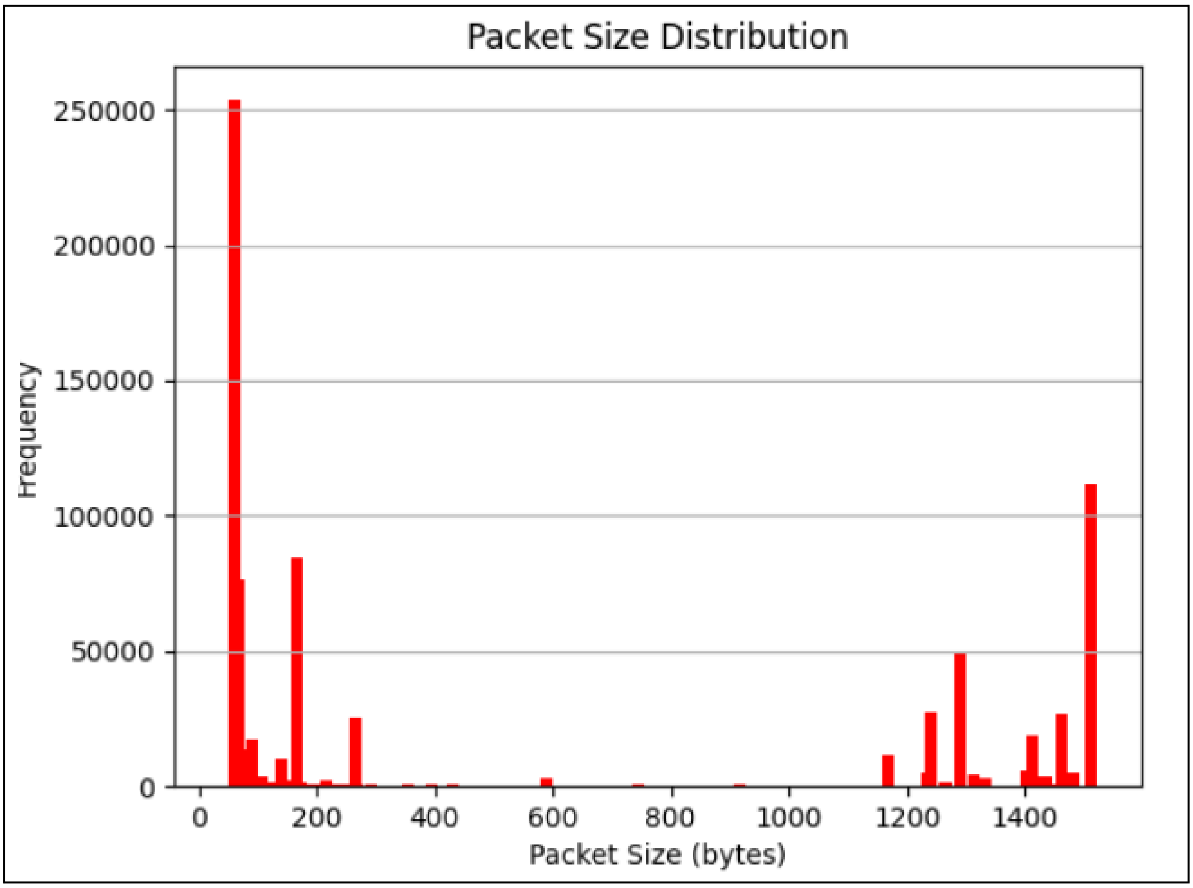
CS 331: Computer Networks Assignment 1

Github repository : https://github.com/ushasree-3/CN_Assignment-1/

Part 1: Metrics and Plots

1.1 Answer is in github repo:
https://github.com/ushasree-3/CN_Assignment-1/blob/main/part1_q/results/1_1.txt

Total Packets: 981722
Total Data Transferred: 515684268 bytes
Min Packet Size: 42 bytes
Max Packet Size: 1514 bytes
Avg Packet Size: 525.285 bytes



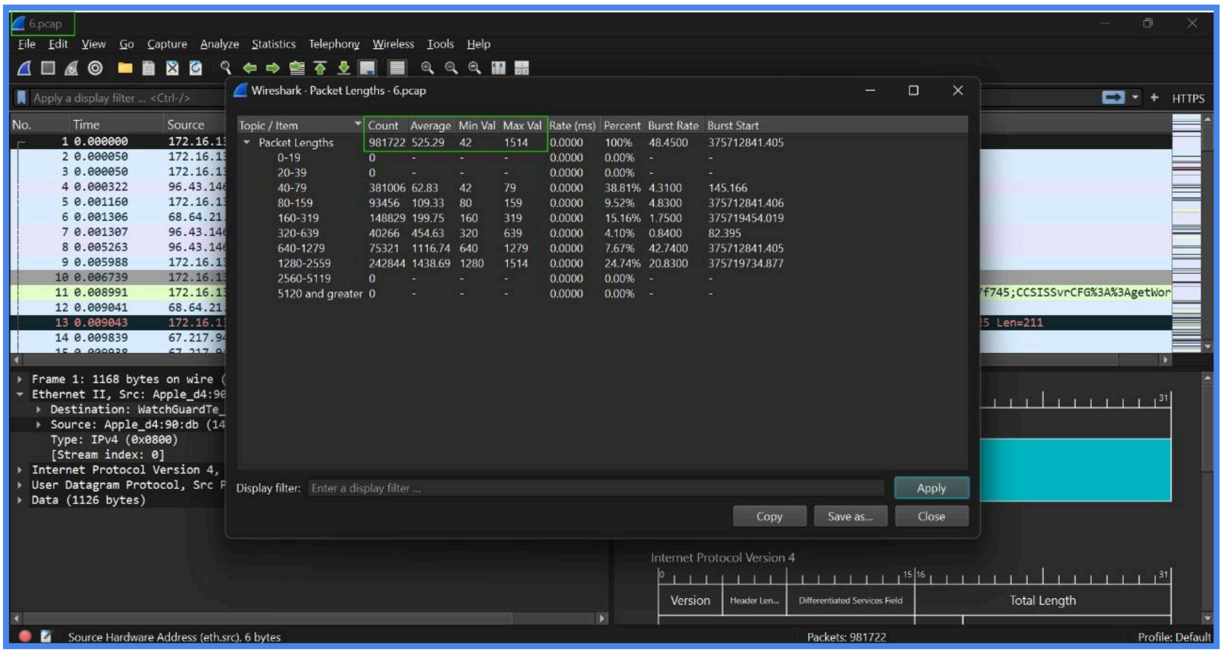
1.2 - Unique source destination pairs :
https://github.com/ushasree-3/CN_Assignment-1/blob/main/part1_q/results/1_2.txt

1.3 - Source & Destination IP flows:
https://github.com/ushasree-3/CN_Assignment-1/blob/main/part1_q/results/1_3.txt

The source - destination which have transferred the most data is:

Max Flow: 180.149.61.76:443 -> 10.240.0.41:57867
Data Transferred: 52695453 bytes

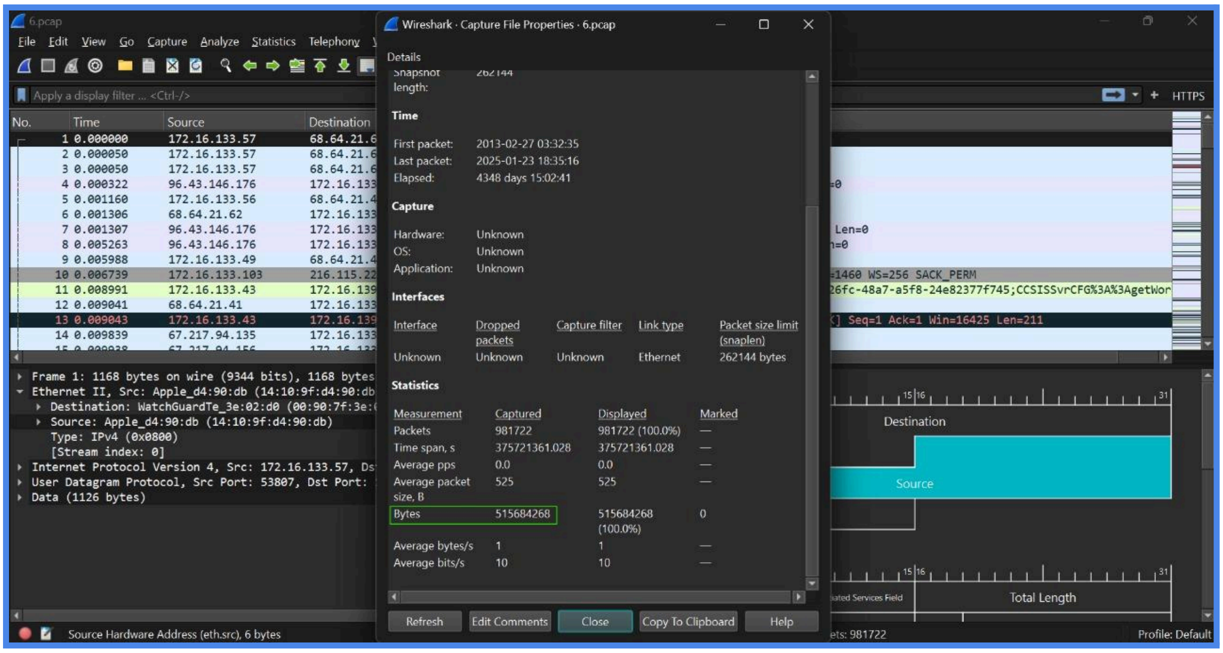
We’ve also checked these results with the wireshark analysis and they are the same. Here are the photos attached for reference (from Wireshark):



