very widely used today, such as office buildings, shopping malls, even inside the house was most people, especially in urban areas, the use of wi-fi for internet access is a commonplace. Wi-fi standard device used is the type IEEE 802.11 a, b, g and n, depending on the needs of the network and a wide range of desired.

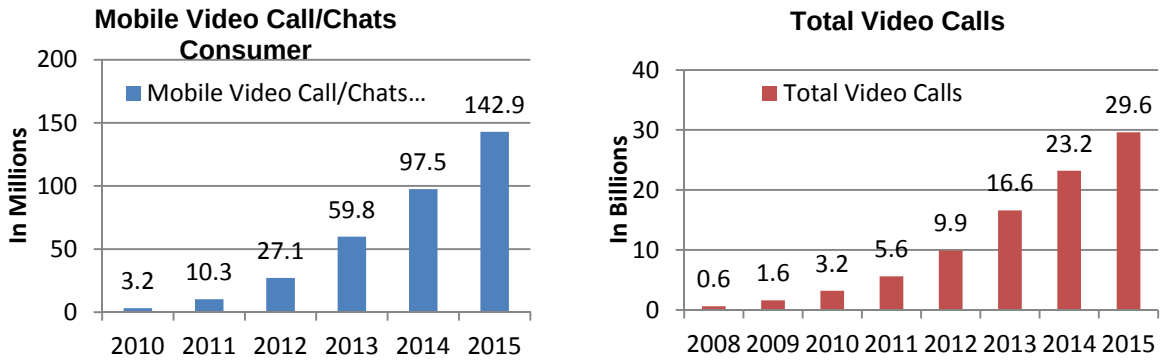


Figure 1. The exponential increase in the number of consumer video calls and total video callsl / chats [1]

Received July 27, 2015; Revised November 2, 2015; Accepted November 20, 2015

When we talk about the real-time video transmission or video streaming then we are talking about data transmission running continuously, where data is simultaneously transmitted and received continuously. When there is interference on the network used, the information will be partly lost and no data transmission back. Therefore, in the video stream is needed to broadband networks with delay, jitter and packet loss (QoS) in accordance with the prerequisites. Another challenge faced when streaming video running on a wireless network required QoS good quality in order to avoid loss of quality on the receiving side (QoE). The other problem is, sending signals via mobile devices with wireless connection technology 802.11 or Wi-Fi, limited the coverage area are become an obstacles to the quality signal transmission of video and audio streaming, so it takes reliability in a handover between an access point (AP) to another [2].

The problems that arise in video streaming over wireless networks is the presence of interference or disturbances that appear around the network either in the form of co-channel (wireless signal with the same frequency channel), or shadowing of the presence of objects that appear in the network, including the presence of human traffic (human traffic interference). As has been observed by [3], where the movement of human traffic or network amid indoors can decrease link throughput as much as 20.4%. So when a video stream running on a wireless network in an office environment that is congested with traffic of employees it will greatly affect the results of the signal delivery. it can be evaluated from two sides, by measuring QoS sender side and on the receiver side by measuring the QoE.

Quality of service refers to the network performance, QoS parameters consist of Throughput, Goodput, Delay, Jitter, Packets Loss. While Quality of Experience (QoE) is defined in many dimensions but generally QoE refers to the quality on the receiving side or percieved Quality and well defined as the user satisfaction of the service or services provided [4]. QoS and QoE interrelated, so if QoS disturbed affect QoE. Some researchers conduct research related to the correlation between QoS and QoE, in [5] where he developed a model correlation QoS / QoE for IPTV customer satisfaction. Model developed by researchers [5] concluded that knowing the QoS parameters it will get a prediction of QoE. So did the opposite by getting QoE parameters can also be used to determine the condition of QoS. More than that, the QoS parameters can be used as a reference level of security in telecommunications sounds like VoIP. As in the study [6] carried out the measurement of QoS parameters such as throughput, delay and packetloss used as a parameter to determine the reliability of the encryption method used.

Studies related to the transmission of video signals in real-time has been done by other researchers which we have summarized in the following matrix.

