

Computer Networks Laboratory

UE23CS252B

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Week# 4 Task Number: 1

TITLE: Understanding Persistent and Non-persistent HTTP

Note: Two trials were done for each experiment instead of one to get consistent results.

Objective: Understand persistent and non-persistent HTTP connections and corresponding performance impact.

Experiment: Create a web page with N (e.g. 10) embedded images. Each image should be of minimum 2 MB size. Configure your browser (Firefox) with following settings (each setting requires repeat of experiment)

TRIAL 1:

a) Non-persistent connection

Client request:

Screenshot of a browser window showing a grid of 10 images. The images include a sunset over water, a bridge over a lake, a peacock feather, a Hindu deity, a mountain landscape, a dog, a girl in a snowy scene, a sunset, and a city skyline.

Below the browser is a Network tab from a developer tools interface, showing a list of network requests:

No.	Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms	320 ms	32 ms
1	200	GET	192.168.218.22	1.jpg	img	jpeg	8.11 kB	8.83 kB			
2	200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB			
3	200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB			
4	200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB			
5	200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB			
6	200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB			
7	200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB			
8	200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB			
9	200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB			
10	404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175	html	1.41 kB	1.11 kB			

Bottom status bar: 12 requests | 82.93 kB / 86.38 kB transferred | Finish: 499 ms | DOMContentLoaded: 382 ms | load: 469 ms

Screenshot of a NetworkMiner tool capturing traffic on port 443 (https). The list of captured packets shows various HTTP requests and responses between the client (192.168.218.90) and the server (192.168.218.22).

No.	Time	Source	Destination	Protocol	Length	Info
1	0.3.0.32261444	192.168.218.90	192.168.218.22	HTTP	457	423 HTTP/1.1 200 OK (text/html)
2	9.3.823855724	192.168.218.22	192.168.218.90	HTTP	17	424 HTTP/1.1 200 OK (text/html)
3	10.3.823855724	192.168.218.22	192.168.218.90	HTTP	126	126 HTTP/1.1 200 OK (JPEG JFIF image)
4	11.3.823855724	192.168.218.22	192.168.218.90	HTTP	21	471 GET /2.jpg HTTP/1.1
5	12.3.823855724	192.168.218.22	192.168.218.90	HTTP	193	593 HTTP/1.1 200 OK (JPEG JFIF image)
6	13.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /3.jpg HTTP/1.1
7	14.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
8	15.3.823855724	192.168.218.22	192.168.218.90	HTTP	41	471 GET /4.jpg HTTP/1.1
9	16.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
10	17.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /5.jpg HTTP/1.1
11	18.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
12	19.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /6.jpg HTTP/1.1
13	20.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
14	21.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /7.jpg HTTP/1.1
15	22.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
16	23.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /8.jpg HTTP/1.1
17	24.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
18	25.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /9.jpg HTTP/1.1
19	26.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
20	27.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /10.jpg HTTP/1.1
21	28.3.823855724	192.168.218.22	192.168.218.90	HTTP	192	760 HTTP/1.1 200 OK (JPEG JFIF image)
22	29.3.823855724	192.168.218.22	192.168.218.90	HTTP	34	471 GET /favicon.ico HTTP/1.1
23	30.3.823855724	192.168.218.22	192.168.218.90	HTTP	139	139 HTTP/1.1 404 Not Found
24	31.3.933466450	192.168.218.90	192.168.218.22	HTTP	471	471 GET /7.jpg HTTP/1.1
25	32.3.933466450	192.168.218.90	192.168.218.22	HTTP	770	770 HTTP/1.1 200 OK (JPEG JFIF image)
26	33.3.933466450	192.168.218.90	192.168.218.22	HTTP	1087	1087 HTTP/1.1 200 OK (JPEG JFIF image)
27	34.3.933466450	192.168.218.90	192.168.218.22	HTTP	471	471 GET /9.jpg HTTP/1.1
28	35.3.933466450	192.168.218.90	192.168.218.22	HTTP	499	499 HTTP/1.1 200 OK (JPEG JFIF image)
29	36.3.933466450	192.168.218.90	192.168.218.22	HTTP	115	472 GET /10.jpg HTTP/1.1
30	37.3.933466450	192.168.218.90	192.168.218.22	HTTP	1045	1045 HTTP/1.1 200 OK (JPEG JFIF image)
31	38.3.933466450	192.168.218.90	192.168.218.22	HTTP	471	471 GET /favicon.ico HTTP/1.1
32	39.4.225291219	192.168.218.90	192.168.218.22	HTTP/X-	136	136 HTTP/1.1 404 Not Found

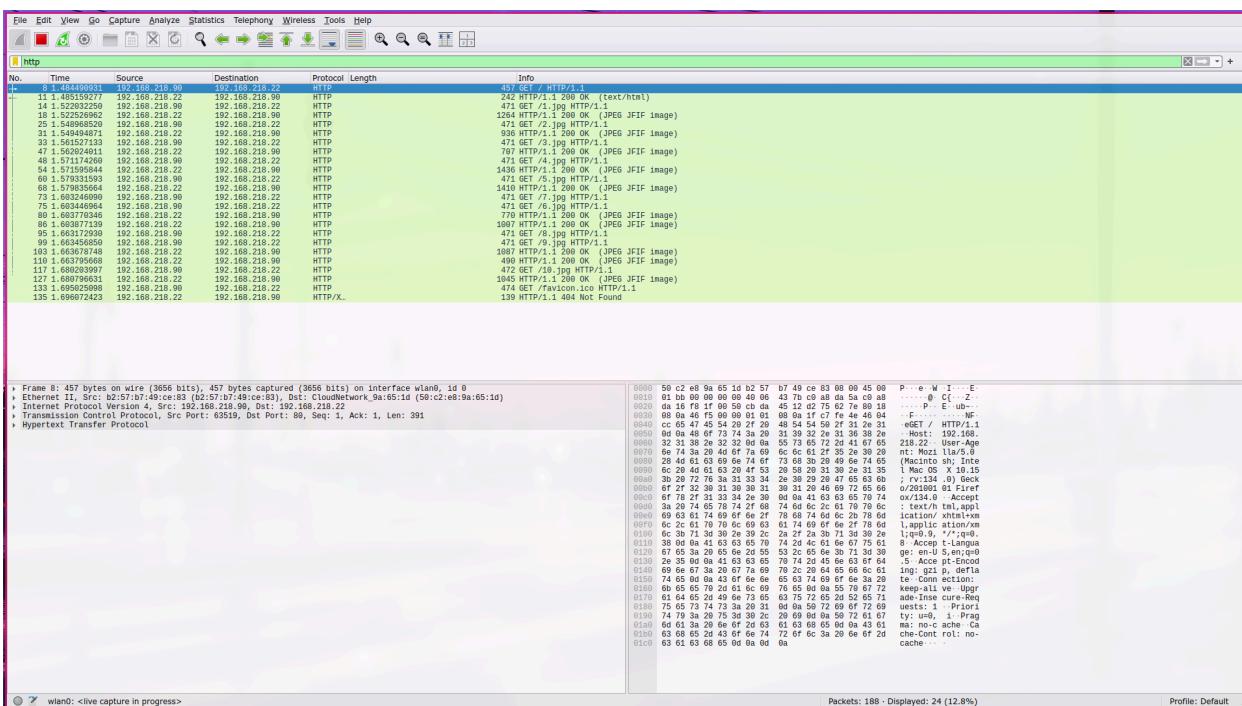
Bottom status bar: Frame: 6 | Hypertext Transfer Protocol: Protocol | Packets: 241 - Displayed: 24 (10.0%) | Profile: Default

b) 2 persistent connections

Client request:

The screenshot shows a browser window with an "Image Grid" tab open, displaying a 3x5 grid of various images. Below the grid, the browser's developer tools Network tab is visible, showing a list of 12 requests made to the domain 192.168.218.22. The requests are all GET requests for files named 2.jpg through 10.jpg, and a favicon.ico file. The Network tab includes columns for Status, Method, Domain, File, Initiator, Type, Transferred, Size, and Time taken. The total transfer time is listed as 320 ms.

Status	Method	Domain	File	Initiator	Type	Transferred	Size	Time	Latency	Wait	Download	Total
200	GET	192.168.218.22	2.jpg	img	jpeg	8.11 kB	7.85 kB	160 ms	68 ms	0 ms	320 ms	
200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB	64 ms	64 ms	0 ms		
200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB	73 ms	73 ms	0 ms		
200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB	74 ms	74 ms	0 ms		
200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB	58 ms	58 ms	0 ms		
200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB	63 ms	63 ms	0 ms		
200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB	77 ms	77 ms	0 ms		
200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB	73 ms	73 ms	0 ms		
200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB	62 ms	62 ms	0 ms		
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:176 (...)	html	1.41 kB	1.11 kB	16 ms	16 ms	0 ms		



c) 4 persistent connections

Client request:

Screenshot of a browser window showing a grid of 10 images. The images include a sunset over water, a bridge over a lake, a peacock feather, a Hindu deity, a mountain landscape, a dog, a girl in a snowy scene, a sunset, and a city skyline.

Below the browser is a Network tab from a developer tools interface, showing a list of requests and a performance timeline.

No.	Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms	80 ms	160 ms	240 ms
1	200	GET	192.168.218.22	1.jpg	img	jpeg	8.11 kB	7.83 kB		74 ms		
2	200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB		61 ms		
3	200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB		61 ms		
4	200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB		114 ms		
5	200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB		65 ms		
6	200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB		75 ms		
7	200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB		112 ms		
8	200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB		121 ms		
9	200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB		122 ms		
10	404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175	html	1.41 kB	1.11 kB		8 ms		

12 requests | 82.93 kB / 86.37 kB transferred | Finish: 182 ms | DOMContentLoaded: 38 ms | load: 173 ms

Screenshot of Wireshark capturing network traffic. The packet list shows numerous HTTP requests from 192.168.218.99 to 192.168.218.22, corresponding to the images seen in the browser. The details and bytes panes show the raw HTTP headers and data for each request.

Frame 0: 457 bytes on wire (3666 bits), 457 bytes captured (3656 bits) on interface wlan0, id 0
 Ethernet II, Src: b2:57:b7:49:ce:83 (b2:57:b7:49:ce:83), Dst: CloudNetwork_9a:65:1d (50:c2:e8:9a:65:1d)
 Internet Protocol Version 4, Src: 192.168.218.99, Dst: 192.168.218.22
 Transmission Control Protocol, Src Port: 63826, Dst Port: 80, Seq: 1, Ack: 1, Len: 391
 Hypertext Transfer Protocol

Packets: 184 - Displayed: 24 (13.0%)

d) 6 persistent connections

Client request:

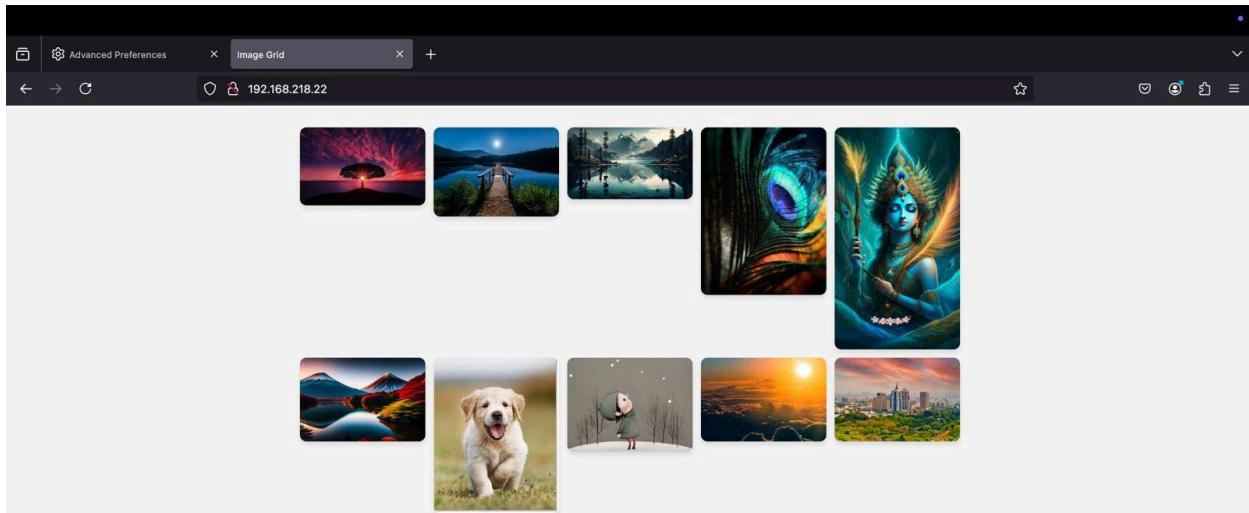
Screenshot of a browser window showing a grid of 10 images. The browser's developer tools Network tab is open, displaying 12 requests for images and one for the favicon. The requests are color-coded by initiator (img) and show various file sizes and transfer times.

Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms	640 ms	1.28
200	GET	192.168.218.22	2.jpg	img	jpeg	8.11 kB	7.83 kB		599 ms	
200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB		629 ms	
200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB		628 ms	
200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB		628 ms	
200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB		629 ms	
200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB		541 ms	
200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB		541 ms	
200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB		544 ms	
200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB		551 ms	
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175	html	1.41 kB	1.11 kB		29 ms	

Below the browser screenshot is a Wireshark capture of network traffic. The list shows 198 captured frames, mostly HTTP requests for images and the favicon. The details pane at the bottom shows the raw hex and ASCII data for frame 32, which corresponds to the first image request in the browser's Network tab.

e) 8 persistent connections

Client request:



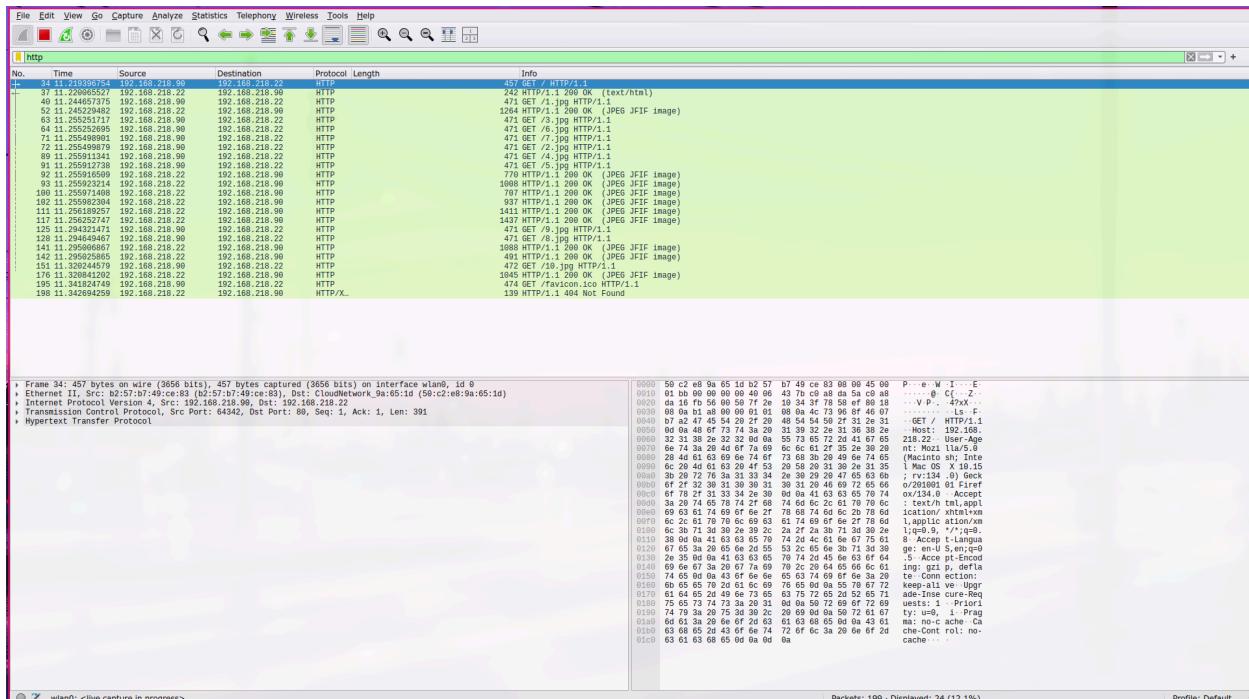
The browser window shows a grid of 10 images. The images are as follows:

- Row 1: Tree at sunset, Bridge over water, Peacock feather, Hindu deity.
- Row 2: Mountain landscape, Dog, Person in green coat, Sunset, City skyline.

Below the browser window is a Network tab from a developer tool showing 12 requests made to the server. The requests are:

Status	Method	Domain	File	Initiator	Type	Transferred	Size	Time
200	GET	192.168.218.22	2.jpg	img	jpeg	8.11 kB	7.83 kB	0 ms
200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB	39 ms
200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB	47 ms
200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB	70 ms
200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB	111 ms
200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB	149 ms
200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB	160 ms
200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB	162 ms
200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB	13 ms
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175	html	1.41 kB	1.11 kB	235 ms

At the bottom of the developer tool interface, it says "12 requests 82.93 kB / 86.37 kB transferred | Finish: 254 ms DOMContentLoaded: 65 ms load: 235 ms".

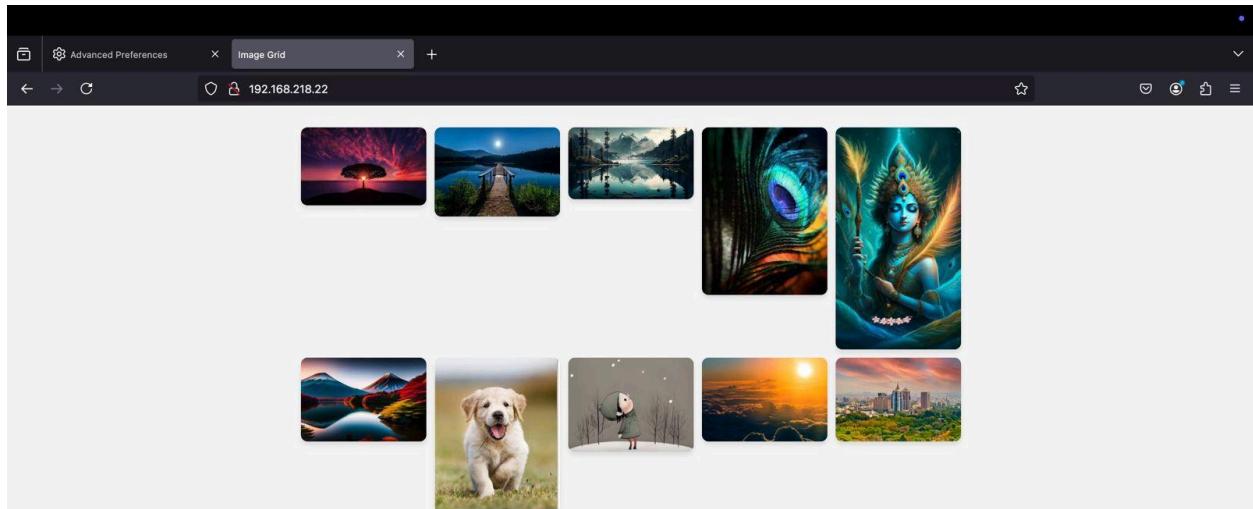


The Wireshark interface shows a list of captured frames. The frames are numbered from 37 to 198. Most frames are HTTP requests for images (e.g., 192.168.218.22:80 HTTP/1.1 GET /1.jpg HTTP/1.1) or the favicon (192.168.218.22:80 HTTP/1.1 GET /favicon.ico HTTP/1.1). The last frame (198) shows a response for the favicon with code 404 Not Found.