Wireshark · Packet Lengths · 6.pcap

Topic / Item	Count	Average	Min Val	Max Val	Rate (ms)	Percent	Burst Rate	Burst Start
Packet Lengths	981722	525.29	42	1514	0.0000	100%	48.4500	375712841.405
0-19	0	-	-	-	0.0000	0.00%	-	-
20-39	0	-	-	-	0.0000	0.00%	-	-
40-79	381006	62.83	42	79	0.0000	38.81%	4.3100	145.166
80-159	93456	109.33	80	159	0.0000	9.52%	4.8300	375712841.406
160-319	148829	199.75	160	319	0.0000	15.16%	1.7500	375719454.019
320-639	40266	454.63	320	639	0.0000	4.10%	0.8400	82.395
640-1279	75321	1116.74	640	1279	0.0000	7.67%	42.7400	375712841.405
1280-2559	242844	1438.69	1280	1514	0.0000	24.74%	20.8300	375719734.877
2560-5119	0	-	-	-	0.0000	0.00%	-	-
5120 and greater	0	-	-	-	0.0000	0.00%	-	-

Display filter: Enter a display filter ...



```
No.  Time      Source          Destination
  1 0.000000  172.16.133.57   68.64.21.6
  2 0.000050  172.16.133.57   68.64.21.6
  3 0.000050  172.16.133.57   68.64.21.6
  4 0.000322  96.43.146.176   172.16.133
  5 0.001160  172.16.133.56   68.64.21.4
  6 0.001306  68.64.21.62     172.16.133
  7 0.001307  96.43.146.176   172.16.133
  8 0.005263  96.43.146.176   172.16.133
  9 0.005988  172.16.133.49   68.64.21.4
 10 0.006739  172.16.133.103  216.115.22
 11 0.008991  172.16.133.43   172.16.139
 12 0.009041  68.64.21.41     172.16.133
 13 0.009043  172.16.133.43   172.16.139
 14 0.009839  67.217.94.135   172.16.133

Frame 1: 1168 bytes on wire (9344 bits), 1168 bytes
Ethernet II, Src: Apple_d4:90:db (14:10:9f:d4:90:db
  Destination: WatchGuardTe_3e:02:d0 (00:90:7f:3e:
  Source: Apple_d4:90:db (14:10:9f:d4:90:db)
  Type: IPv4 (0x0800)
  [Stream index: 0]
Internet Protocol Version 4, Src: 172.16.133.57, Ds
User Datagram Protocol, Src Port: 53807, Dst Port:
Data (1126 bytes)
```

Wireshark · Capture File Properties · 6.pcap

Details

Snapshot length: 262144

Time

First packet: 2013-02-27 03:32:35
Last packet: 2025-01-23 18:35:16
Elapsed: 4348 days 15:02:41

Capture

Hardware: Unknown
OS: Unknown
Application: Unknown

Interfaces

Interface	Dropped packets	Capture filter	Link type	Packet size limit (snaplen)
Unknown	Unknown	Unknown	Ethernet	262144 bytes

Statistics

Measurement	Captured	Displayed	Marked
Packets	981722	981722 (100.0%)	—
Time span, s	375721361.028	375721361.028	—
Average pps	0.0	0.0	—
Average packet size, B	525	525	—
Bytes	515684268	515684268 (100.0%)	0
Average bytes/s	1	1	—
Average bits/s	10	10	—

Part 2: Catch Me If You Can

1) Private IP Address: 172.16.131.10

2) Username: alexwell
   Password: bemymaxwellSS

3) Sender (MAIL FROM): <ab@iitgn.ac.in>
   Recipient (RCPT TO): <ag@iitgn.ac.in>
   Email Body:
   Subject: CS331 - Enrollment
   HostName: Chris Martin

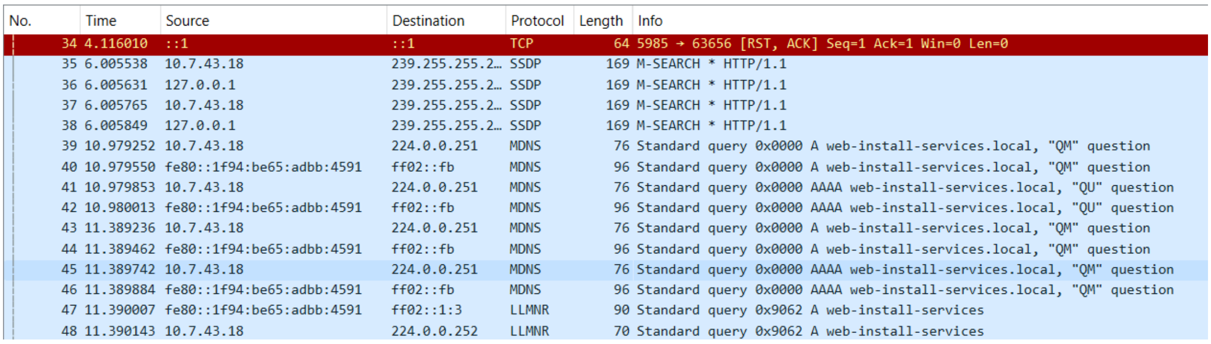
Part 3: Capture the packets
1. Wireshark Packet Capture Analysis:

For this task, we ran **Wireshark** to capture network packets on my host device while performing regular internet activities. During the capture, I identified these 5 protocols:

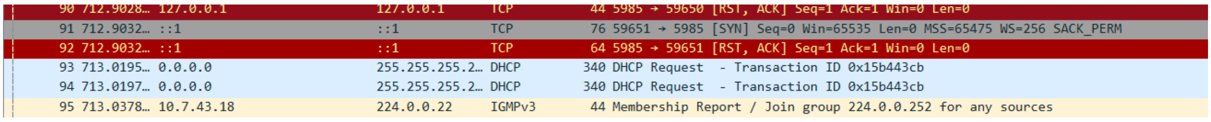
1. **SSDP (Simple Service Discovery Protocol)**
    - **Operation/Usage**: SSDP is used for discovering services and devices on a local network. It allows devices like printers, media players, and other IoT devices to find and communicate with each other without the need for a central server.
    - **Layer**: Application Layer
    - **RFC**: Not specified
2. **mDNS (Multicast DNS)**
    - **Operation/Usage**: mDNS is used for name resolution within a local network without the need for a traditional DNS server. It allows devices on the same network to resolve hostnames to IP addresses using multicast.
    - **Layer**: Application Layer
    - **RFC**: RFC 6762
3. **LLMNR (Link-Local Multicast Name Resolution)**
    - **Operation/Usage**: LLMNR is a protocol used for resolving hostnames to IP addresses on local networks. It operates similarly to mDNS, but it is commonly used in Windows-based networks for name resolution when no DNS server is available.
    - **Layer**: Application Layer
    - **RFC**: RFC 4795
4. **DHCP (Dynamic Host Configuration Protocol)**
    - **Operation/Usage**: DHCP is responsible for dynamically assigning IP addresses and other configuration information to devices on a network, simplifying network management by eliminating the need for manual IP address assignments.
    - **Layer**: Application Layer
    - **RFC**: RFC 2131
5. **SSH (Secure Shell)**
    - **Operation/Usage**: SSH is a cryptographic protocol that enables secure remote login and communication between a client and server over an unsecured network. It is widely used for securely accessing and managing remote systems and transferring files.
    - **Layer**: Application Layer
    - **RFC**: RFC 4254

These protocols all operate at the **Application Layer** of the OSI model, which is responsible for enabling end-to-end communication between applications across a network.

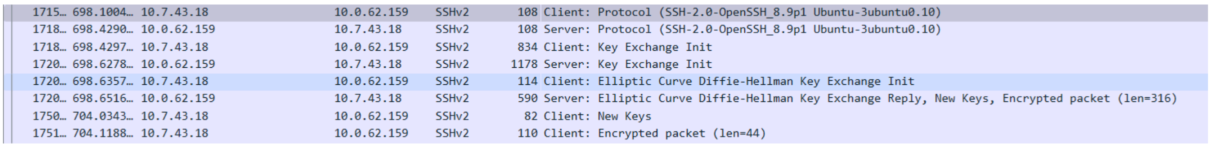
I've attached the screenshots for the reference:



No.	Time	Source	Destination	Protocol	Length	Info
34	4.116010	::1	::1	TCP	64	5985 → 63656 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
35	6.005538	10.7.43.18	239.255.255.2…	SSDP	169	M-SEARCH * HTTP/1.1
36	6.005631	127.0.0.1	239.255.255.2…	SSDP	169	M-SEARCH * HTTP/1.1
37	6.005765	10.7.43.18	239.255.255.2…	SSDP	169	M-SEARCH * HTTP/1.1
38	6.005849	127.0.0.1	239.255.255.2…	SSDP	169	M-SEARCH * HTTP/1.1
39	10.979252	10.7.43.18	224.0.0.251	MDNS	76	Standard query 0x0000 A web-install-services.local, "QM" question
40	10.979550	fe80::1f94:be65:adbb:4591	ff02::fb	MDNS	96	Standard query 0x0000 A web-install-services.local, "QM" question
41	10.979853	10.7.43.18	224.0.0.251	MDNS	76	Standard query 0x0000 AAAA web-install-services.local, "QU" question
42	10.980013	fe80::1f94:be65:adbb:4591	ff02::fb	MDNS	96	Standard query 0x0000 AAAA web-install-services.local, "QU" question
43	11.389236	10.7.43.18	224.0.0.251	MDNS	76	Standard query 0x0000 A web-install-services.local, "QM" question
44	11.389462	fe80::1f94:be65:adbb:4591	ff02::fb	MDNS	96	Standard query 0x0000 A web-install-services.local, "QM" question
45	11.389742	10.7.43.18	224.0.0.251	MDNS	76	Standard query 0x0000 AAAA web-install-services.local, "QM" question
46	11.389884	fe80::1f94:be65:adbb:4591	ff02::fb	MDNS	96	Standard query 0x0000 AAAA web-install-services.local, "QM" question
47	11.390007	fe80::1f94:be65:adbb:4591	ff02::1:3	LLMNR	90	Standard query 0x9062 A web-install-services
48	11.390143	10.7.43.18	224.0.0.252	LLMNR	70	Standard query 0x9062 A web-install-services