Table 1. Matrix Related Studies

No	Researcher	Topic Research	Research Scenario				
			Streaming Video	Wifi	Inter-ference	Skype	
						PC	Mobile OS
1	Nurul Sarkar et.al [3]	“The Effect of People Movement on Wi-Fi Link Throughput in Indoor Propagation Environments,”	No	Yes	Yes	No	No
2	K. K. Eudon [7]	“Video Streaming over 802. 11b in the Presence of Fading due to Human Traffic and Bluetooth Interference,”	Yes	Yes	Yes	No	No
3	E. Masala et.al [8]	"Real-time transmission of h. 264 video over 802. 11b-based wireless ad hoc"	Yes	Ad-hoc	Yes	No	No
4	Fernandez et.al [9]	“Video Conferences through the Internet: How to Survive in a Hostile Environment”	Yes	No	Yes	Yes	No
5	RB.Bahweres; Oki Teguh Karya; Mudrik Alaydrus	“Transmission of Real-Time Video Signal with Interference Density and Human Traffic”	Yes	Yes	Yes	Yes	Yes

Starting from the above studies, researchers tried to carry out a study which is the intersection of the three studies above. Researchers conducted a field experiment in the form of streaming video using Skype application android-based peer-to-peer (p2p). Video streaming runs on wi-fi network that interference by traffic and the density of the employees in the office room. This study was conducted to determine how the reliability of a network with Wi-Fi on an office building in transmitting video in real-time using Skype on interference by the presence of human density and traffic in the middle of the Wi-Fi network. Skype android is used to conduct video conferences are peer-to-peer (p2p) with other Skype users on the same wi-fi network. Reliability is a measure video streaming quality, while Skype takes place amid the density of employees, in other words the bandwidth is erratic due to the interference of the density and traffic of employees. Video streaming quality in terms of two parts, namely QoS (Quality of Service) as a wi-fi network reliability are used and QoE (Quality of Experience) as a measure of perceived quality on the receiving side.

2. Research Method

In a study conducted, the researchers tested the transmission of video signals in real-time using the Skype application based on android operating system, running on a Wi-Fi network in the building of Kompas TV. Skype application on the actual function is an application used for video conferencing, but for this study, Skype is used only to transmit video signals only. Thus the measurement limit research to be carried out later is just video streaming quality. Video streaming quality is closely related to the perception of the end user or known by the QoE [4], which to measure it is by knowing what is perceived by the end user. Related to the results to be known by researchers, then this can not be separated also by measuring the QoS or Quality of Service of the wi-fi network it self. Both of these (QoE and QoS) will be controlled by the control variables traffic and density of employees in the building Kompas TV based office hours at the room naturally.

Measurement tools used by researchers to determine the quality streaming video using a Linux-based software that is EvalVid [10], the parameters used are PSNR and MSE. The most important factor of PSNR is MSE (Mean Square Error) which is the maximum possible value of the luminance (28-1 = 255 for 8 bit) [10].

$$MSE = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}[(f_{ij}-F_{ij})]^2}{M.N} \quad (1)$$

$$PSNR = 20log_{10}\left[\frac{255}{\sqrt{MSE}}\right]dB \quad (2)$$

Where fij is the original signal of pixel (i, j), while the Fij a degraded signal, and MN is the size of the video. The larger the value of MSE, the smaller PSNR value, which means the quality of the video is ugly.

While in measuring QoS, researchers use Wireshark software as a tool to determine Throughput, Packet Loss, Delay and Jitter. From the measurement results, the researchers wanted to know how the traffic and the density of the employees in the building KompasTV able to interference QoS and QoE video signal transmission via Skype android.

This study was conducted to answer the following questions:

1) How much influence traffic and density of employees in the building KompasTV to the value QoS and QoE video signal transmission process with Skype Android, while traffic and high density employees?
2) How much influence traffic and density of employees in the building KompasTV to the value QoS and QoE video signal transmission process with Skype Android, while traffic and density of the low employee?

This study is given limitations as follows:

1) The study was conducted in the second floor of the building KompasTV use a separate network from the existing network in the building, with take place with traffic and density of employees (Division HR / LEGAL, GA Division, Division FINANCE, and Division MARCOMM).