At the bottom of the Wireshark interface, it says "Packets: 199 - Displayed: 24 (12.1%)".

f) 10 persistent connections

Client request:

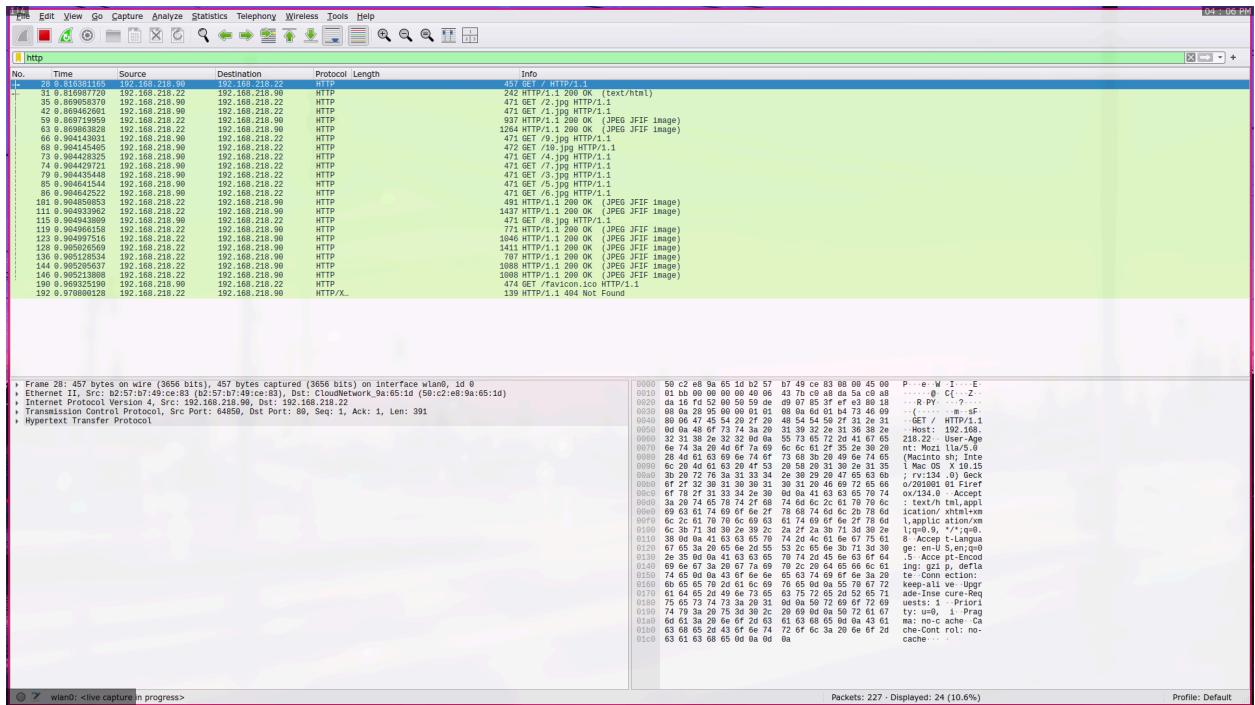


The screenshot shows a browser window displaying a grid of 10 images. The images are arranged in two rows of five. The top row contains: 1. A tree at sunset with a red glow. 2. A bridge over a lake under a full moon. 3. A landscape with mountains and a lake. 4. A close-up of a peacock's feather. 5. A colorful illustration of a Hindu deity. The bottom row contains: 1. A mountain range reflected in water. 2. A yellow Labrador Retriever. 3. A person sitting in a snowy environment. 4. A sunset over a city skyline. 5. A landscape with a large sun or moon.

Below the browser window is a screenshot of the Network tab in the developer tools. The table shows 12 requests made to the domain 192.168.218.22. The requests are all successful (200) except for one favicon.ico request which failed (404). The table includes columns for Status, Method, Domain, File, Initiator, Type, Transferred, Size, and various timing metrics like Load Time and Total Time.

Status	Method	Domain	File	Initiator	Type	Transferred	Size	Load Time	Total Time
200	GET	192.168.218.22	2.jpg	img	jpeg	8.11 kB	7.83 kB	~37 ms	~160 ms
200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB	~56 ms	~320 ms
200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB	~67 ms	~480 ms
200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB	~78 ms	
200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB	~67 ms	
200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB	~111 ms	
200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.08 kB	~131 ms	
200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB	~144 ms	
200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB	~179 ms	
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175 (...	html	1.41 kB	1.11 kB		206 ms

At the bottom of the developer tools interface, there is a summary: 12 requests | 82.93 kB / 86.37 kB transferred | Finish: 467 ms | DOMContentLoaded: 70 ms | load: 260 ms.



Time difference of captures:

Non persistent: 0.402029775

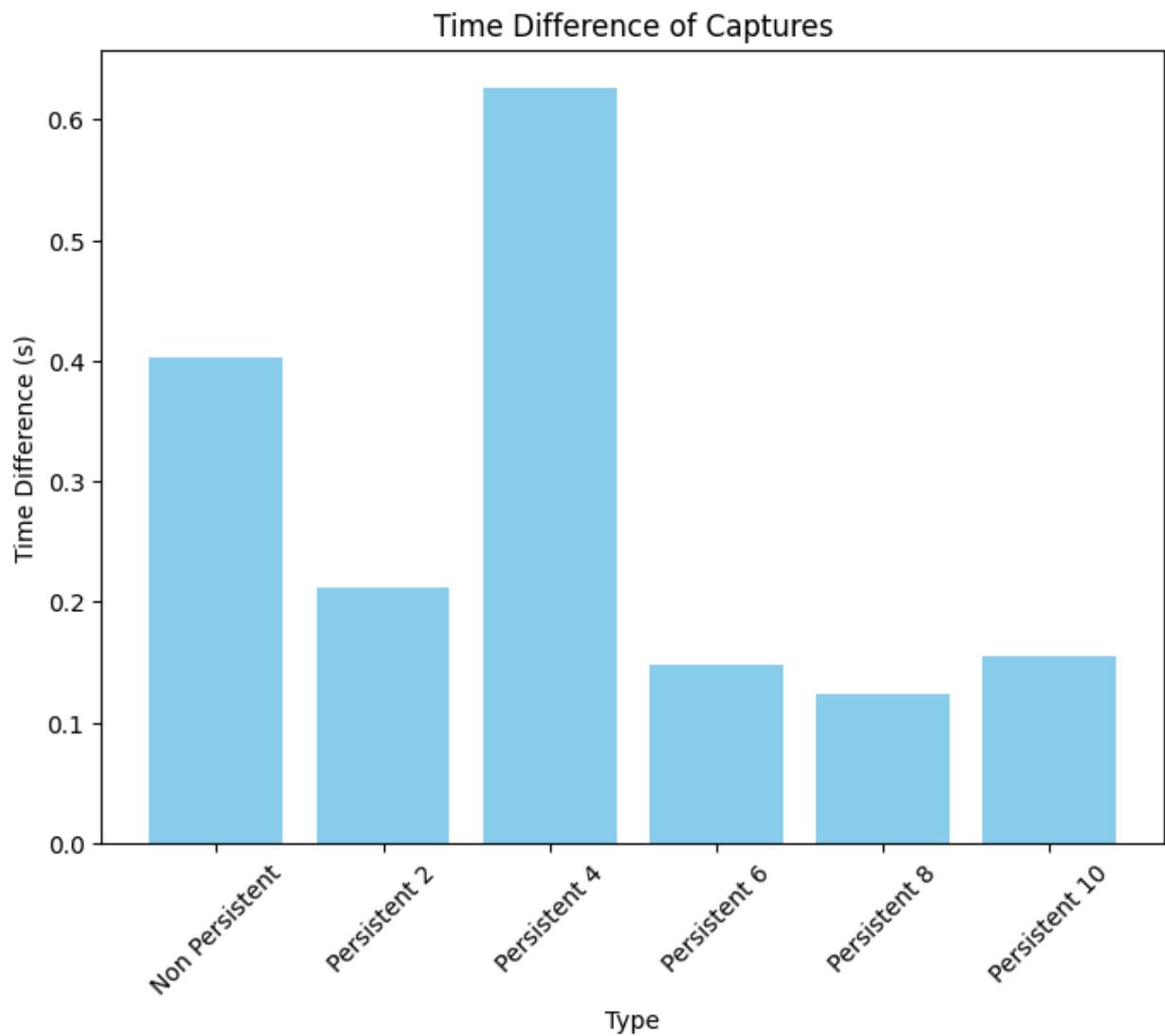
Persistent 2 : 0.211581492

Persistent 4 : 0.626499735

Persistent 6 : 0.148255278

Persistent 8 : 0.123297505

Persistent 10 : 0.154418963



TRIAL 2:

a) Non-persistent connection

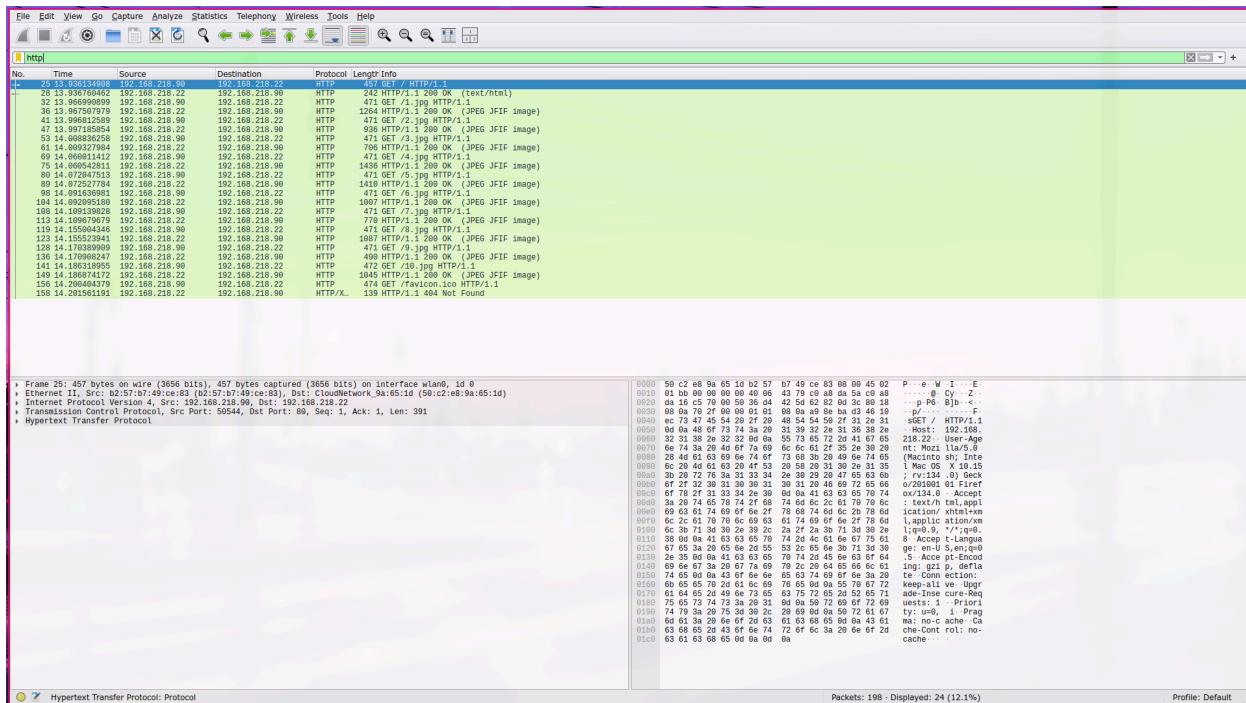
Client request:

The screenshot shows a browser window with the URL `192.168.218.22`. The main content area displays a grid of ten images. The first row contains five images: a sunset over a tree, a night scene with a bridge, a landscape with mountains and water, a close-up of a peacock feather, and a colorful illustration of a deity. The second row contains five images: a landscape with mountains and water, a white dog, a person in a snowy environment, a sunset over a city, and a landscape with a city skyline.

Below the browser window is the Network tab of the developer tools. The table lists network requests:

Status	Method	Domain	File	Initiator	Type	Transferred	Size	Time
200	GET	192.168.218.22	2.jpg	img	jpeg	8.11 kB	7.83 kB	320 ms
200	GET	192.168.218.22	3.jpg	img	jpeg	9.33 kB	9.04 kB	32 ms
200	GET	192.168.218.22	4.jpg	img	jpeg	8.61 kB	8.33 kB	85 ms
200	GET	192.168.218.22	5.jpg	img	jpeg	11.48 kB	11.19 kB	81 ms
200	GET	192.168.218.22	6.jpg	img	jpeg	8.18 kB	7.90 kB	83 ms
200	GET	192.168.218.22	7.jpg	img	jpeg	6.50 kB	6.21 kB	86 ms
200	GET	192.168.218.22	8.jpg	img	jpeg	5.37 kB	5.09 kB	81 ms
200	GET	192.168.218.22	9.jpg	img	jpeg	9.11 kB	8.83 kB	84 ms
200	GET	192.168.218.22	10.jpg	img	jpeg	11.12 kB	10.83 kB	89 ms
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175 (...	html	1.41 kB	1.11 kB	81 ms

At the bottom of the developer tools, the status bar shows: 12 requests | 82.99 kB / 86.38 kB transferred | Finish: 499 ms DOMContentLoaded: 382 ms load: 469 ms



b) 2 persistent connections

Client request:

The browser interface shows a network tab with 12 requests. The requests are as follows:

No.	Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms
0	200	GET	192.168.218.22	2.jpg		img	8.11 kB	7.83 kB	160 ms
1	200	GET	192.168.218.22	3.jpg		img	9.33 kB	9.04 kB	66 ms
2	200	GET	192.168.218.22	4.jpg		img	8.61 kB	8.33 kB	23 ms
3	200	GET	192.168.218.22	5.jpg		img	11.48 kB	11.19 kB	24 ms
4	200	GET	192.168.218.22	6.jpg		img	8.18 kB	7.90 kB	58 ms
5	200	GET	192.168.218.22	7.jpg		img	6.50 kB	6.21 kB	77 ms
6	200	GET	192.168.218.22	8.jpg		img	5.37 kB	5.08 kB	23 ms
7	200	GET	192.168.218.22	9.jpg		img	9.11 kB	8.83 kB	82 ms
8	200	GET	192.168.218.22	10.jpg		img	11.12 kB	10.83 kB	16 ms
9	404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175	html	1.41 kB	1.11 kB	

Network statistics: 12 requests, 82.93 kB / 86.38 kB transferred, Finish: 259 ms, DOMContentLoaded: 148 ms, load: 241 ms.

