



Web Conference Internet Traffic Analysis during Study-from-Home Period: Case in Sampoerna University

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ABSTRACT

Web conference feature embedded in Learning Management System (LMS) has been implemented in Sampoerna University (SU) to support Teaching-and-Learning activities during early stage of Covid-19 spreading period in Jakarta. Teaching and studying from home were mandatory for all SU lecturers and students during the period. The use of technologies and internet connection to support these academic activities became very essential. The objective of this research is to analyze internet speed and quota consumptions to meet the web conference requirements. Lecturers and students need stable internet connection with proper speed, either using wired or wireless connection, in prepaid or postpaid subscriptions for smooth online learning including web conferences. This research was an exploratory and quantitative research with surveys using non-probability with identified voluntary response sampling. The results showed that web conferences using BigBlueButton for audio-call, text-based chat, and rarely updated presenter shared-screen consumed only 3.11% of average students' Internet connection speed, while the quota consumptions for 3 Credit Points Course session was 129.15 MB (Megabyte) per session, and for 4 Credit Points Course session was 140.2 MB per session. It was concluded that students are supposed to experience no or less delay during web conferences, and still have plenty of internet bandwidth to support Study-from-Home processes.

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1. INTRODUCTION

In mid of March 2020, Teaching-and-Learning activities in Sampoerna University had to transform to fully online / distance learning due to Covid-19 pandemic in Jakarta. Teaching-from-Home for lec-

turers and Learning-from-Home for students were mandatory in SU. (Canvas, n.d.) LMS with its web conference is used to substitute the face-to-face in-class activities. This Covid-19 pandemic has impacted the performance and quality of

both fixed-broadband and mobile Internet globally, where fixed-broadband speed has an increment of 5%, and mobile Internet speed has an increment of 7%. Indonesia has both speed above global increments, where fixed-broadband speed has an increment of 7% (2% above global), and mobile Internet speed has an increment of 14% (7% above global) as mentioned in (Ookla, 2020) on Tracking COVID-19's Impact on Global Internet Performance web page.

Communications between lecturers and students through emails, Internet messaging system, and these LMS activities rely on Internet connection. All of these activities required proper and stable connectivity for both wired and wireless (WLAN or 4G) connections. The use of mobile phones helped these academic activities. As illustrated in (The World Bank, 2020), 65% of the delivery mode for education technology products and services are using Android mobile application, and 50% of them are using iOS mobile applications. Mobile phones equipped with LMS, email, and messaging applications made communication become more frequent, and mobile phone notifications increased lecturers and students awareness.

Academic activities during web conference include lectures, students presentations, and discussions. Web conference technology embedded in the implemented LMS at SU is BigBlueButton. As mentioned in its official website (BigBlueButton, n.d.-b), BigBlueButton is an open source web conferencing system built to support online learning. BigBlueButton in SU's LMS is an integrated feature within the LMS, which has different implementation approach compared with STT Ibnu Sina - Batam illustrated by (Basar et al., 2019) and UIN Walisongo - Sema-

rang illustrated by (Kusuma et al., 2020). Conferences can be generated through LMS with specific time duration or with no time limit. Conference can also be recorded if needed. Conference invitation will be sent to some or all students once a conference has been set.

Many convenience services were offered by BigBlueButton technology, including Internet audio-call, text-based chat, and screen sharing during web conference session between lecturer and students. Video-call conference with web camera only held once at the beginning of conference for attendance purpose. Screen sharing was often used to show teaching materials, presentations, and computer application interfaces.

In Spring / Even semester of academic year 2019/2020, two courses with their web conference activities were monitored and evaluated. There were 21 students surveyed from both courses during Study-from-Home period. These 21 students have returned to their home-town for health and security purposes. The students' location based on major islands in Indonesia during Study-from-Home period is shown in the following **Table 1**.