90	712.9028…	127.0.0.1	127.0.0.1	TCP	44	5985 → 59650 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
91	712.9032…	::1	::1	TCP	76	59651 → 5985 [SYN] Seq=0 Win=65535 Len=0 MSS=65475 WS=256 SACK_PERM
92	712.9032…	::1	::1	TCP	64	5985 → 59651 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
93	713.0195…	0.0.0.0	255.255.255.2…	DHCP	340	DHCP Request - Transaction ID 0x15b443cb
94	713.0197…	0.0.0.0	255.255.255.2…	DHCP	340	DHCP Request - Transaction ID 0x15b443cb
95	713.0378…	10.7.43.18	224.0.0.22	IGMPv3	44	Membership Report / Join group 224.0.0.252 for any sources



1715…	698.1004…	10.7.43.18	10.0.62.159	SSHv2	108	Client: Protocol (SSH-2.0-OpenSSH_8.9p1 Ubuntu-3ubuntu0.10)
1718…	698.4290…	10.0.62.159	10.7.43.18	SSHv2	108	Server: Protocol (SSH-2.0-OpenSSH_8.9p1 Ubuntu-3ubuntu0.10)
1718…	698.4297…	10.7.43.18	10.0.62.159	SSHv2	834	Client: Key Exchange Init
1720…	698.6278…	10.0.62.159	10.7.43.18	SSHv2	1178	Server: Key Exchange Init
1720…	698.6357…	10.7.43.18	10.0.62.159	SSHv2	114	Client: Elliptic Curve Diffie-Hellman Key Exchange Init
1720…	698.6516…	10.0.62.159	10.7.43.18	SSHv2	590	Server: Elliptic Curve Diffie-Hellman Key Exchange Reply, New Keys, Encrypted packet (len=316)
1750…	704.0343…	10.7.43.18	10.0.62.159	SSHv2	82	Client: New Keys
1751…	704.1188…	10.7.43.18	10.0.62.159	SSHv2	110	Client: Encrypted packet (len=44)

2. We analyzed network requests by visiting the following websites in google:

i) canarabank.com
ii) github.com
iii) netflix.com

Note: The assignment specified analyzing `canarabank.in`, but as we could not access it, we have considered `canarabank.com` instead for our analysis.

a. Request Line Analysis:

i) canarabank.com

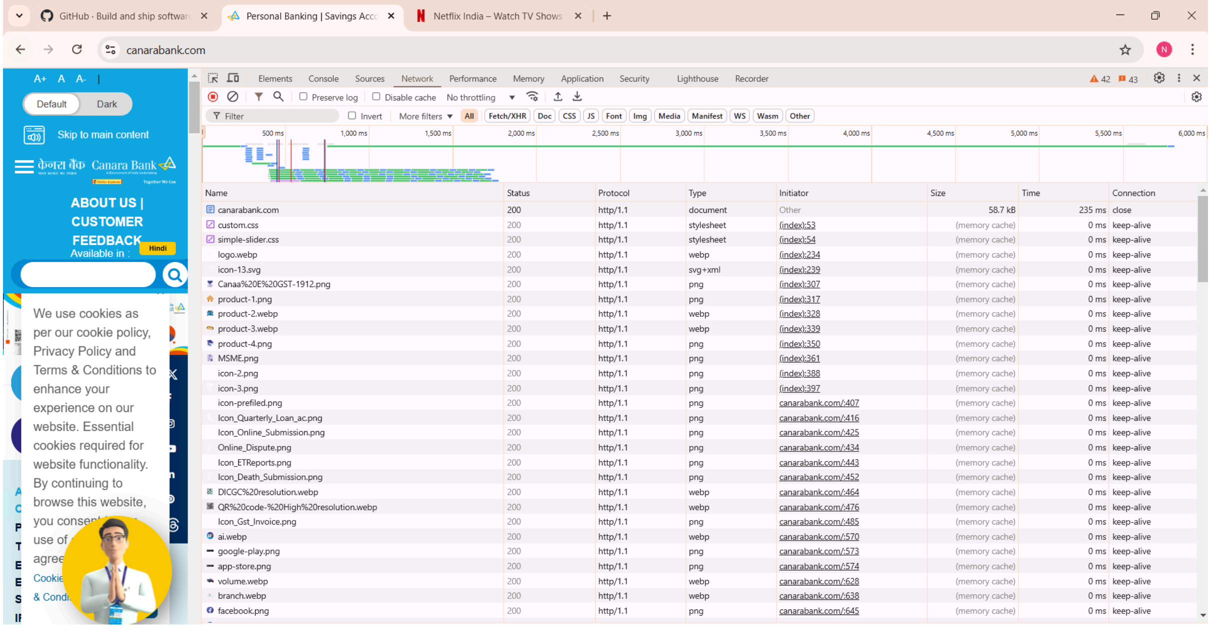
Request line : GET / HTTP/1.1
IP Address: 107.162.160.8:443

Connection:

- Connection: keep-alive (In the response header)
- Connection: close (In the response header)

Interpretation:

- The client (Google browser) requested a persistent connection with `Connection: keep-alive`.
- The server responded with `Connection: close`, indicating that it will close the connection after sending the response.
- In this case, the connection is **not persistent**.



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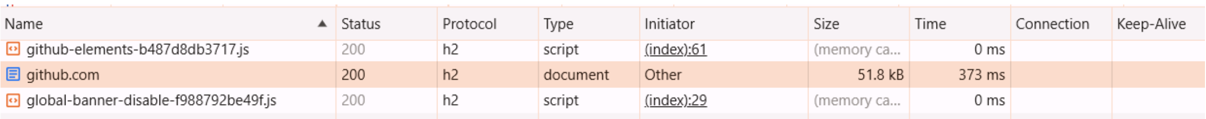
Name	Status	Protocol	Type	Initiator	Size	Time	Connection
canarabank.com	200	http/1.1	document	Other	58.7 kB	235 ms	close
custom.css	200	http/1.1	stylesheet	(index):53	(memory cache)	0 ms	keep-alive
simple-slider.css	200	http/1.1	stylesheet	(index):54	(memory cache)	0 ms	keep-alive
logo.webp	200	http/1.1	webp	(index):234	(memory cache)	0 ms	keep-alive
icon-13.svg	200	http/1.1	svg+xml	(index):239	(memory cache)	0 ms	keep-alive
Canaa%20E%20GST-1912.png	200	http/1.1	png	(index):307	(memory cache)	0 ms	keep-alive
product-1.png	200	http/1.1	png	(index):317	(memory cache)	0 ms	keep-alive
product-2.webp	200	http/1.1	webp	(index):328	(memory cache)	0 ms	keep-alive
product-3.webp	200	http/1.1	webp	(index):339	(memory cache)	0 ms	keep-alive
product-4.png	200	http/1.1	png	(index):350	(memory cache)	0 ms	keep-alive
MSME.png	200	http/1.1	png	(index):361	(memory cache)	0 ms	keep-alive
icon-2.png	200	http/1.1	png	(index):388	(memory cache)	0 ms	keep-alive
icon-3.png	200	http/1.1	png	(index):397	(memory cache)	0 ms	keep-alive
icon-prefiled.png	200	http/1.1	png	canarabank.com/:407	(memory cache)	0 ms	keep-alive
Icon_Quarterly_Loan_ac.png	200	http/1.1	png	canarabank.com/:416	(memory cache)	0 ms	keep-alive
Icon_Online_Submission.png	200	http/1.1	png	canarabank.com/:425	(memory cache)	0 ms	keep-alive
Online_Dispute.png	200	http/1.1	png	canarabank.com/:434	(memory cache)	0 ms	keep-alive
Icon_ETReports.png	200	http/1.1	png	canarabank.com/:443	(memory cache)	0 ms	keep-alive
Icon_Death_Submission.png	200	http/1.1	png	canarabank.com/:452	(memory cache)	0 ms	keep-alive
DICGC%20resolution.webp	200	http/1.1	webp	canarabank.com/:464	(memory cache)	0 ms	keep-alive
QR%20code-%20High%20resolution.webp	200	http/1.1	webp	canarabank.com/:476	(memory cache)	0 ms	keep-alive
Icon_Gst_Invoice.png	200	http/1.1	png	canarabank.com/:485	(memory cache)	0 ms	keep-alive
ai.webp	200	http/1.1	webp	canarabank.com/:570	(memory cache)	0 ms	keep-alive
google-play.png	200	http/1.1	png	canarabank.com/:573	(memory cache)	0 ms	keep-alive
app-store.png	200	http/1.1	png	canarabank.com/:574	(memory cache)	0 ms	keep-alive
volume.webp	200	http/1.1	webp	canarabank.com/:628	(memory cache)	0 ms	keep-alive
branch.webp	200	http/1.1	webp	canarabank.com/:638	(memory cache)	0 ms	keep-alive
facebook.png	200	http/1.1	png	canarabank.com/:645	(memory cache)	0 ms	keep-alive

From the above figure, the connection is closed (response) for the canarabank.com page only, but for other pages, it is keep-alive, it means they are all **persistent connections**.

