THE UNIVERSITY OF SYDNEY

School of Computer Science

COMP5347: Web Application Development
Week 4 Tutorial: HTTP and Browser Performance

Learning Objectives

- Understand HTTP Protocol
- Understand browser behavior with respect to requesting resources and rendering process

Task 1: Examine the HTTP protocol using TELNET/SSH

Start PUTTY and set up a SSH session to `ucpu1.ug.cs.usyd.edu.au` (alternatively, you may use `ucpu3.ug.cs.usyd.edu.au`) using your unikey and password.

a) In the SSH window type the following command:

```
telnet soit-usrweb-pro-1.ucc.usyd.edu.au 80
GET /~cshe6391/week4.html HTTP/1.0
```

You need to type `Enter` key an extra time after the `GET` command to send out the request. This will send out an HTTP 1.0 request to the server `soit-usrweb-pro-1.ucc.usyd.edu.au` Examine the response message and identify the following fields from the status lines:

Protocol Version	
Status Code	
Status Message	

Also Identify the following fields from the header line:

Web Server	
ETag	
Content Type	
TCP connection closed?	

b) Now type the following command to send out an HTTP/1.1 request

```
telnet soit-usrweb-pro-1.ucc.usyd.edu.au 80
GET /~cshe6391/week4.html HTTP/1.1
```

```
Host: soit-usrweb-pro-1.ucc.usyd.edu.au
```

Remember to type `Enter` key twice to send out the request. You may have noticed that in the first request, the connection is closed immediately, while in the second one, the connection is still open and you are able to type in another request, that is, if your typing speed is really fast. The connection will be closed after some timeout period.

c) Now type the following command to send out a conditional request

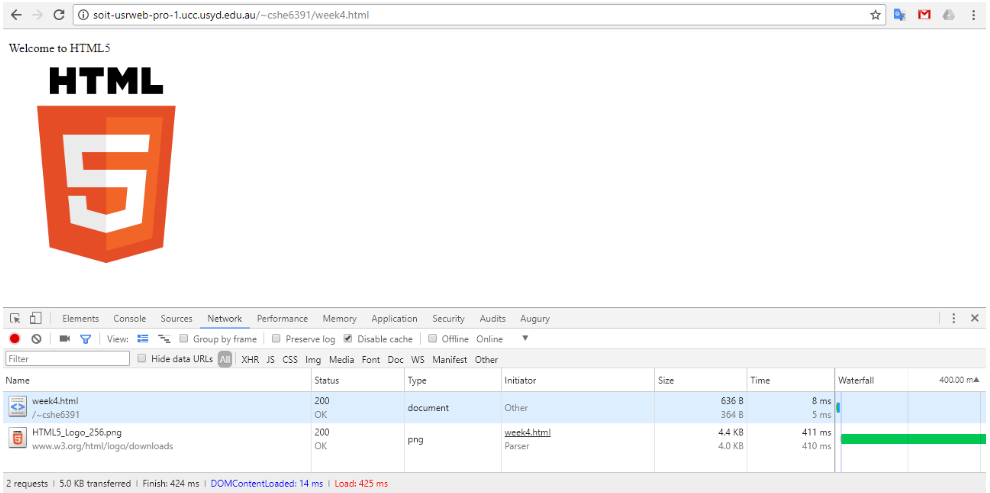
```
GET /~cshe6391/week4.html HTTP/1.1

Host: soit-usrweb-pro-1.ucc.usyd.edu.au
If-None-Match: "2c8003c-16c-5680ed05cab7d"
```

Read the response message and identify the status code. You should expect an “HTTP/1.1 304 Not Modified” status code and message. The response should not contain any body.

Task 2: Inspect browser HTTP request/response details with DevTool

a) Start Google Chrome and open the developer tool same as you did in week 3 lab. In this week, we focus on the `Network` tab instead. Type the following URL in the address bar:

`http://soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4.html` and type enter to send out the request. You should get a screen similar to the Figure 1



□ Group by frame □ Preserve log ☑ Disable cache □ Offline □ Hide data URLs

Name	Status	Type	Initiator	Size	Time	Waterfall 400.00 m▲
week4.html /~cshe6391	200 OK	document	Other	636 B 364 B	8 ms 5 ms	
HTML5_Logo_256.png www.w3.org/html/logo/downloads	200 OK	png	week4.html Parser	4.4 KB 4.0 KB	411 ms 410 ms	