From students' home-town locations, Internet connection profiles were gathered to be analyzed to answer the following question: Were the Internet connection speed and its quota sufficient to support web conference for Study-from-Home activities? There were times when the Internet speed is good, but unstable for long duration of conference, or vice versa. In several occasions, students needed to rejoin the conference because their wireless signal were lost. During this Work-from-Home (WFH) and Study-from-Home periods, Internet dependencies have significantly increased.

Table 1. Students Home-Town Location

Island	Students #	Students %
Java	15	71.43
Sumatera	2	9.52
Sulawesi	0	0
Kalimantan	2	9.52
Papua	0	0
Not Mentioned	2	9.52
TOTAL	21	100

Internet connection is tightly related with the Internet access speed and Internet traffic consumptions. According to Ookla Speedtest Global Index (Ookla, n.d.-b), Indonesia has average download speed of 16.94 Mbps (Megabit per second) for mobile and 23.06 Mbps for fixed broadband.

For unlimited postpaid users, postpaid Internet has options of quota-based and total unlimited. (*Worldwide Broadband Price Research 2020*, 2020) illustrated that cost of fixed-line broadband in Indonesia has an average of US\$30.02 per month. But for mobile prepaid subscribers, Internet quota is an important factor to be considered. Indonesia has an average price of \$0.64 per 1GB for mobile data pricing on February 2020 as mentioned on (*Worldwide Mobile Data Pricing League: Cost of 1GB in 230 Countries*, 2020).

The objective of this research is to analyze Internet speed and its quota consumptions to meet the web conference requirements. Students are not only required to have sufficient Internet speed, but they are also required to have sufficient Internet quota for supporting Study-from-Home activities. Internet usage information was gathered in the beginning of web conference and stopped at the end. This information was able to provide

bigger picture on how much Internet data were consumed by the students for every single web conference. Students with prepaid Internet will be able to anticipate on how much internet quota needed to be spent.

The rest of the paper has the following structure: Section 2 elaborates the research methodology and how the supporting data were gathered from the 2 surveys using Canvas LMS; Section 3 presents the results, analysis and discussion; lastly Section 4 presents the conclusion of this paper and some recommendations that can be explored in the future.

2. RESEARCH METHODOLOGY

This research was an exploratory and quantitative research. Primary data were gathered directly from students through surveys using Discussion service provided in the LMS.

There are 2 types of survey that were conducted. The first survey consists of 4 short-text answer type of questions about students location and their Internet connection speed information, in which the Students' name and date-time on the survey's answers were grabbed automatically by the Discussion service.

Students required to do speed test using Ookla SpeedTest (Ookla, n.d.-a) at

<https://www.speedtest.net> with specific configuration: Canada as the server host location and the use of multi connections option. These configurations are used to make sure that the method to retrieve information about Internet connection speed from Indonesia to reach overseas are uniform. In the first survey, from the total 21 students, 19 students (91.3%) were participated meanwhile 2 students (9.52%) did not give complete response. Results from the first survey are shown in **Table 2**.

The second survey consists of 2 short-text answer type of questions from 2 courses about how much Internet data were consumed after web conference, and the Internet Service Provider (ISP) or

cell operator used by the students. Students' name, date-time, and course name on the survey's answers were grabbed automatically by the Discussion service. There were 9 students (39.13%) participated in Course 1, and 13 students (59.09%) participated in Course 2. **Table 3** shows the survey's result for Course 1.

Both surveys were non-probability with identified voluntary response sampling. Students were encouraged to participate on these surveys on LMS Discussion service from March 23rd 2020 to April 15th 2020. There were 28 Internet consumption data received for Course 1 from 6 web conferences, and 29 Internet consumption data received for Course 2 also from 6 web conferences.