2) The process of transmitting real-time video signal is done in a peer-to-peer from the sending device (android 1) to a receiving device (android 2).
3) Measuring tool used for measure the QoS is Wireshark with parameter only Throughput.
4) Measuring tool used to measure the QoE is EvalVid, by taking only parameter PSNR (Peak Signal to Noise Ratio).
5) Another parameter to measure percieved quality, researchers used one way video delay method [11]. This method is used because Skype encrypts the information related to the performance of the system. through this method researchers can collect data related to the video delay the teleconferencing system in Skype.

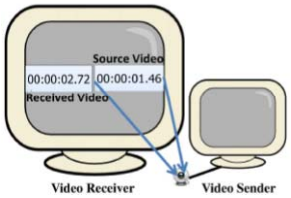


Figure 2. One Way Video Delay Method [11]

6) To get the data, the process of real-time video transmission lasts for around 15 seconds, at any intervals for 30 minutes. The data began to be taken at 09.30 am until 21.00 pm.

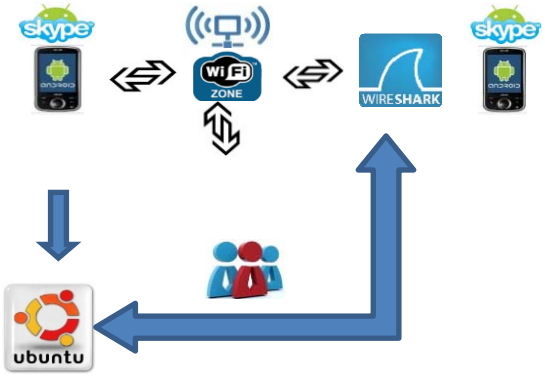


Figure 3. Design study conducted to answer the research question

3. Results and Analysis

3.1. Data Traffic and Density of Employees

Data traffic and density of employees, obtained through monitoring of existing CCTV cameras on the second floor of the building KompasTV. From the data collected, it was noted that the employees' peak density at interval time 14:30 pm to 15:30 pm, with a range between 51 to 53 people, as shown in Figure 4 and 5.

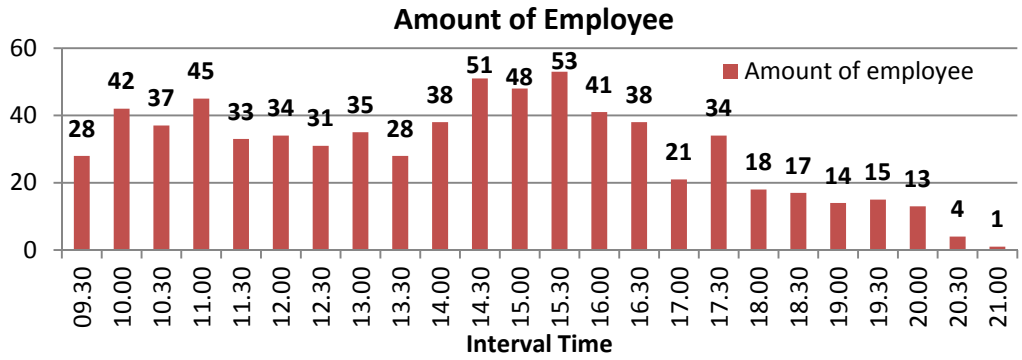


Figure 4. The Amount Of Employee Based On Interval Time

3.2. Data of Network Throughput

To obtain the data of network throughput in the form of interference by traffic and density of employees, researchers used the Wireshark software while the video delivery via skype process underway, with results of data collection as shown in Figure 6