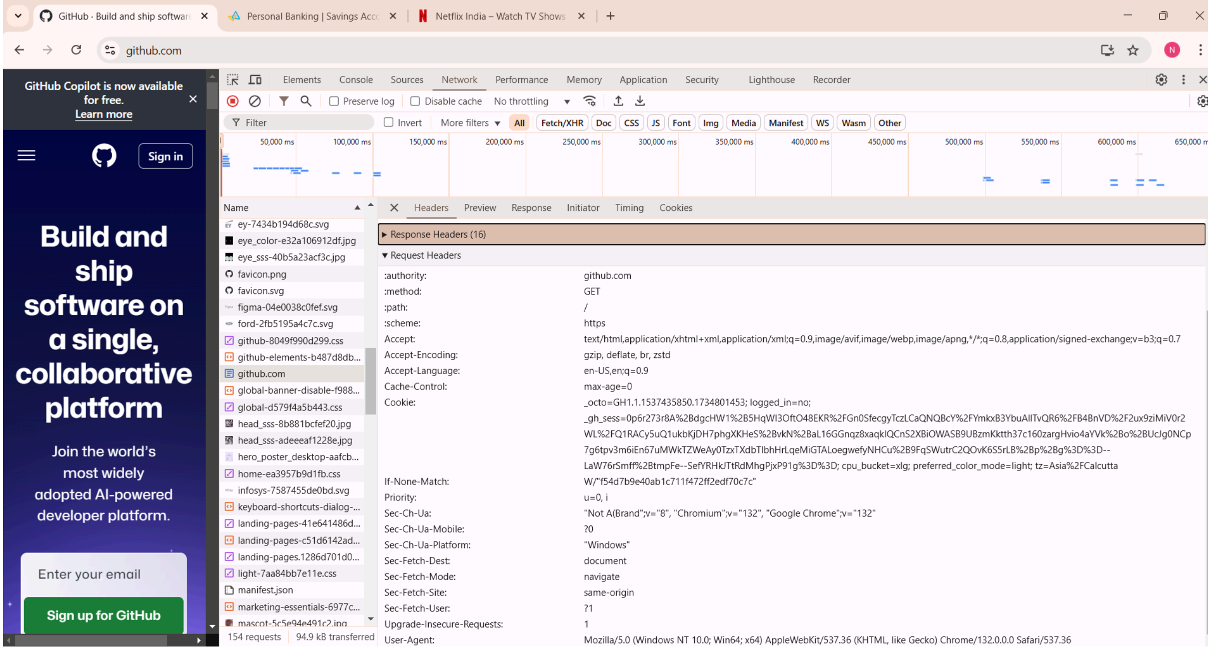
ii) github.com

As shown in the below image, the `github.com` page is using the HTTP/2 protocol, which indicates that HTTP version 2 is being utilized.



Name	Status	Protocol	Type	Initiator	Size	Time	Connection	Keep-Alive
github-elements-b487d8db3717.js	200	h2	script	(index):61	(memory ca...	0 ms		
github.com	200	h2	document	Other	51.8 kB	373 ms		
global-banner-disable-f988792be49f.js	200	h2	script	(index):29	(memory ca...	0 ms		

HTTP/2 does not have a traditional request line. Instead, it uses a set of special headers known as pseudo-headers. These pseudo-headers carry the necessary data in a more efficient, binary format. I’ve attached the figure for reference.



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Name
ey-7434b194d68c.svg
eye_color-e32a106912df.jpg
eye_sss-40b5a23acf3c.jpg
favicon.png
favicon.svg
figma-04e0038c0fef.svg
ford-2fb5195a4c7c.svg
github-8049f990d299.css
github-elements-b487d8db...
github.com
global-banner-disable-f988...
global-d579f4a5b443.css
head_sss-8b881bcfef20.jpg
head_sss-adeeeaf1228e.jpg
hero_poster_desktop-aafcb...
home-ea3957b9d1fb.css
infosys-7587455de0bd.svg
keyboard-shortcuts-dialog-...
landing-pages-41e641486d...
landing-pages-c51d6142ad...
landing-pages.1286d701d0...
light-7aa84bb7e11e.css
manifest.json
marketing-essentials-6977c...
mascot-5c5e94e491c2.jpg

154 requests | 94.9 kB transferred

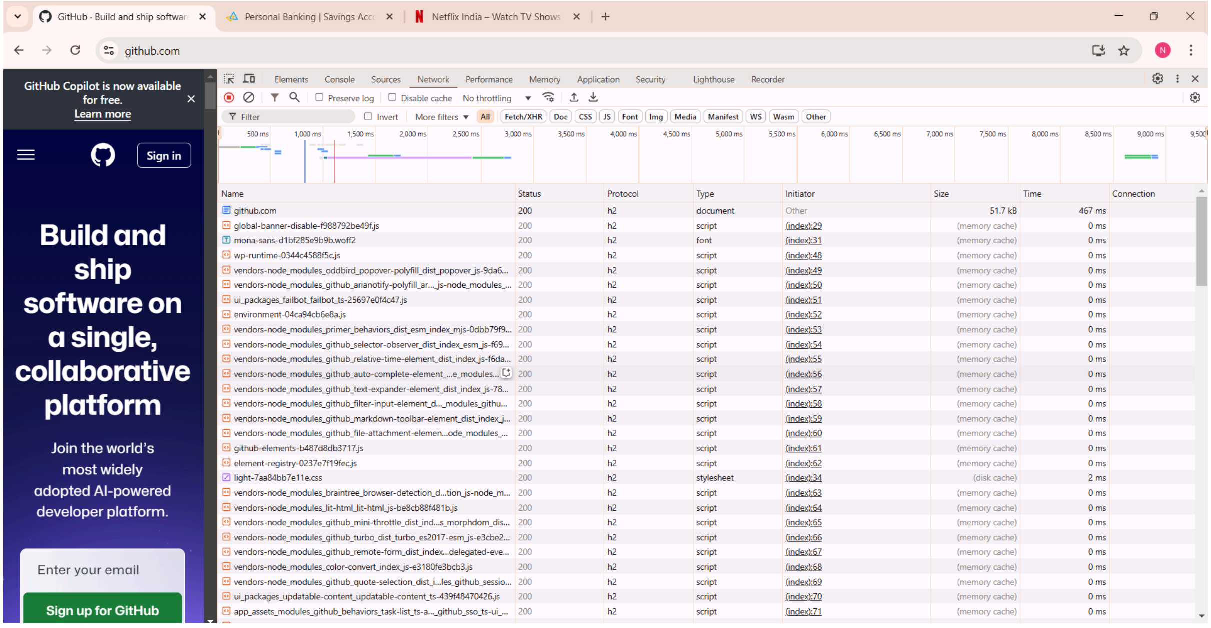
▶ Response Headers (16)

▼ Request Headers

```
:authority:                  github.com
:method:                     GET
:path:                       /
:scheme:                     https
Accept:                      text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.7
Accept-Encoding:             gzip, deflate, br, zstd
Accept-Language:             en-US,en;q=0.9
Cache-Control:               max-age=0
Cookie:                      _octo=GH1.1.1537435850.1734801453; logged_in=no;
                             _gh_sess=0p6r273r8A%2BdgcHW1%2B5HqWI3OftO48EKR%2FGn0SfecgyTczLCaQNQBcY%2FYmkxB3YbuAllTvQR6%2FB4BnVD%2F2ux9ziMiV0r2
                             WL%2FQ1RACy5uQ1ukbKjDH7phgXKHeS%2BvkN%2BaL16GGnqz8xaqkIQCnS2XBiOWASB9UBzmKktth37c160zargHvio4aYVk%2Bo%2BUcJg0NCp
                             7g6tpv3m6iEn67uMWkTZWeAy0TzxTXdbTIbhHrLqeMiGTALoegwefyNHCu%2B9FqSWutrC2QOvK6S5rLB%2Bp%2Bg%3D%3D--
                             LaW76rSmff%2BtmpFe--SefYRHkJTtRdMhgPjxP91g%3D%3D; cpu_bucket=xlg; preferred_color_mode=light; tz=Asia%2FCalcutta
If-None-Match:               W/"f54d7b9e40ab1c711f472ff2edf70c7c"
Priority:                    u=0, i
Sec-Ch-Ua:                   "Not A(Brand";v="8", "Chromium";v="132", "Google Chrome";v="132"
Sec-Ch-Ua-Mobile:            ?0
Sec-Ch-Ua-Platform:          "Windows"
Sec-Fetch-Dest:              document
Sec-Fetch-Mode:              navigate
Sec-Fetch-Site:              same-origin
Sec-Fetch-User:              ?1
Upgrade-Insecure-Requests:   1
User-Agent:                  Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/132.0.0.0 Safari/537.36
```

IP Address: 20.207.73.82:443

Since HTTP/2 is used, connections are always persistent across requests, and there is no need for an explicit Connection: keep-alive header as HTTP/2 assumes persistent connections by default.



