TNE40001/80003 Broadband Multimedia Networks
Lab 5 - Introduction to DASH

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I. Introduction

Lab 5 introduces the basic concepts of Dynamic Adaptive Streaming over HTTP (DASH). In this lab, students will use an open-source DASH client `dash.js` [1] under Chrome to stream content from a server running at `rule27.caia.swin.edu.au`. The 'BigBuckBunny' dataset [2] at the server, comprise full-length sequences encoded at different bitrates, resolutions and qualities. Students are required to throttle the network bandwidth, observe DASH's adaptive behaviour and plot the selected representation rates (*aka* video bitrates or quality) over the experiment duration.

II. Assessment

Lab 5 is marked in the laboratory class session. Instructions on how to do lab 5 are given in Section III. Please note, for assessment purposes, lab demonstrators expect that the student *should* be able to complete the lab during their session, the focus of this lab will be how well the student *understood* the whole process of lab 5.

The following question(s) that the student can get asked by the lab demonstrator, including, but not limited to, are:

- What post-filtering rules have you applied in Wireshark (or equivalent tool)? And, why?
- When you change the throttling speed(s), why doesn't the representation rate change immediately with respect to the video time?
- What differences do you observe when running experiments with 2 and 10-sec chunks?
- Using the provided DASH client, why can't we force a certain video quality at the client-end?
- Questions related to R script and how it functions (or equivalent script of your own).

Marks will be given based on the students' answer(s) to the question(s) posed by the lab demonstrator. Completing the whole lab increases your chance of answering the questions correctly – even if you do not complete the whole lab, it is still recommended to ask the lab demonstrator to assess your understanding of lab 5. If you do *not* (or *incorrectly*) answer ***all*** question(s), you will receive **0 marks**.

Whilst doing the experiment it is suggested to think about the potential question(s) that you may be asked, and note the relevant details that you've discovered during the lab.

III. DASH experiment methodology

In the following part, the assumption is that the equipment used is the Swinburne's local machine (using Windows operating system).

A. DASH client setup for Chrome (and Chromium) browser

Due to security permissions and browser caching issues, we need the following options enabled when launching Chrome browser to access the DASH dataset:

1) `--disable-web-security`
2) `--user-data-dir`
3) `--incognito`

For simplicity, copy-and-paste the following options (as shown in Figure 1) into Chrome browser.

```
--disable-web-security --user-data-dir --incognito
```

Figure 1. Options that need to be enabled in Chrome Browser

Figure 2 illustrates how to add these options in Chrome Browser. Create a shortcut icon of Chrome browser. Select Chrome properties and add Figure 1 options as shown in Figure 2. Make sure to apply the changes and select ok.

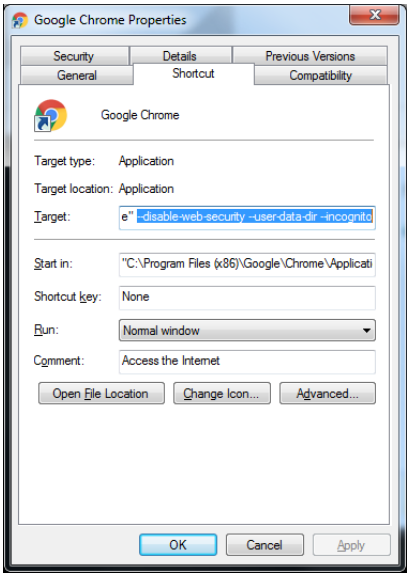

Figure 2. Chrome properties

B. Streaming video with DASH client

To use the `dash.js v2.4.1` client, go to http://rule27.caia.swin.edu.au/dashjs-v2.4.1/samples/dash-if-reference-player/index.html and load one of the Media Presentation Description (MPD) files (by copying the following URL onto the manifest bar on the client):

- 2-sec chunks:

```
http://rule27.caia.swin.edu.au/dash_dataset/2sec/BigBuckBunny_2s_simple.mpd
```

- 10-sec chunks:

```
http://rule27.caia.swin.edu.au/dash_dataset/10sec/BigBuckBunny_10s_simple.mpd
```

Video should start playing if the MPD is loaded successfully.

C. Throttling network bandwidth

To observe DASH's adaptive behaviour, throttle the network bandwidth with Chrome's in-built throttling features.