The NetworkMiner tool displays the captured traffic. Key details from the list view:

- Frame 6: 457 bytes on wire (3666 bits), 457 bytes captured (3656 bits) on interface wlan0, id 0
 - Ethernet II, Src: b2:57:b7 (b2:57:b7:49:ce:83) (b2:57:b7:49:ce:83), Dst: CloudNetwork_9a:65:1d (50:c2:e8:9a:65:1d)
 - Internet Protocol Version 4, Src: 192.168.218.99, Dst: 192.168.218.22
 - Transmission Control Protocol, Src Port: 51515, Dst Port: 80, Seq: 1, Ack: 1, Len: 391
 - HyperText Transfer Protocol
- Frame 147: 457 bytes on wire (3666 bits), 457 bytes captured (3656 bits) on interface wlan0, id 0
 - Ethernet II, Src: b2:57:b7 (b2:57:b7:49:ce:83) (b2:57:b7:49:ce:83), Dst: CloudNetwork_9a:65:1d (50:c2:e8:9a:65:1d)
 - Internet Protocol Version 4, Src: 192.168.218.99, Dst: 192.168.218.22
 - Transmission Control Protocol, Src Port: 51515, Dst Port: 80, Seq: 1, Ack: 1, Len: 391
 - HyperText Transfer Protocol

The details view shows the raw hex and ASCII data for each packet, including headers like Host: 192.168.218.99 and Accept: text/html, application/xhtml+xml, application/xml, */*. The tool also highlights specific fields such as 'GET / HTTP/1.1' and 'HTTP/1.1 200 OK'.

c) 4 persistent connections

Client request:

The browser interface shows a network tab with 12 requests. The requests are as follows:

- 200 GET / 192.168.218.22 Z.jpg
- 200 GET / 192.168.218.22 3.jpg
- 200 GET / 192.168.218.22 4.jpg
- 200 GET / 192.168.218.22 5.jpg
- 200 GET / 192.168.218.22 6.jpg
- 200 GET / 192.168.218.22 7.jpg
- 200 GET / 192.168.218.22 8.jpg
- 200 GET / 192.168.218.22 9.jpg
- 200 GET / 192.168.218.22 10.jpg
- 404 GET / 192.168.218.22 favicon.ico

The timeline shows the duration for each request, with most taking between 60ms and 100ms.

The screenshot shows a packet capture tool interface with the following details:

- Frame 25:** 457 bytes on wire (3666 bits), 467 bytes captured (3666 bits) on interface wlan0, id 0
 - Ethernet II, Src: b2:57:b7:49:ce:83 (b2:57:b7:49:ce:83), Dst: CloudNetwork_9a:65:1d (50:c2:eb:9a:65:1d)
 - Internet Protocol Version 4, Src: 192.168.218.98, Dst: 192.168.218.22
 - Transmission Control Protocol, Src Port: 51898, Dst Port: 80, Seq: 1, Ack: 1, Len: 391
 - HyperText Transfer Protocol
- Frame 139:** 457 bytes on wire (3666 bits), 467 bytes captured (3666 bits) on interface wlan0, id 0
 - Ethernet II, Src: b2:57:b7:49:ce:83 (b2:57:b7:49:ce:83), Dst: CloudNetwork_9a:65:1d (50:c2:eb:9a:65:1d)
 - Internet Protocol Version 4, Src: 192.168.218.98, Dst: 192.168.218.22
 - Transmission Control Protocol, Src Port: 51898, Dst Port: 80, Seq: 1, Ack: 1, Len: 391
 - HyperText Transfer Protocol

The packet details and bytes sections show the HTTP traffic between the client and the server, including headers like Host, User-Agent, and Accept, and body content related to the images requested.

d) 6 persistent connections

Client request:

The browser interface shows a grid of 10 images. Below the grid, the Network tab of the developer tools is selected, displaying a list of 12 requests. Most requests are for images (jpg files), with one for a favicon.ico file.

Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms	640 ms	509 ms
200	GET	192.168.218.22	2.jpg		img	jpeg	8.11 kB	7.83 kB		
200	GET	192.168.218.22	3.jpg		img	jpeg	9.33 kB	9.04 kB		
200	GET	192.168.218.22	4.jpg		img	jpeg	8.61 kB	8.33 kB		
200	GET	192.168.218.22	5.jpg		img	jpeg	11.48 kB	11.19 kB		
200	GET	192.168.218.22	6.jpg		img	jpeg	8.18 kB	7.90 kB		
200	GET	192.168.218.22	7.jpg		img	jpeg	6.50 kB	6.21 kB		
200	GET	192.168.218.22	8.jpg		img	jpeg	5.37 kB	5.08 kB		
200	GET	192.168.218.22	9.jpg		img	jpeg	9.11 kB	8.83 kB		
200	GET	192.168.218.22	10.jpg		img	jpeg	11.12 kB	10.83 kB		
404	GET	192.168.218.22	favicon.ico	FaviconLoader.sys.mjs:175 (...	img	html	1.41 kB	1.11 kB		