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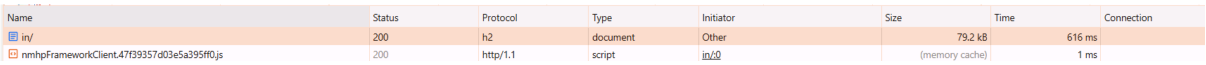
Name	Status	Protocol	Type	Initiator	Size	Time	Connection
github.com	200	h2	document	Other	51.7 kB	467 ms	
global-banner-disable-f988792be49f.js	200	h2	script	(index):29	(memory cache)	0 ms	
mona-sans-d1bf285e9b9b.woff2	200	h2	font	(index):31	(memory cache)	0 ms	
wp-runtime-0344c4588f5c.js	200	h2	script	(index):48	(memory cache)	0 ms	
vendors-node_modules_oddbird_popover-polyfill_dist_popover_js-9da6...	200	h2	script	(index):49	(memory cache)	0 ms	
vendors-node_modules_github_arianotify-polyfill_ar..._js-node_modules_...	200	h2	script	(index):50	(memory cache)	0 ms	
ui_packages_failbot_failbot_ts-25697e0f4c47.js	200	h2	script	(index):51	(memory cache)	0 ms	
environment-04ca94cb6e8a.js	200	h2	script	(index):52	(memory cache)	0 ms	
vendors-node_modules_primer_behaviors_dist_esm_index_mjs-0dbb79f9...	200	h2	script	(index):53	(memory cache)	0 ms	
vendors-node_modules_github_selector-observer_dist_index_esm_js-f69...	200	h2	script	(index):54	(memory cache)	0 ms	
vendors-node_modules_github_relative-time-element_dist_index_js-f6da...	200	h2	script	(index):55	(memory cache)	0 ms	
vendors-node_modules_github_auto-complete-element_...e_modules...	200	h2	script	(index):56	(memory cache)	0 ms	
vendors-node_modules_github_text-expander-element_dist_index_js-78...	200	h2	script	(index):57	(memory cache)	0 ms	
vendors-node_modules_github_filter-input-element_d..._modules_githu...	200	h2	script	(index):58	(memory cache)	0 ms	
vendors-node_modules_github_markdown-toolbar-element_dist_index_j...	200	h2	script	(index):59	(memory cache)	0 ms	
vendors-node_modules_github_file-attachment-elemen...ode_modules_...	200	h2	script	(index):60	(memory cache)	0 ms	
github-elements-b487d8db3717.js	200	h2	script	(index):61	(memory cache)	0 ms	
element-registry-0237e7f19fec.js	200	h2	script	(index):62	(memory cache)	0 ms	
light-7aa84bb7e11e.css	200	h2	stylesheet	(index):34	(disk cache)	2 ms	
vendors-node_modules_braintree_browser-detection_d...tion_js-node_m...	200	h2	script	(index):63	(memory cache)	0 ms	
vendors-node_modules_lit-html_lit-html_js-be8cb88f481b.js	200	h2	script	(index):64	(memory cache)	0 ms	
vendors-node_modules_github_mini-throttle_dist_ind...s_morphdom_dis...	200	h2	script	(index):65	(memory cache)	0 ms	
vendors-node_modules_github_turbo_dist_turbo_es2017-esm_js-e3cbe2...	200	h2	script	(index):66	(memory cache)	0 ms	
vendors-node_modules_github_remote-form_dist_index...delegated-eve...	200	h2	script	(index):67	(memory cache)	0 ms	
vendors-node_modules_color-convert_index_js-e3180fe3bcb3.js	200	h2	script	(index):68	(memory cache)	0 ms	
vendors-node_modules_github_quote-selection_dist_i...les_github_sessio...	200	h2	script	(index):69	(memory cache)	0 ms	
ui_packages_updatable-content_updatable-content_ts-439f48470426.js	200	h2	script	(index):70	(memory cache)	0 ms	
app_assets_modules_github_behaviors_task-list_ts-a..._github_sso_ts-ui_...	200	h2	script	(index):71	(memory cache)	0 ms	

For all pages using HTTP/2, the connection is implicitly persistent across requests. Although the connection is not explicitly mentioned, HTTP/2 assumes persistent connections by default, so I am considering the connections to be **persistent**.

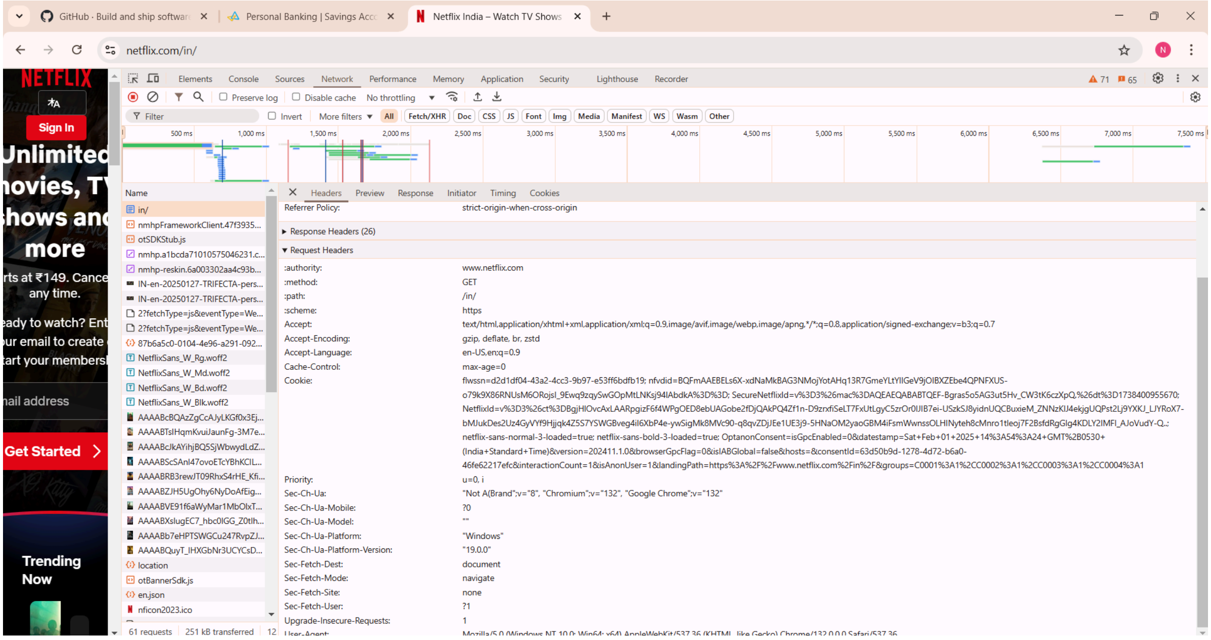
iii) netflix.com

As observed in the below image, the `netflix.com` page is using the HTTP/2 protocol, meaning HTTP version 2 is being utilized.



Name	Status	Protocol	Type	Initiator	Size	Time	Connection
in/	200	h2	document	Other	79.2 kB	616 ms	
nmhpFrameworkClient.47f39357d03e5a395ff0.js	200	http/1.1	script	in/:0	(memory cache)	1 ms	

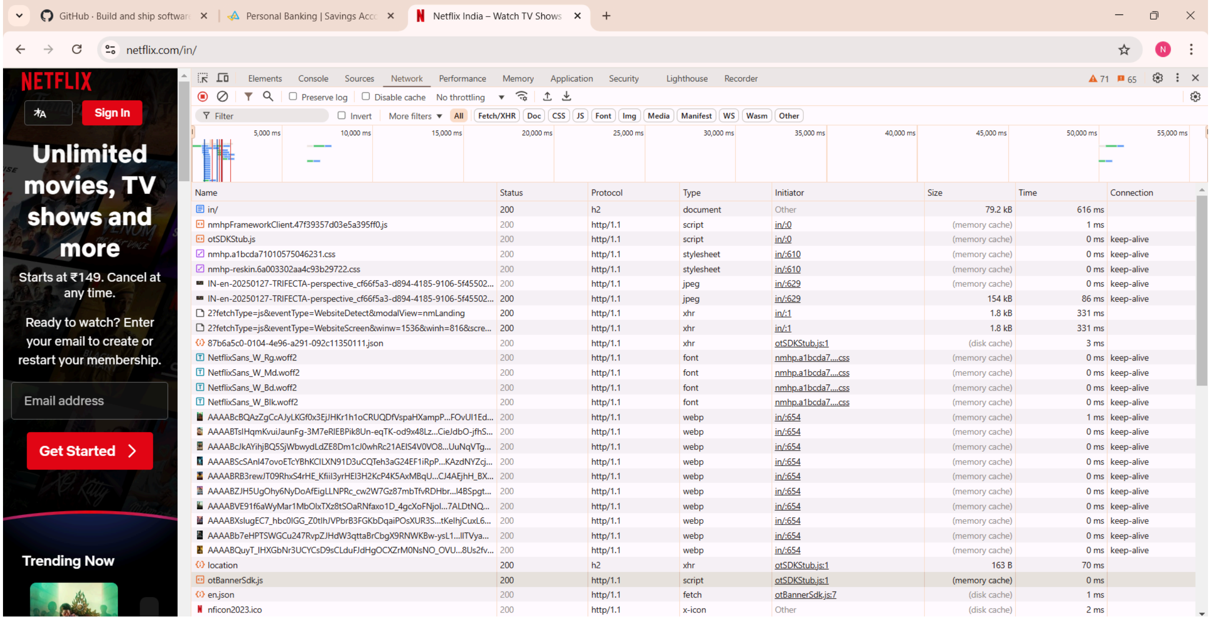
As mentioned earlier, HTTP/2 does not use a traditional request line. Instead, it employs a series of **pseudo-headers** at the front of the request, replacing the need for a traditional request line. I've attached the figure for reference.



```
Referrer Policy:              strict-origin-when-cross-origin
▸ Response Headers (26)
▾ Request Headers
:authority:                   www.netflix.com
:method:                      GET
:path:                        /in/
:scheme:                      https
Accept:                       text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.7
Accept-Encoding:              gzip, deflate, br, zstd
Accept-Language:              en-US,en;q=0.9
Cache-Control:                max-age=0
Cookie:                       flwssn=d2d1df04-43a2-4cc3-9b97-e53ff6bdfb19; nfvdid=BQFmAAEBELs6X-xdNaMkBAG3NMojYotAHq13R7GmeYLtYIIGeV9jOIBXZEbe4QPNFXUS-
                              o79k9X86RNUsM6ORojsl_9Ewq9zqySwGOpMtLNKsj94lAbdkA%3D%3D; SecureNetflixId=v%3D3%26mac%3DAQEAEQABABTQEF-Bgras5o5AG3ut5Hv_CW3tK6czXpQ.%26dt%3D1738400955670;
                              NetflixId=v%3D3%26ct%3DBgjHlOvcAxLAARpgizF6f4WPgOED8ebUAGobe2fDjQAkPQ4Zf1n-D9zrxfiSeLT7FxUtLgyC5zrOr0IJIB7ei-USzkSJ8yidnUQCBuxieM_ZNNzKIJ4ekjgUQPst2Lj9YXKJ_LJYRoX7-
                              bMJukDes2Uz4GyVYf9Hjjqk4Z5S7YSWGBveg4il6XbP4e-ywSigMk8MVc90-q8qvZDjJEe1UE3j9-5HNaOM2yaoGBM4iFsmWwnssOLHINyteh8cMnro1tleoj7F2BsfdRgGlg4KDLY2IMFl_AJoVudY-Q..;
                              netflix-sans-normal-3-loaded=true; netflix-sans-bold-3-loaded=true; OptanonConsent=isGpcEnabled=0&datestamp=Sat+Feb+01+2025+14%3A54%3A24+GMT%2B0530+
                              (India+Standard+Time)&version=202411.1.0&browserGpcFlag=0&isIABGlobal=false&hosts=&consentId=63d50b9d-1278-4d72-b6a0-
                              46fe62217efc&interactionCount=1&isAnonUser=1&landingPath=https%3A%2F%2Fwww.netflix.com%2Fin%2F&groups=C0001%3A1%2CC0002%3A1%2CC0003%3A1%2CC0004%3A1
Priority:                     u=0, i
Sec-Ch-Ua:                    "Not A(Brand";v="8", "Chromium";v="132", "Google Chrome";v="132"
Sec-Ch-Ua-Mobile:             ?0
Sec-Ch-Ua-Model:              ""
Sec-Ch-Ua-Platform:           "Windows"
Sec-Ch-Ua-Platform-Version:   "19.0.0"
Sec-Fetch-Dest:               document
Sec-Fetch-Mode:               navigate
Sec-Fetch-Site:               none
Sec-Fetch-User:               ?1
Upgrade-Insecure-Requests:    1
User-Agent:                   Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/132.0.0.0 Safari/537.36
```