Table 2. Internet Connection Profile

Location	Ping (ms)	Download (Mbps)	Upload (Mbps)
Lampung	322	11.7	10.22
Jombang	318	2.41	15.68
Ketapang	278	14.01	16.3
Jombang	319	10.95	1.38
Depok	114	9.8	2.23
Jakarta	275	9.58	1.31
Probolinggo	251	5.11	1.32
Surabaya	290	6.04	4.17
Jakarta	267	14.84	3.81
Pasuruan	274	7.07	8.96
Palembang	371	0.33	0.34
Lumajang	283	0.85	6.75
Jakarta	250	7.71	66.74
Jakarta	271	2.63	17.09
Jakarta	274	23.87	10.68
Jakarta	213	3.45	0.96
Mandor	418	0.5	0.59
Semarang	13	9.63	10.88
Jakarta	22	6.25	3.67

Table 3. Internet Traffic Sample Data for Course 1

Operator	Traffic (MB)
Telkomsel	100
Indosat	109.8
Indosat	55
Indosat	30
Tri	120
Indosat	98
Indosat	170
Indosat	173
Indosat	180
Tri	150

The flow chart of the web conference process and how students grabbed the information about Internet quota that has been consumed by a single web conference is shown in **Figure 1** below.

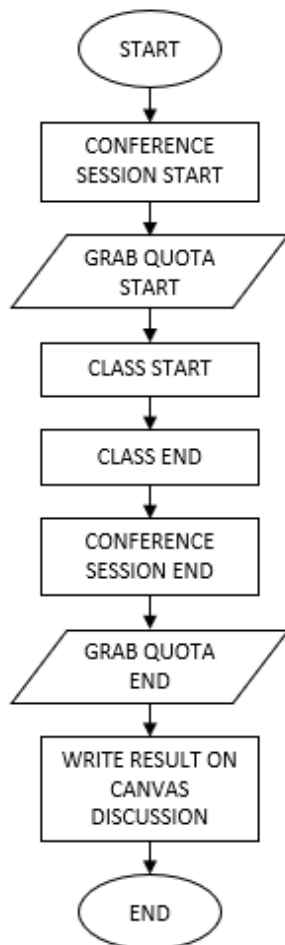


Figure 1. Flowchart of the Quota Information Gathering Process

On the second survey, the Internet usage information were captured by grabbing information of available quota from Mobile Operator app before the class started and then grabbed the available quota information again after the web conference session ended.

3. RESULT AND DISCUSSION

According to BigBlueButton FAQ site page (BigBlueButton, n.d.-a), it is recommended that students should have at least 0.5 Mbps (0.0625 MBps) for upstream and 1 Mbps (0.125 MBps) for downstream. Since there was no web camera activity during web conference, the amount of upstream bandwidth used will be less than 0.5 Mbps (0.0625 MBps).

Upstream is a connection speed from client’s device to the Internet, meanwhile Downstream is a connection speed from the Internet to client’s device. Internet bandwidth was described by (Selby & Bawa, 2018) as the amount of data that is able to be delivered over the Internet in a certain period of time.

During web conference, audio-call took about 0.04 Megabit per second (Mbps), equivalent with 0.005 Megabyte per second (MBps), and there was screen-sharing activity. As mentioned also on (BigBlueButton, n.d.-a), screen-sharing activity consumed from 0.2 Megabit per second (Mbps), equivalent with 0.025 Megabyte per second (MBps) for low-end (rarely-updated-shared-screen) to high-end (frequently-update-shared-screen) at 1 Megabit per second (Mbps), equivalent with 0.125 Megabyte per second (MBps).

The results based on the first survey taken by 21 voluntary students (91.3%) were summarized in **Table 4**. Students' Internet connections were very diverse in all these 3 aspects: Pings in milliseconds (ms), Downloads in Megabit per second (Mbps), and Uploads also in Mbps.

Students were located at their hometown on 3 major islands in Indonesia, with different cities, and also different Internet service providers. The first survey did not include the Internet connection type: wired and wireless or wireless extension through WLAN after wired connection. These 2 types of connections were common in most Internet home installation.

As also shown in **Table 4**, on average, Internet Upload speed found to be faster compared to the Download speed. This condition is rare, since usually Downstream is faster than Upstream as mentioned in (Ookla, n.d.-b) where Download speed is faster than Upload for both Mobile and Fixed Broadband Internet connection in global average. This asymmetric type of connection is usually to limit personal subscription to run server services.