Figure 5. Camera Monitoring at 15.30 p

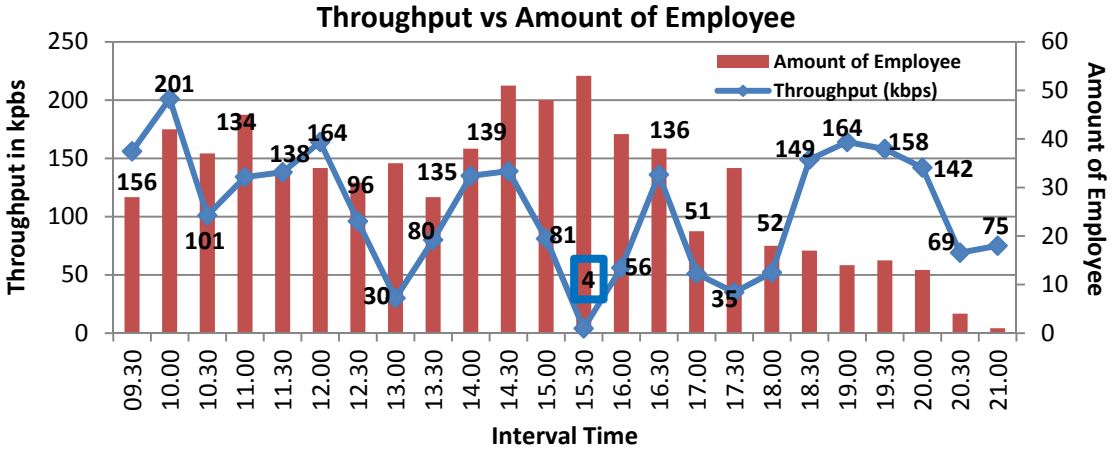


Figure 6. Network Throughput Based on Interval Time

3.2. Data Video Delay

To facilitate interaction between user teleconferencing, it's needs a standard delay time for video (video delay) not too long. The user experience will be decreased if the video delay exceeds 350 ms [12]. In this study we used a video delay measurement methods used by [11], in this way we record it in a video file for 15 seconds, then on every frame we calculate the time difference between the video sent to the incoming video.

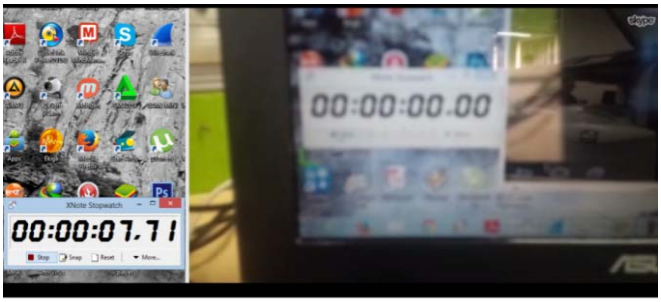


Figure 7. Screen capture video delay on data retrieval 14.30 pm

On Figure 7, we can see the stopwatch on the left side of the video image sent by android device 1, and stopwatch on the right side is received video images on android devices 2. It can be seen that the difference in time between the left image and a right image, which defined as a video delay. In the picture above clearly visible when the picture stopwatch sent already on 7.71 seconds, at the receiving android devices still in 0.00 seconds. The data collecting video delay can be seen in Figure 8

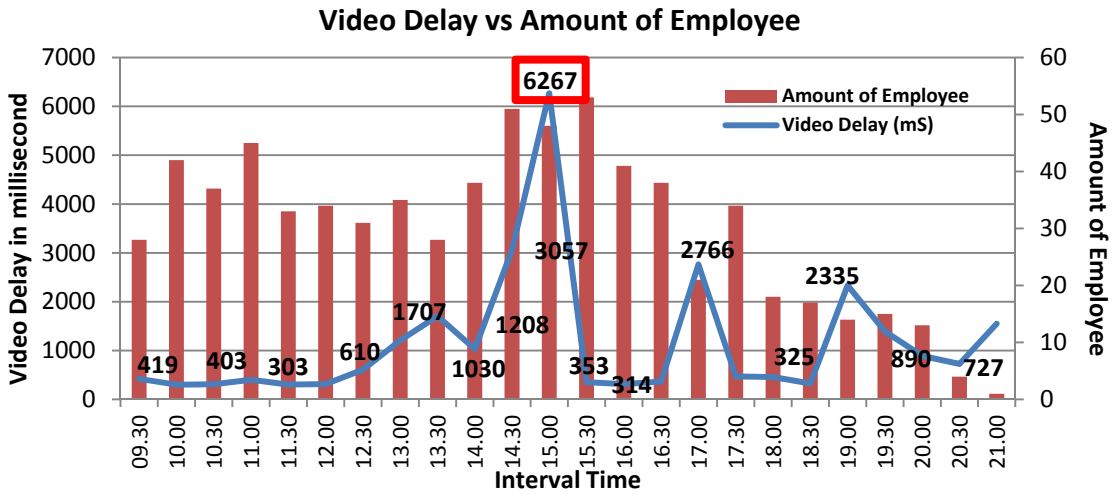
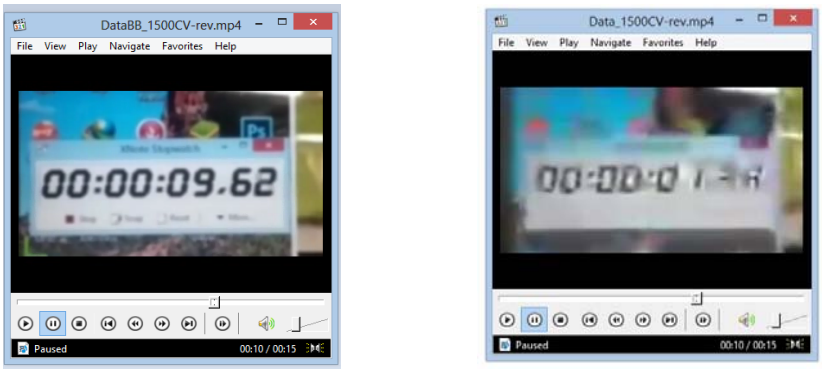