IP Address: 100.20.29.191:443

Since HTTP/2 is used, connection is **persistent** by default.



Name	Status	Protocol	Type	Initiator	Size	Time	Connection
in/	200	h2	document	Other	79.2 kB	616 ms	
nmhpFrameworkClient.47f39357d03e5a395ff0.js	200	http/1.1	script	in/:0	(memory cache)	1 ms	
otSDKStub.js	200	http/1.1	script	in/:0	(memory cache)	0 ms	keep-alive
nmhp.a1bcda71010575046231.css	200	http/1.1	stylesheet	in/:610	(memory cache)	0 ms	keep-alive
nmhp-reskin.6a003302aa4c93b29722.css	200	http/1.1	stylesheet	in/:610	(memory cache)	0 ms	keep-alive
IN-en-20250127-TRIFECTA-perspective_cf66f5a3-d894-4185-9106-5f45502...	200	http/1.1	jpeg	in/:629	(memory cache)	0 ms	keep-alive
IN-en-20250127-TRIFECTA-perspective_cf66f5a3-d894-4185-9106-5f45502...	200	http/1.1	jpeg	in/:629	154 kB	86 ms	keep-alive
2?fetchType=js&eventType=WebsiteDetect&modalView=nmLanding	200	http/1.1	xhr	in/:1	1.8 kB	331 ms	
2?fetchType=js&eventType=WebsiteScreen&winw=1536&winh=816&scre...	200	http/1.1	xhr	in/:1	1.8 kB	331 ms	
87b6a5c0-0104-4e96-a291-092c11350111.json	200	http/1.1	xhr	otSDKStub.js:1	(disk cache)	3 ms	
NetflixSans_W_Rg.woff2	200	http/1.1	font	nmhp.a1bcda7....css	(memory cache)	0 ms	keep-alive
NetflixSans_W_Md.woff2	200	http/1.1	font	nmhp.a1bcda7....css	(memory cache)	0 ms	keep-alive
NetflixSans_W_Bd.woff2	200	http/1.1	font	nmhp.a1bcda7....css	(memory cache)	0 ms	keep-alive
NetflixSans_W_Blk.woff2	200	http/1.1	font	nmhp.a1bcda7....css	(memory cache)	0 ms	keep-alive
AAAABcBQAzZgCcAJyLKGf0x3EjJHKr1h1oCRUQDfVspaHXampP...FOvUI1Ed...	200	http/1.1	webp	in/:654	(memory cache)	1 ms	keep-alive
AAAABTsIHqmKvuiJaunFg-3M7eRIEBPik8Un-eqTK-od9x48Lz...CieJdbO-jfhS...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABcJkAYihjBQ5SjWbwydLdZE8Dm1cJ0whRc21AEIS4V0VO8...UuNqVTg...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABScSAnl47ovoETcYBhKCILXN91D3uCQTeh3aG24EF1iRpP...KAzdNYZcj...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABRB3rewJT09RhxS4rHE_Kfiil3yrHEI3H2KcP4K5AxMBqU...CJ4AEjhH_BX...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABZJH5UgOhy6NyDoAfEigLLNPRc_cw2W7Gz87mbTfvRDHbr...l4BSpgt...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABVE91f6aWyMar1MbOlxTXz8tSOaRNfaxo1D_4gcXoFNjol...7ALDtNQ...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABXslugEC7_hbc0IGG_Z0tlhJVPbrB3FGKbDqaiPOsXUR3S...tKelhjCuxL6...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABb7eHPTSWGCu247RvpZJHdW3qttaBrCbgX9RNWKBw-ysL1...lITVya...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
AAAABQuyT_IHXGbNr3UCYCsD9sCLduFJdHgOCXZrM0NsNO_OVU...8Us2fv...	200	http/1.1	webp	in/:654	(memory cache)	0 ms	keep-alive
location	200	h2	xhr	otSDKStub.js:1	163 B	70 ms	
otBannerSdk.js	200	http/1.1	script	otSDKStub.js:1	(memory cache)	0 ms	
en.json	200	http/1.1	fetch	otBannerSdk.js:7	(disk cache)	1 ms	
nficon2023.ico	200	http/1.1	x-icon	Other	(disk cache)	2 ms	

As you can see from the figure, different pages are using different HTTP versions. For pages using HTTP/1.1, some of them explicitly mention Connection: keep-alive, indicating persistent connections. For others, the connection details are not mentioned, so no conclusions can be drawn about their persistence. For pages using HTTP/2, there is no explicit mention of Connection: keep-alive or Connection: close. However, since HTTP/2 is used, connections are always persistent across requests, and there is no need for an explicit Connection: keep-alive header, as HTTP/2 assumes persistent connections by default. Therefore, I assume all HTTP/2 connections are persistent.

b. Header Field Analysis:

Analyzing the `canarabank.com` website

Request header :

Header Field Name	**Value**
Host	canarabank.com
User-Agent	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/132.0.0.0 Safari/537.36
Accept	text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.7

Response header :

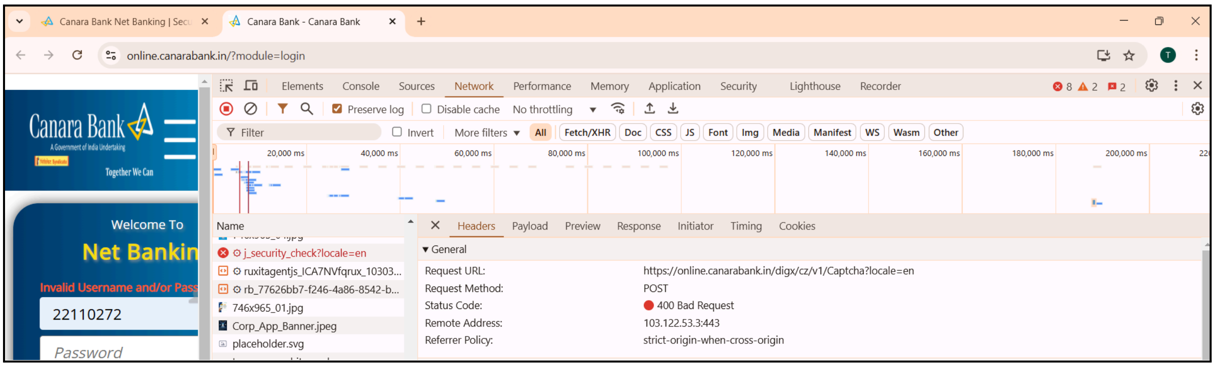
Header Field Name	**Value**
Date	Sat, 01 Feb 2025 06:26:06 GMT
Content-Type	text/html; charset=utf-8
Connection	close

HTTP Error codes:

HTTP error code	**Brief Description**
400 Bad Request	Your request is malformed or incorrect in some way.
403 Forbidden	You don't have permission to access the resource.
404 Not Found	The page/resource does not exist.
405 Method Not Allowed	You're using an incorrect HTTP method to interact with the server.

Screenshots attached for reference:

400 Bad Request



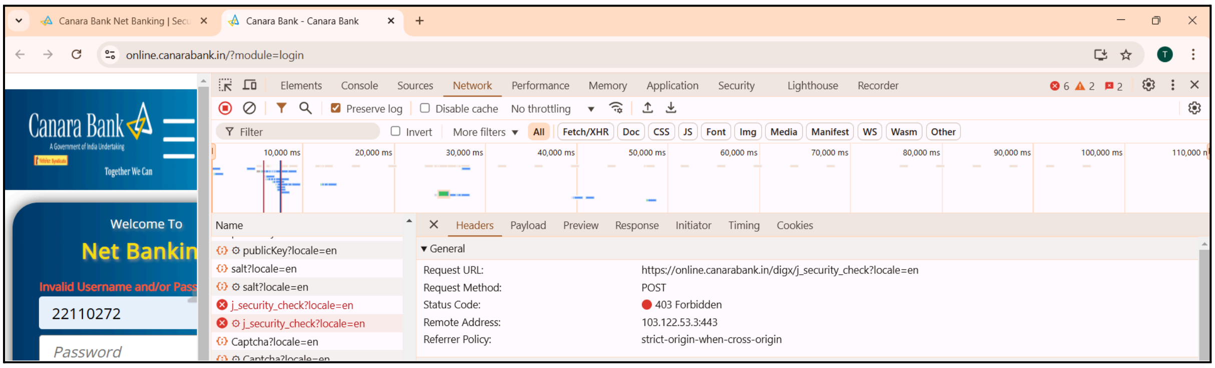
online.canarabank.in/?module=login

- j_security_check?locale=en
- ruxitagentjs_ICA7NVfqrux_10303...
- rb_77626bb7-f246-4a86-8542-b...
- 746x965_01.jpg
- Corp_App_Banner.jpeg
- placeholder.svg