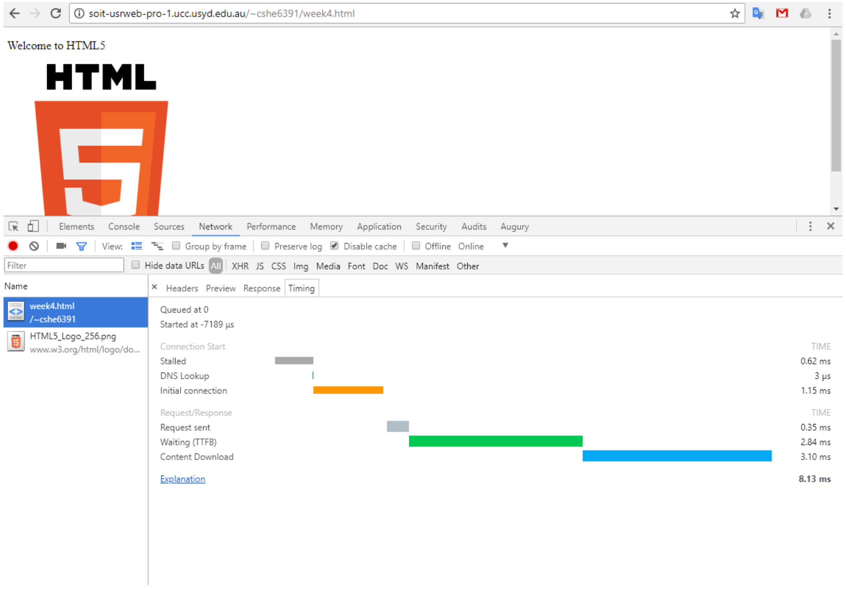
2 requests | 5.0 KB transferred | Finish: 424 ms | DOMContentLoaded: 14 ms | Load: 425 ms

Figure 1: Screenshot of Network tab in DevTool

The network panel provides a number of views. Figure 1 does not show overview and use “small request rows” option. You may switch between different views by clicking the two option icons after the `View:` item.

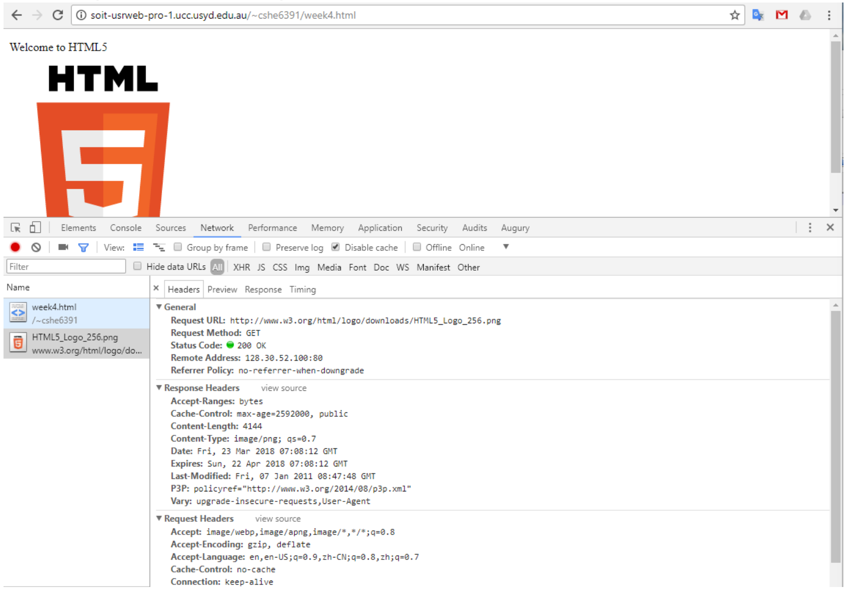
You can inspect various details of each individual request by clicking the request and selecting what you want to view. For instance, Figure 2 shows the “timing” of request

`week4.html`, Figure 3 shows the headers of request `HTML5 Logo 256.png`
Use the information provided by DevTool to answer the following question regarding HTTP messages:


soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4.html
Welcome to HTML5
HTML
Elements Console Sources Network Performance Memory Application Security Audits Augury
View: □ Group by frame □ Preserve log ☑ Disable cache □ Offline Online
Filter □ Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other
Name
week4.html
/~cshe6391
HTML5_Logo_256.png
www.w3.org/html/logo/do...
× Headers Preview Response Timing
Explanation

```
Queued at 0
Started at -7189 µs

Connection Start                 TIME
Stalled                          0.62 ms
DNS Lookup                       3 µs
Initial connection               1.15 ms

Request/Response                 TIME
Request sent                     0.35 ms
Waiting (TTFB)                   2.84 ms
Content Download                 3.10 ms

                                 8.13 ms
```