Figure 8. Video Delay based on Work Time

3.3. Data Peak Signal to Noise Ratio (PSNR)

Peak Signal to Noise Ratio (PSNR) is used as a measure of satisfaction the user experience. The PSNR value it's had from the result of a comparison of the received video images with video images sent via skype. In this study, the video image received through on the android 2 recorded using Camtasia Recorder using a frame rate of 15 fps. While the video image that is sent in via android 1 recorded using Screen Recorder app also with a frame rate of 15 fps. The example comparison of the android 1 (sender) and the android 2 (receiver) can be seen on figure 9, and All the PSNR data collected can be seen in Figure 10.



(a) (b)

Figure 9. Comparison video image sent from Android 1 (figure 9a) and video image received on Android 2 (figure 9b), on data retriveal at 15.00 pm.

3.4. Data Analysis

In the previous section we had seen the data of three area, network throughput as a parameter for quality of service (QoS), while video delay time and PSNR as a parameter for quality of experience (QoE). In every parameter (QoS and QoE) we compare by the condition of amount of employee. In my assumption earlier before this study began, if the amount of employee increased can be linear on the traffic and density of employee, and it can give some interference to the QoS parameter. Then if the QoS parameter changed so it can change the QoE parameter. Based on the data that we have, in figure 4 we can see the peak value amount of employee at interval time 14.30 to 15.30 pm. And if we make comparation to the next data in figure 6, we can seen that at the peak value of employee, the network throughput changed to the lower position at range 4 to 81 kbps. If compare again with another data in figure 8, at the same value (peak) of the employee, the Delay Time of video at the high position, that it meant the video delay time is very lag.

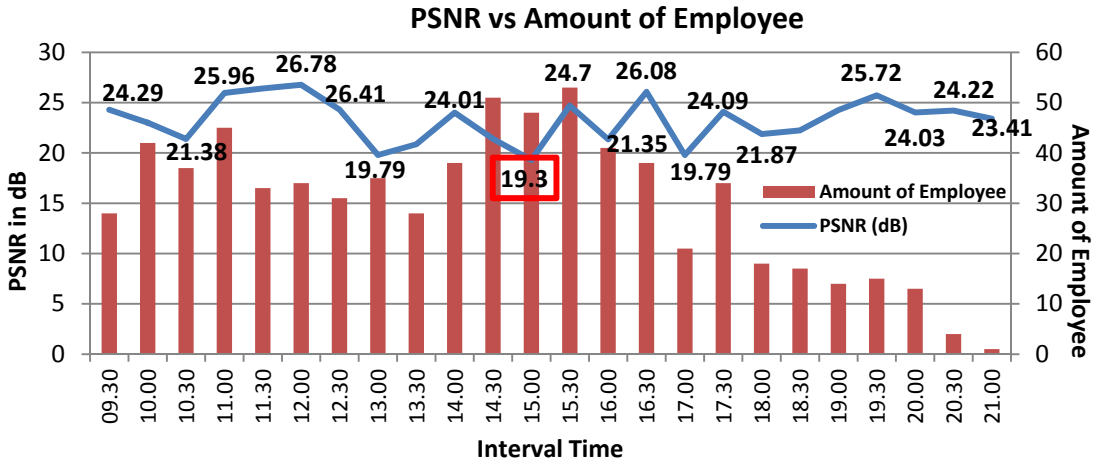


Figure 10. PSNR based on Work Time

Let's we jump to another data in figure 10, we can seen the value of PSNR compare with the (peak) amount of employee. In this data, the PSNR show to us that in this condition PSNR go to the lowest value (19,3 dB) from the other. Temporary we can conclude that in interval time at 14.30 to 15.00 pm, all parameters both QoS and QoE affected by traffic and density of employee.