General

Request URL: https://online.canarabank.in/digx/cz/v1/Captcha?locale=en
Request Method: POST
Status Code: 400 Bad Request
Remote Address: 103.122.53.3:443
Referrer Policy: strict-origin-when-cross-origin

403 Forbidden



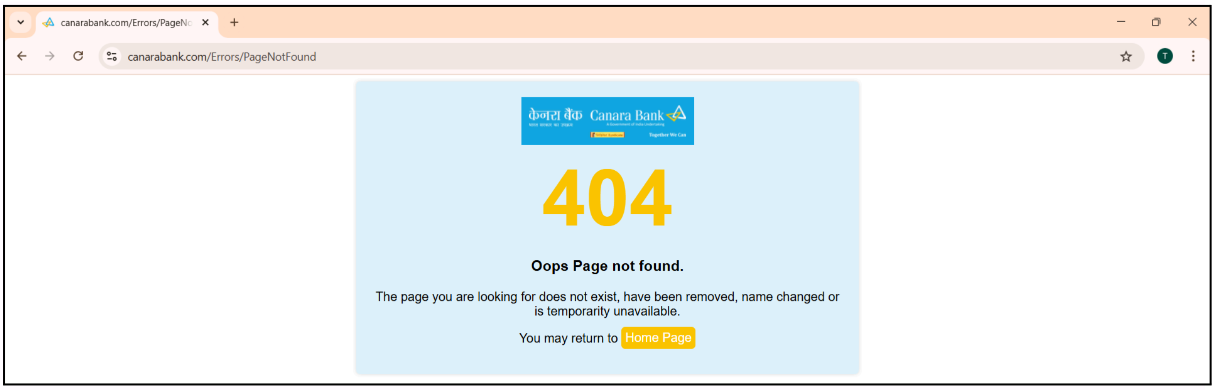
online.canarabank.in/?module=login

- publicKey?locale=en
- salt?locale=en
- salt?locale=en
- j_security_check?locale=en
- j_security_check?locale=en
- Captcha?locale=en

General

Request URL: https://online.canarabank.in/digx/j_security_check?locale=en
Request Method: POST
Status Code: 403 Forbidden
Remote Address: 103.122.53.3:443
Referrer Policy: strict-origin-when-cross-origin

404 Not Found



canarabank.com/Errors/PageNotFound

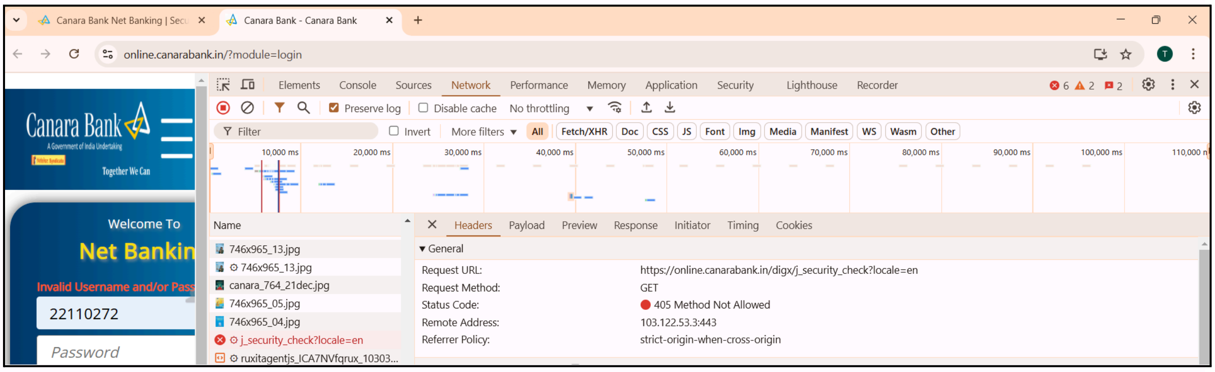
404

Oops Page not found.

The page you are looking for does not exist, have been removed, name changed or is temporarity unavailable.

You may return to Home Page

405 Method Not Allowed



online.canarabank.in/?module=login

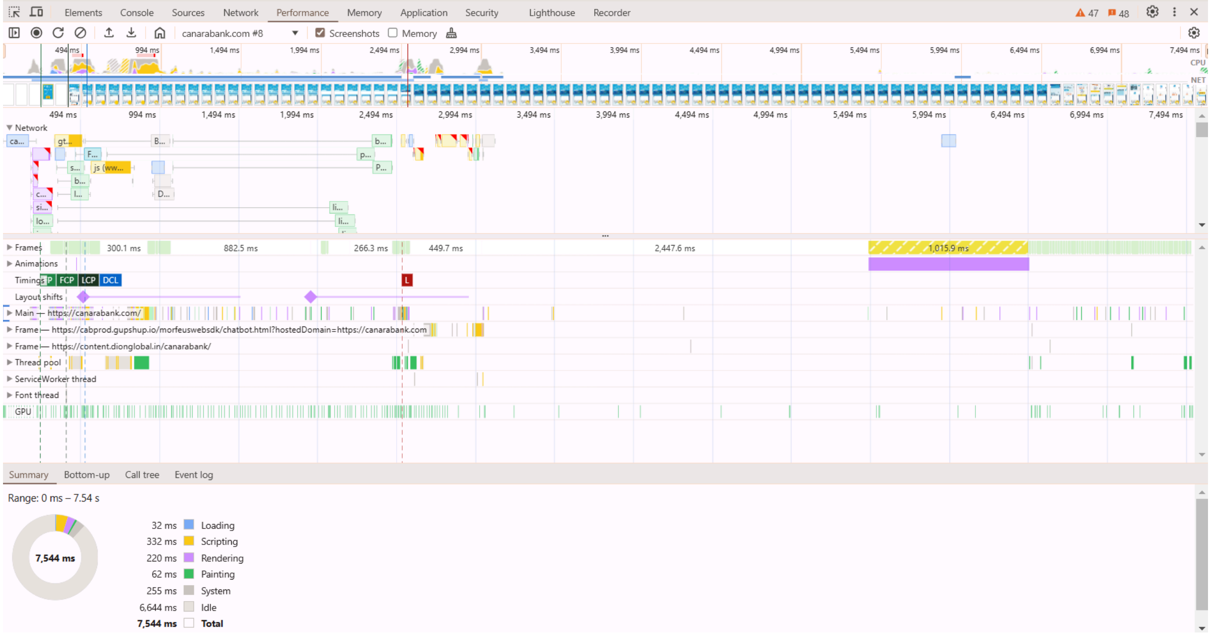
- 746x965_13.jpg
- 746x965_13.jpg
- canara_764_21dec.jpg
- 746x965_05.jpg
- 746x965_04.jpg
- j_security_check?locale=en
- ruxitagentjs_ICA7NVfqrux_10303...

General

Request URL: https://online.canarabank.in/digx/j_security_check?locale=en
Request Method: GET
Status Code: 405 Method Not Allowed
Remote Address: 103.122.53.3:443
Referrer Policy: strict-origin-when-cross-origin

c. Performance Metrics and Cookies:

i) canarabank.com:



Range: 0 ms – 7.54 s

7,544 ms

32 ms	Loading
332 ms	Scripting
220 ms	Rendering
62 ms	Painting
255 ms	System
6,644 ms	Idle
7,544 ms	**Total**

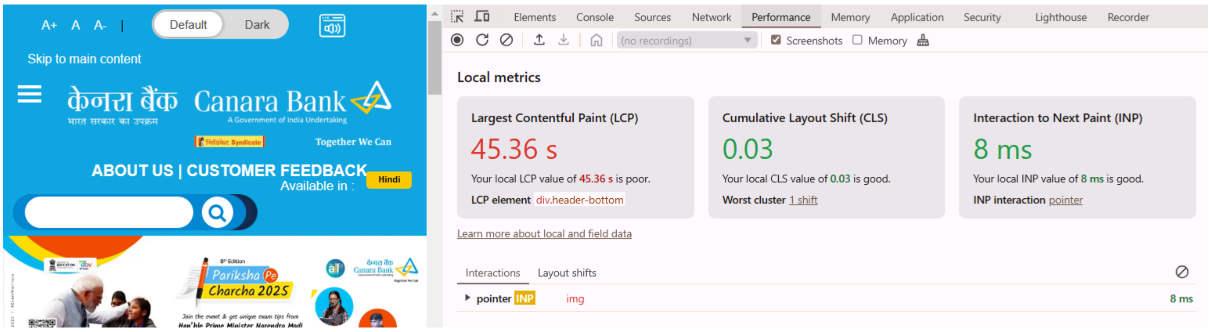
DOMContentLoaded (DCL) - 524.61ms

Largest Contentful Paint (LCP) - 404.16ms

First Contentful Paint (FCP) - 237.64ms

First Paint (FP) - 237.64ms

Browser used : Google Chrome



Local metrics

Largest Contentful Paint (LCP)
45.36 s
Your local LCP value of 45.36 s is poor.
LCP element div.header-bottom

Cumulative Layout Shift (CLS)
0.03
Your local CLS value of 0.03 is good.
Worst cluster 1 shift