Figure 2: Timing details of request `week4.html`


soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4.html
Welcome to HTML5
HTML
Elements Console Sources Network Performance Memory Application Security Audits Augury
View: □ Group by frame □ Preserve log ☑ Disable cache □ Offline Online
Filter □ Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other
Name
week4.html
/~cshe6391
HTML5_Logo_256.png
www.w3.org/html/logo/do...
× Headers Preview Response Timing

```
▼ General
    Request URL: http://www.w3.org/html/logo/downloads/HTML5_Logo_256.png
    Request Method: GET
    Status Code: ● 200 OK
    Remote Address: 128.30.52.100:80
    Referrer Policy: no-referrer-when-downgrade
▼ Response Headers      view source
    Accept-Ranges: bytes
    Cache-Control: max-age=2592000, public
    Content-Length: 4144
    Content-Type: image/png; qs=0.7
    Date: Fri, 23 Mar 2018 07:08:12 GMT
    Expires: Sun, 22 Apr 2018 07:08:12 GMT
    Last-Modified: Fri, 07 Jan 2011 08:47:48 GMT
    P3P: policyref="http://www.w3.org/2014/08/p3p.xml"
    Vary: upgrade-insecure-requests,User-Agent
▼ Request Headers      view source
    Accept: image/webp,image/apng,image/*,*/*;q=0.8
    Accept-Encoding: gzip, deflate
    Accept-Language: en,en-US;q=0.9,zh-CN;q=0.8,zh;q=0.7
    Cache-Control: no-cache
    Connection: keep-alive
```

Figure 3: Headers of request `HTML5_ Logo 256.png`

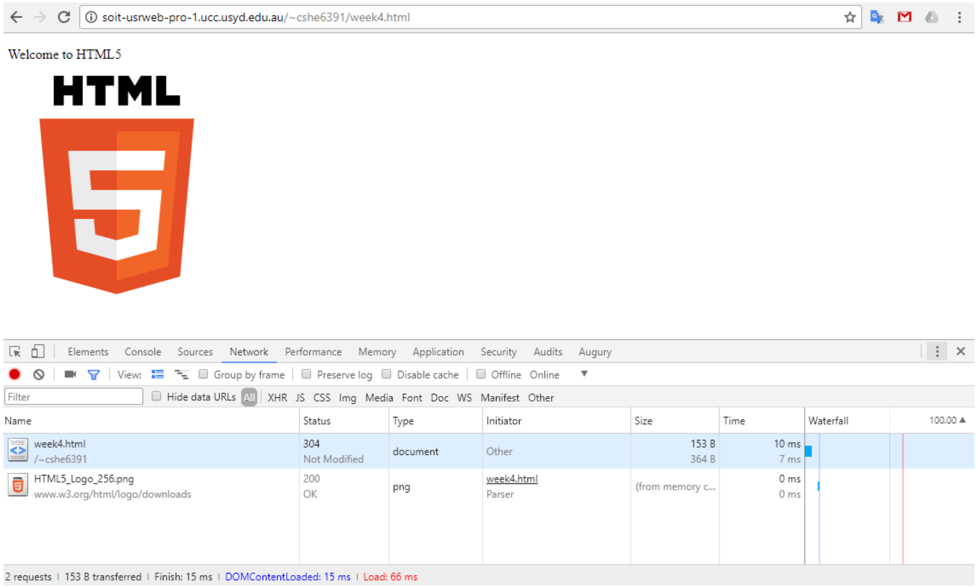
- How many requests are sent by the browser?
- Are the requests sent to the same server?
- What are the response status codes for all requests?
- Which server sends cache instructions and what are the instructions?