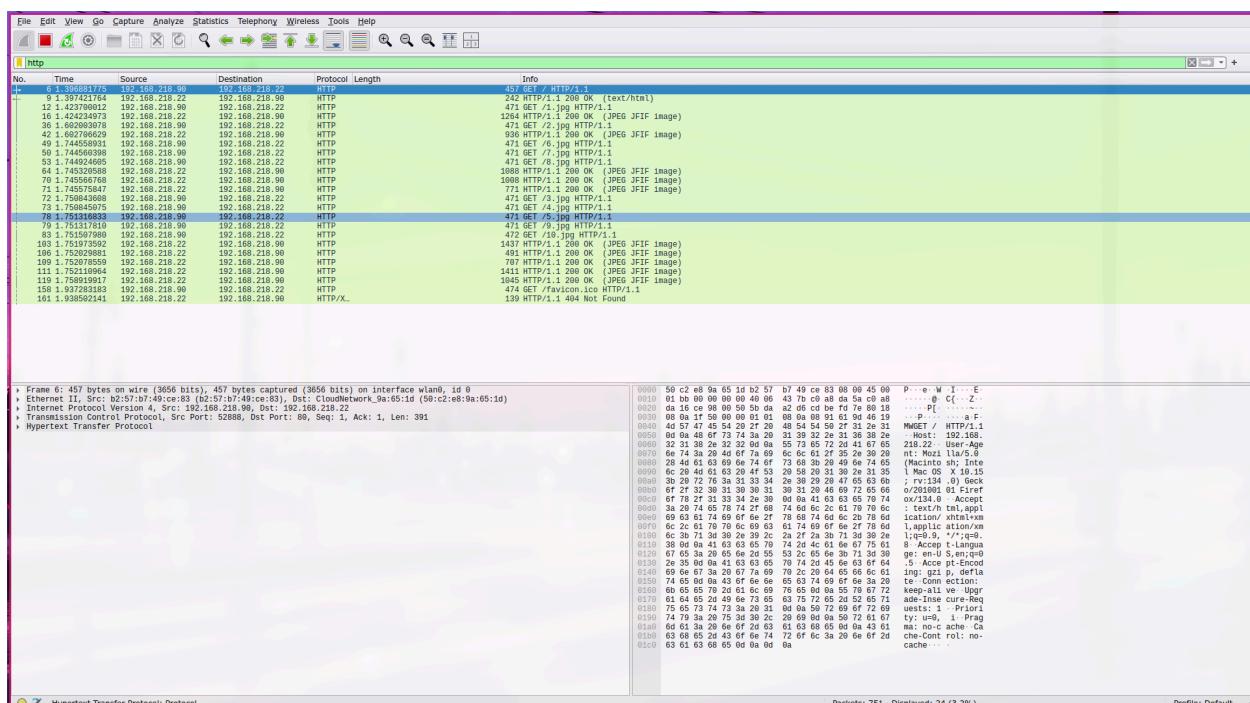
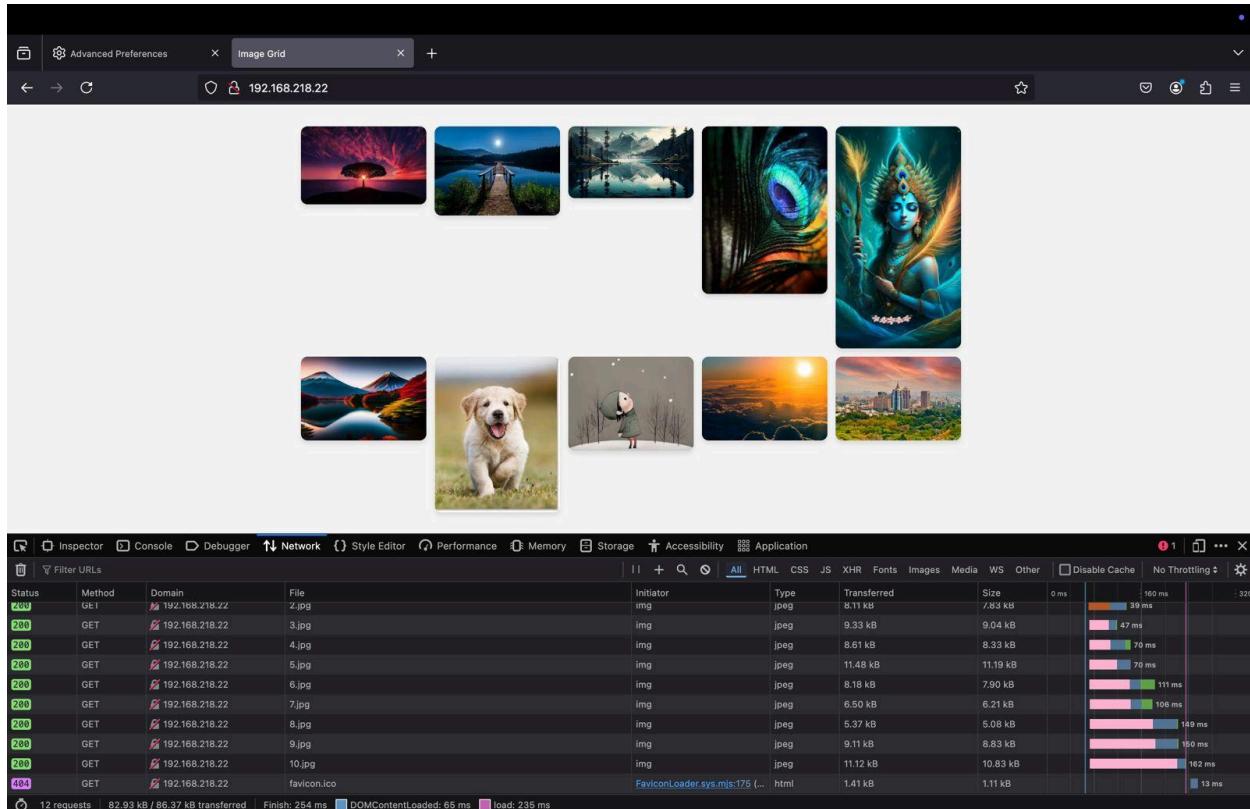
Below the table, network traffic details are shown:

No.	Time	Source	Destination	Protocol	Length	Info
18	3.397741493	192.168.218.99	192.168.218.22	HTTP	457	GET / HTTP/1.1
19	3.397741493	192.168.218.99	192.168.218.22	HTTP	242	GET /index.htm (text/html)
20	3.572446988	192.168.218.99	192.168.218.22	HTTP	471	GET /1.jpg HTTP/1.1
39	3.579895588	192.168.218.22	192.168.218.99	HTTP	1264	HTTP/1.1.2 200 OK (JPEG/JFIF image)
40	3.621984542	192.168.218.22	192.168.218.99	HTTP	471	GET /2.jpg HTTP/1.1
45	3.621978711	192.168.218.99	192.168.218.22	HTTP	471	GET /4.jpg HTTP/1.1
46	3.621988108	192.168.218.99	192.168.218.22	HTTP	471	GET /5.jpg HTTP/1.1
52	3.621988108	192.168.218.99	192.168.218.22	HTTP	471	GET /6.jpg HTTP/1.1
53	3.621981254	192.168.218.99	192.168.218.22	HTTP	471	GET /7.jpg HTTP/1.1
62	3.621931648	192.168.218.99	192.168.218.22	HTTP	471	GET /8.jpg HTTP/1.1
63	3.621931648	192.168.218.99	192.168.218.22	HTTP	493	GET /9.jpg HTTP/1.1 (JPEG/JFIF image)
82	3.621919583	192.168.218.22	192.168.218.99	HTTP	1080	HTTP/1.1.2 200 OK (JPEG/JFIF image)
87	3.621954622	192.168.218.22	192.168.218.99	HTTP	770	HTTP/1.1.2 200 OK (JPEG/JFIF image)
92	3.621954622	192.168.218.22	192.168.218.99	HTTP	1452	HTTP/1.1.2 200 OK (JPEG/JFIF image)
93	3.622019528	192.168.218.22	192.168.218.99	HTTP	787	HTTP/1.1.2 200 OK (JPEG/JFIF image)
96	3.622098449	192.168.218.22	192.168.218.99	HTTP	1437	HTTP/1.1.2 200 OK (JPEG/JFIF image)
97	3.622098449	192.168.218.22	192.168.218.99	HTTP	471	GET /9.jpg HTTP/1.1
117	3.721894553	192.168.218.99	192.168.218.22	HTTP	472	GET /10.jpg HTTP/1.1
142	3.723722739	192.168.218.22	192.168.218.99	HTTP	484	HTTP/1.1.2 200 OK (JPEG/JFIF image)
139	3.723694338	192.168.218.22	192.168.218.99	HTTP	489	HTTP/1.1.2 200 OK (JPEG/JFIF image)
145	3.732722739	192.168.218.99	192.168.218.22	HTTP	471	GET /8.jpg HTTP/1.1
142	3.732722739	192.168.218.22	192.168.218.99	HTTP	480	HTTP/1.1.2 200 OK (JPEG/JFIF image)
173	3.776157711	192.168.218.99	192.168.218.22	HTTP	474	GET /favicon.ico HTTP/1.1
181	3.777206229	192.168.218.22	192.168.218.99	HTTP/X-	139	HTTP/1.1.4 404 Not Found