On the conditions in another time interval, the data in Figure 6, at intervals time at 10:00 am, number of the employees showed 42 people, wireshark measure the network throughput at position 142 kbps. If we compare the conditions in which the number of employees in top positions in 53 employees, wireshark shows extreme values in position 4 kbps. Why did it happen?, Our analysis concluded in the current conditions of the number of employees in top positions coupled with the movement of the traffic conditions of the employees are quite busy, this can have a significant influence on the wifi network conditions, compared to only state the number of employees crowded yet traffic movement is slight. Thus we conclude that the time intervals at 10.00 am, the movement of traffic is not as busy employees at 15.30 pm. This analysis is in line with what has been concluded in the study [3], that the movement of people through the network either moving forwards or random moving can reduce throuhput link.

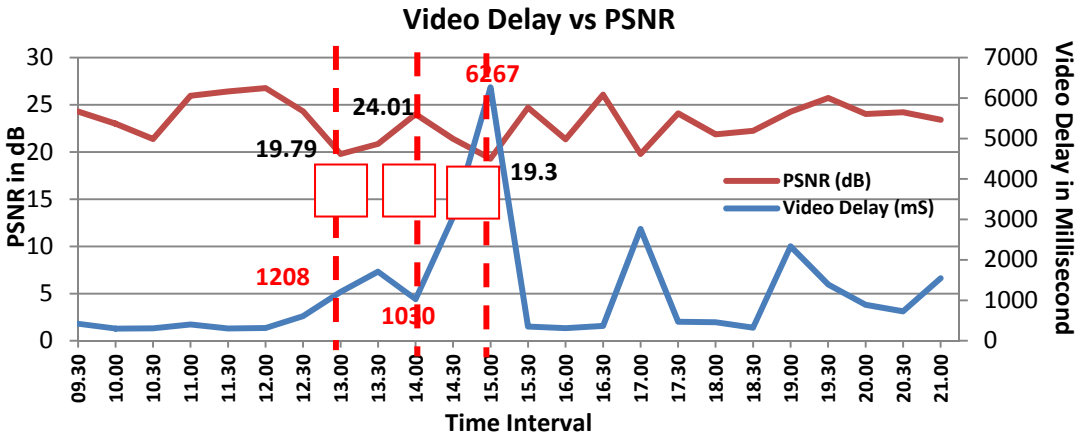


Figure 11. PSNR compared with video delay time based on Work Time

In figure 11, we can see the influence of video delay time value against the value of PSNR as a quality user experience, researchers gave a sign in the form of a dotted line at three intersection. At the first intersection of video delay time positions in 1208 ms and PSNR value indicates the position of 19.79 dB, then we look at the second line of intersection video delay positions down at 1030 ms and PSNR value rose to 24.01 dB, at the intersection of the lines third, the position of the video delay is in the extreme value at 6267 ms and PSNR value fell to 19.3 dB position. From the picture above is very obvious that the video delay time affects the quality of user experience is represented by the value of PSNR. if the value rises then the video delay PSNR value falls, the opposite condition if the value of video delay down the value of the PSNR rises, which means the video images are received in good quality.

4. Result and Discussion

With the widespread use of video streaming, especially on video conferencing using a wireless network, through this research we can know that traffic and density of employees in the room able to interference to quality of the wireless network (wifi) which is used, also reduce the quality of user experience shown on QoE value. In this study note that the decline in the value of PSNR is affected by the time delay video. the longer the time video delay, the worse the value of PSNR.

In future studies we can add a scenario if the sender and recipient android device moves indoors to closer or move away to acces point. so that we can know the interference parameters that most influence on the value of QoS and QoE video streaming.

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