To open Chrome's developer console: Right click -> Inspect -> Network -> [Drop down menu of preset scenarios with various downstream/upstream speeds and RTT, emulating various technologies] -> apply them and see how the video quality changes.

Hint: Note the approximate video time of 'BigBuckBunny' when you change the throttling speeds, it will assist you when you analyse your representation rates vs. time graph.

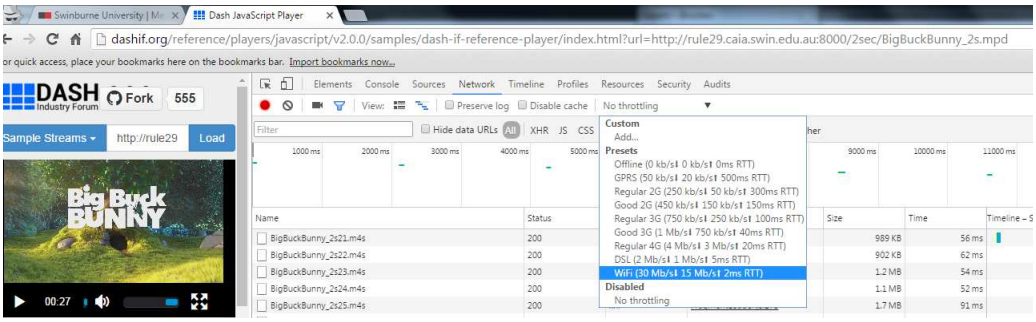

Figure 3. Chrome's network throttling feature

D. *Capturing traffic*

Wireshark (or equivalent tool) should be used to capture traffic when viewing the dataset. You should start capturing before launching your experiments.

Hint: make sure to do post-filtering based on your local IP address (Swinburne's local machine) and HTTP traffic.

An example capture file has been provided for you on Blackboard: dash-test-throttle-bw.pcap.

E. *Analysis of captured traffic*

You are required to analyse the selected representation rates over the duration of your experiments from your captured data. One suggestion is to parse the HTTP GET Requests and identify the requested URI. Since the video chunks are structured in the form of `[chunk size]/[representation rate]/[segment number]`, you can easily identify the selected representation rates from the URI.

R (or equivalent tool) portable should be used to analyse the captured traffic data. Download R portable here: https://sourceforge.net/projects/rportable/files/R-Portable/3.4.0/R-Portable_3.4.0.paf.exe/download. Install R portable on Desktop.

An example R solution script that plots the representation rates over time has been provided for you on Blackboard: analyse_dash_representation_rates.R. The input file is a 2-column CSV file in the form of `[timestamps, representation rates in bps]`.

```
1462174432.942985000,4219897
1462174435.163412000,4219897
1462174436.743936000,4219897
1462174439.100389000,4219897
1462174440.590327000,4219897
```

1) Example: You should expect to see something like this:

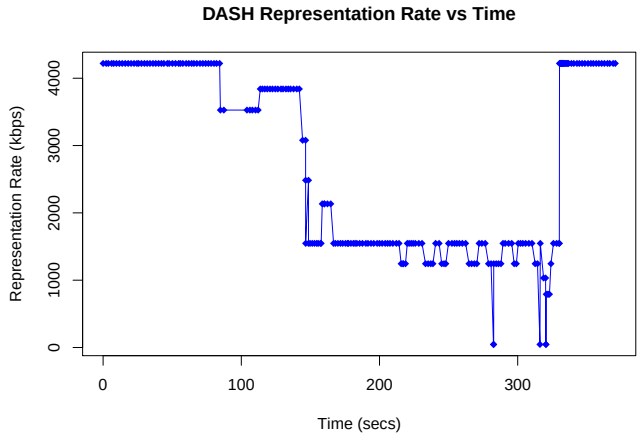

Figure 4. DASH adaptive behaviour evident from the representation rates changes when the available network bandwidth has been throttled.

IV. Conclusion

Since this lab is assessed in class, show the lab demonstrator your representation rates vs time graphs and answer the questions posed.

References

[1] DASH Industry Forum, "dash.js." https://github.com/Dash-Industry-Forum/dash.js/wiki, May 2016.

[2] S. Lederer, C. Müller, and C. Timmerer, "Dynamic Adaptive Streaming over HTTP Dataset," in *Proceedings of the 3rd Multimedia Systems Conference*, MMSys '12, (New York, NY, USA), pp. 89–94, ACM, 2012.