On the other hand, nowadays, personal video calls or broadcast streamings are becoming more often to be used which will consume higher speed bandwidth for Upstream.

Web conferences during surveys usually have Internet audio-call with rarely update-shared-screen. In this scenario, bandwidth consumption was 0.24 Mbps (0.04 Mbps audio + 0.2 Mbps rarely updated shared-screen) for Downloads. So, this type of web conference only consumed 3.11% of students' Internet connection on average. Students are supposed to experience no or less lag during web conference.

There were conditions where students did group presentations and became presenters but these were not frequent. In this scenario, students' Internet connection are consumed only 2.49% based on average upload speed. Both as participants and presenters, students were in good condition for web conference.

There were 2 courses for the second survey. Course 2 took longer times compared with Course 1, as shown in **Table 5**. This is due to Course 1 has 3 Credit Points and Course 2 has 4 Credit Points. Web conference durations also have different values. This is because web conference Internet usage data were taken from 6 dates for both Courses. Activities in a web conference were not only lectures' and students's presentations, but also included class discussion and interaction with students. Quizzes and Assignments activities were still in LMS, but not in web conference.

Table 4. Internet Connection Speed Test

Variable	Ping (ms)	Download (Mbps)	Upload (Mbps)
Average	253.84±103.05	7.72±5.9	9.64±14.93
Min	13	0.33	0.34

Max	418	23.87	66.74
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Table 5. Web Conference Internet Usage

Course	Variable	Usage (MB)	Duration (Sec)	Speed (Mbps)
Course 1	Average	129.15±46.88	3882.86±578.01	0.03±0.01
	Min	30	3180	0.01
	Max	230	4620	0.05
Course 2	Average	140.2±65.93	4357.24±627.12	0.03±0.01
	Min	50.5	3720	0.01
	Max	350	5469	0.06

Actual web conference durations were recorded in minutes, but the durations then converted into seconds for easier calculation, and this conversion was also related to the Internet speed in seconds. Longer durations will cause bigger Internet usage.

Internet Usage in Megabyte (MB) in **Table 5** shows how much Internet quota the students spent during web conferences. On average, for 3 Credit Points Course, the students spent 129.15 MB per session and for 4 Credit Points Course, they spent 140.2 MB per session.

These Usage (MB) values in **Table 5** are then divided by the durations in seconds where both Courses have 0.03 Mbps in average. This average speed of 0.03 Mbps is equal to 0.03 Mbps audio-call + rarely updated presenter screen web conference (0.005 Mbps of audio-call + 0.025 Mbps of rarely-updated-shared-screen).

The use of the provided Mobile App from the network operator installed on mobile phone to measure Internet data usage has possibilities of inaccuracy. If the Internet connection come from mobile personal hotspot and the bandwidth usage is less than 10%, there are possibilities that the Internet was also used for other purposes without experiencing connection difficulties for web conferences, and

this other connection will also being included in the Internet usage measurement. However, since the calculated average of Internet speed in **Table 5** (Usage divided by Durations) is still equal to 0.03 Mbps with standard deviation of 0.01, then this result is still acceptable.

4. CONCLUSION

Web conference Internet traffic analysis during study-from-pome period has been presented in this paper. Web conference technology with BigBlueButton, especially for only audio-call, text-based chat, and rarely updated presenter shared-screen consumed only 3.11% of average students' Internet connection speed. In this condition, based on the students' Internet connection profile, students are supposed to have no or less experience of web conference lag. Consequently, there were still plenty of available Internet bandwidth that can be utilized to optimize Study-from-Home processes. Usage of web camera would be a good option to enhance teaching-and-learning quality.

Alternative data gathering methods can be explored to obtain more accurate data, as well as to capture Internet consumption data for alternative teaching methods, such as video-sharing, online polling, and drawing/writing using digital

drawing/writing pad, that may have different Internet consumption.

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