Below the table, a detailed packet capture is shown, listing individual bytes transmitted and received over the wlan0 interface. The capture includes various HTTP requests and responses, along with their corresponding byte ranges and protocols (HTTP/1.1, HTTP/1.0, etc.).

e) 8 persistent connections

Client request:



f) 10 persistent connections

Client request:

The browser interface shows a grid of 10 images. Below the grid, the Network tab of the developer tools is selected, displaying a list of 12 requests. The requests are all GET requests to the same domain (192.168.218.22) for files named 1.jpg through 10.jpg, and a favicon.ico. The requests are listed in chronological order, showing a sequence of 10 requests followed by a single favicon.ico request.

No.	Status	Method	Domain	File	Initiator	Type	Transferred	Size	0 ms	160 ms	320 ms	480 ms
30	200	GET	192.168.218.22	1.jpg		image	8.11 kB	/83 kB		37 ms		
31	200	GET	192.168.218.22	2.jpg		image	9.33 kB	9.04 kB		56 ms		
32	200	GET	192.168.218.22	3.jpg		image	8.61 kB	8.33 kB		67 ms		
33	200	GET	192.168.218.22	4.jpg		image	11.48 kB	11.19 kB		78 ms		
34	200	GET	192.168.218.22	5.jpg		image	8.18 kB	7.90 kB		67 ms		
35	200	GET	192.168.218.22	6.jpg		image	6.50 kB	6.21 kB		111 ms		
36	200	GET	192.168.218.22	7.jpg		image	5.37 kB	5.08 kB		131 ms		
37	200	GET	192.168.218.22	8.jpg		image	9.11 kB	8.83 kB		144 ms		
38	200	GET	192.168.218.22	9.jpg		image	11.12 kB	10.83 kB		179 ms		
39	200	GET	192.168.218.22	10.jpg		image	1.41 kB	1.11 kB				206 ms
40	404	GET	192.168.218.22	favicon.ico	Favicon Loader.sys.mjs:175	html						

The screenshot shows a network traffic capture tool (likely Wireshark) with the 'Http' protocol selected. The list of captured frames shows 216 entries. The first 10 entries correspond to the persistent connections established in the browser screenshot, with each entry showing a GET request for a different image file (1.jpg to 10.jpg). The remaining frames show various other network activity, including a final frame (Frame 216) indicating a 404 Not Found error for a request to 'HTTP/X...'.

Time difference of captures:

Non Persistent: 0.265426283

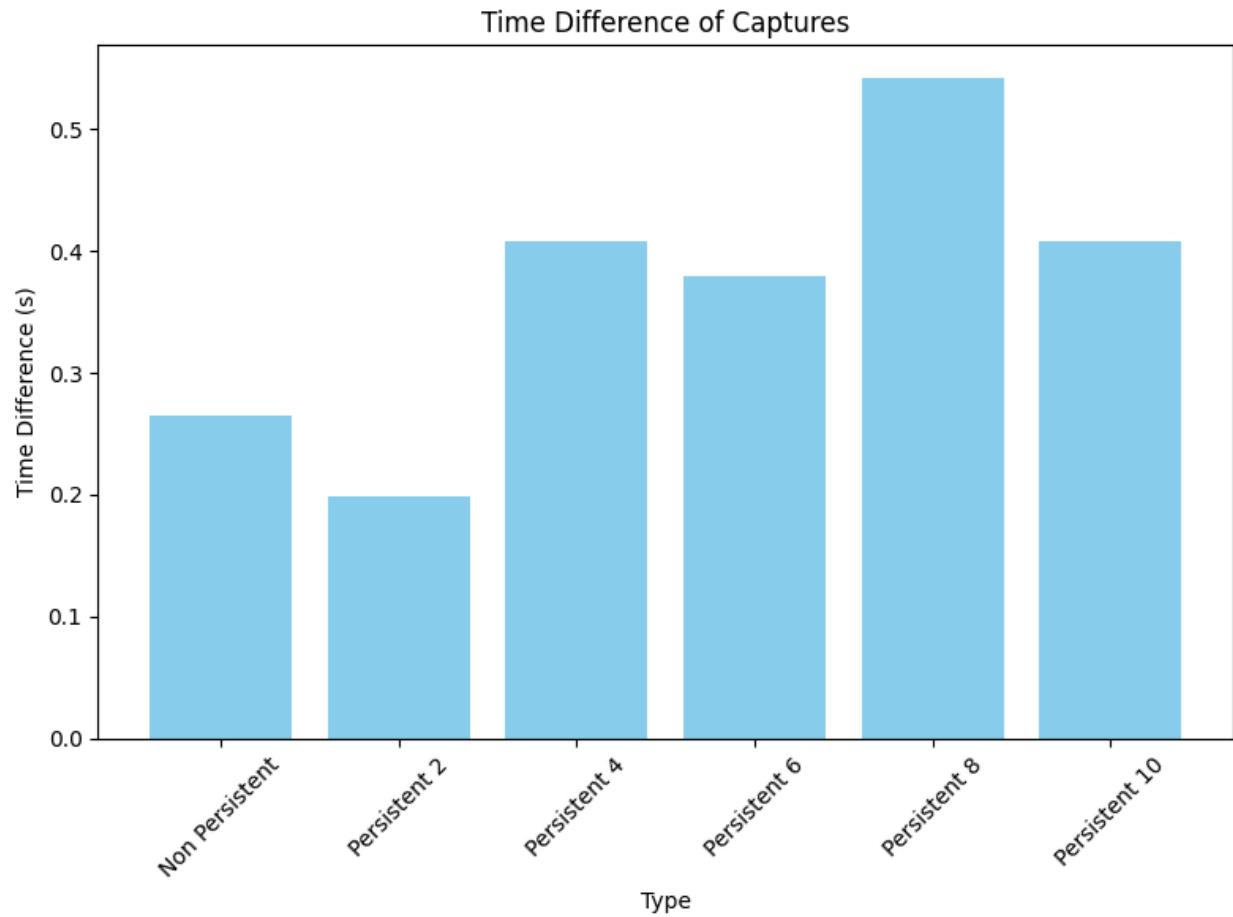
Persistent 2 : 0.198491158

Persistent 4 : 0.407485119

Persistent 6 : 0.379464736

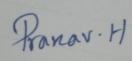
Persistent 8 : 0.541620366

Persistent 10 : 0.407915725



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- I have not copied from any of my peers nor from external resources such as the internet.
- If found plagiarized, I will abide with the disciplinary action of the University.

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