Use the information provided by DevTool to answer the following questions regarding browser rendering process:

- What are the DOMContentLoaded time and the Load time?
- What happens between these two events?
- In Figure 1, there is a small gap between `week4.html` request time (8ms) and the `DOMContentLoaded` event time (14ms). What happens during the gap?
- In Figure 1, the request for `HTML5 Logo 256.png` took much 411ms while the request for `week4.html` took 8ms. You may have slightly different numbers in your DevTool. What is the main cause for delay in getting `HTML5 Logo 256.png`.

b) Right click on Chrome page and select “Inspect”. Click the “Application” tab and expand the “Cache Storage” in the left section options. Select a cache to view its contents and search for the two objects: `week4.html` and `HTML5 Logo 256.png`. You should be able to find both. Clicking the link representing each object will display the actual cache entry. You will find the data captured are similar to the respective HTTP response header. For instance, both entries contain basic data such as `Last Modified` time. The cache entry of `HTML5 Logo 256.png` contain the `Cache-Control` header and `Expires` time. The cache entry of `week4.html` contains `ETag` data. Theoretically, the browser will use cache validation mechanism for `week4.html` and cash expiration mechanism for `HTML5 Logo 256.png`. We will see if that is the case.

c) Now reload the page and inspect the content of Network panel (which would be similar to Figure 4 to answer the following questions:



soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4.html
HTML
Elements
Console
Sources
Network
Performance
Memory
Application
Security
Audits
Augury
View:
Filter
XHR JS CSS Img Media Font Doc WS Manifest Other

Welcome to HTML5

□ Group by frame □ Preserve log □ Disable cache □ Offline Online

□ Hide data URLs All

Name	Status	Type	Initiator	Size	Time	Waterfall 100.00 ▲
week4.html /~cshe6391	304 Not Modified	document	Other	153 B 364 B	10 ms 7 ms	
HTML5_Logo_256.png www.w3.org/html/logo/downloads	200 OK	png	week4.html Parser	(from memory c...	0 ms 0 ms	

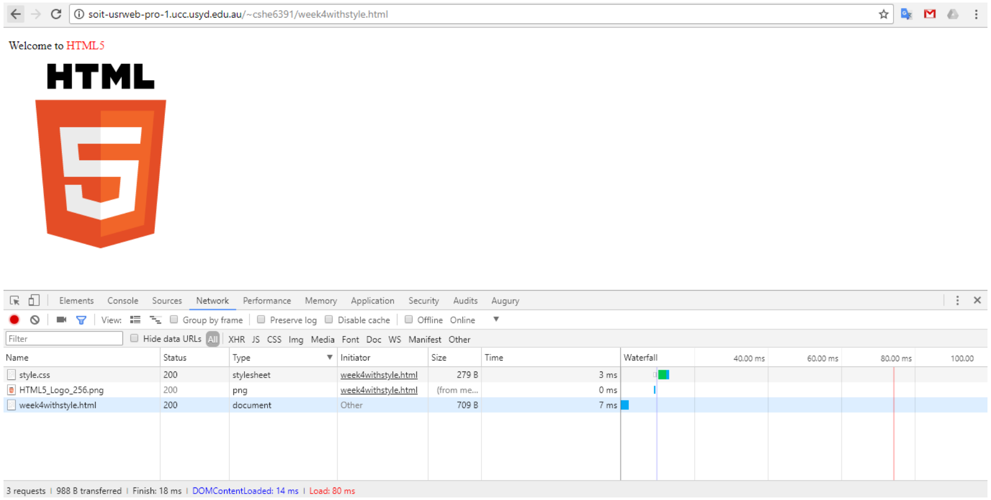
2 requests | 153 B transferred | Finish: 15 ms | DOMContentLoaded: 15 ms | Load: 66 ms

Figure 4: Reloading `week4.html`

- what are the latencies for both requests? Are there any difference between the latencies observed in the previous question (first time requesting `week4.html`)
- What are the `DOMContentLoaded` and `load` time? Are there any difference between the time recorded in the previous question (first time requesting `week4.html`)

- How does the browser obtain content of `week4.html` and `HTML5_Logo_256.png`?

d) Open DevTool on another tab, point the browser to the following URL: `http://soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4withstyle.html` Your network panel may look like Figure 5:



soit-usrweb-pro-1.ucc.usyd.edu.au/~cshe6391/week4withstyle.html

Welcome to HTML5

Name	Status	Type	Initiator	Size	Time
style.css	200	stylesheet	week4withstyle.html	279 B	3 ms
HTML5_Logo_256.png	200	png	week4withstyle.html	(from me...	0 ms
week4withstyle.html	200	document	Other	709 B	7 ms

3 requests | 988 B transferred | Finish: 18 ms | DOMContentLoaded: 14 ms | Load: 80 ms

Figure 5: Loading `week4_ with style.html`

Try to interpret the rendering process of the browser based on the DevTool information. This page has two supporting resources: `style.css` and `HTML5_Logo_256.png`. In which order does the browser send request for each?