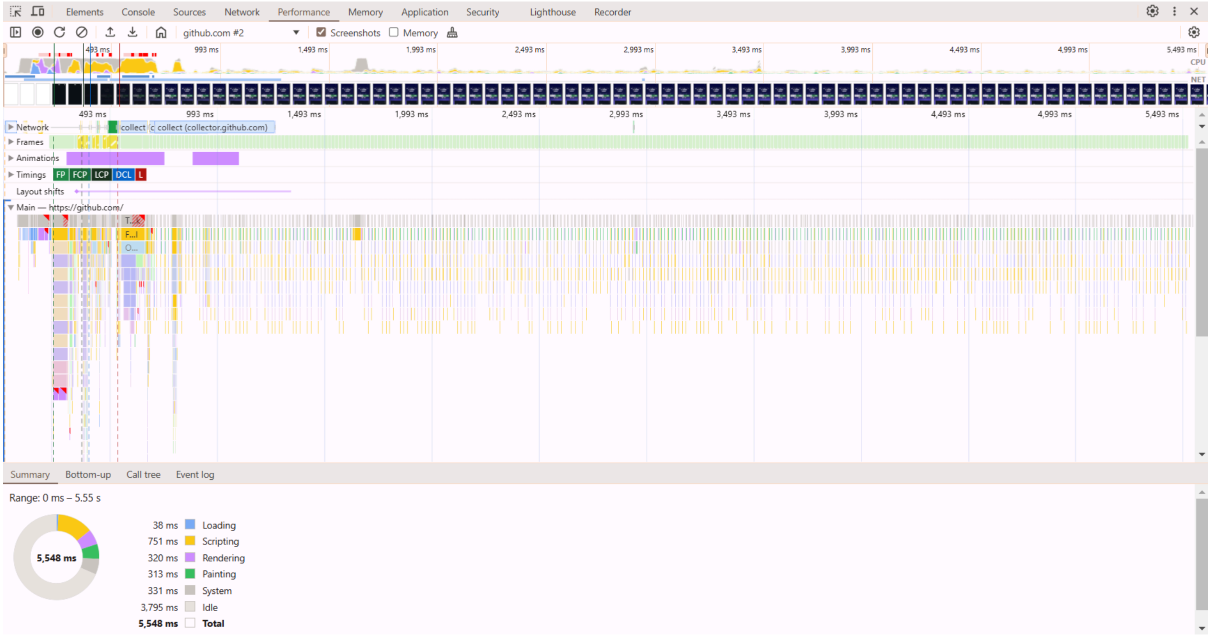
Interaction to Next Paint (INP)
8 ms
Your local INP value of 8 ms is good.
INP interaction pointer

Learn more about local and field data

Interactions
Layout shifts

pointer INP img 8 ms

ii) github.com



Range: 0 ms – 5.55 s

38 ms	🟦	Loading
751 ms	🟨	Scripting
320 ms	🟪	Rendering
313 ms	🟩	Painting
331 ms	▨	System
3,795 ms	□	Idle
5,548 ms	□	**Total**

Onload event (L) - 527.5ms

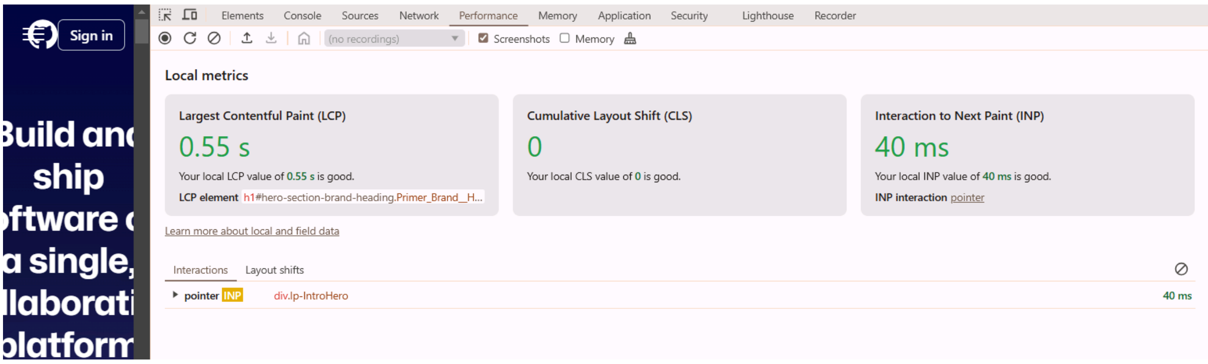
DOMContentLoaded event (DCL) - 391.3ms

Largest Contentful Paint (LCP) - 359.7ms

First Contentful Paint (FCP) -226.6ms

First Paint (FP) - 226.6ms

Browser used : Google Chrome



Local metrics

Largest Contentful Paint (LCP)
0.55 s
Your local LCP value of 0.55 s is good.
LCP element h1#hero-section-brand-heading.Primer_Brand__H...

Cumulative Layout Shift (CLS)
0
Your local CLS value of 0 is good.

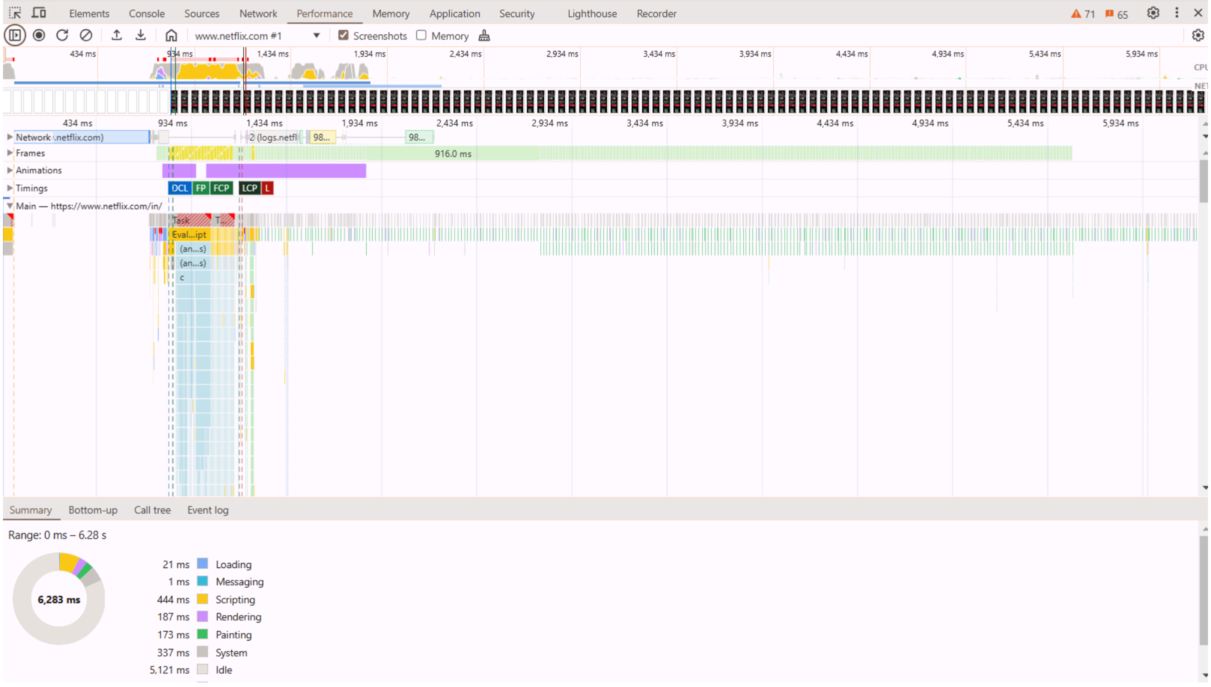
Interaction to Next Paint (INP)
40 ms
Your local INP value of 40 ms is good.
INP interaction pointer

Learn more about local and field data

Interactions | Layout shifts

▸ **pointer** INP div.lp-IntroHero 40 ms

iii) netflix.com



Range: 0 ms – 6.28 s

6,283 ms

21 ms	🟦	Loading
1 ms	🟦	Messaging
444 ms	🟨	Scripting
187 ms	🟪	Rendering
173 ms	🟩	Painting
337 ms	⬜	System
5,121 ms	⬜	Idle

Onload event (L) - 1197.6ms

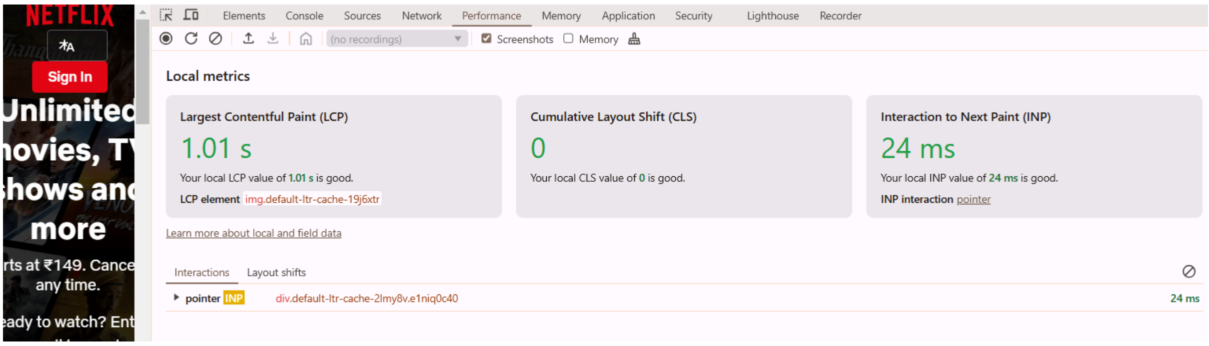
DOMContentLoaded event (DCL) - 811.6ms

Largest Contentful Paint (LCP) - 1184.4ms

First Contentful Paint (FCP) 834.8ms

First Paint (FP) - 834.8ms

Browser used : Google Chrome



Local metrics

Largest Contentful Paint (LCP)

1.01 s

Your local LCP value of 1.01 s is good.

LCP element img.default-ltr-cache-19j6xtr

Cumulative Layout Shift (CLS)

0

Your local CLS value of 0 is good.

Interaction to Next Paint (INP)

24 ms

Your local INP value of 24 ms is good.

INP interaction pointer

Learn more about local and field data

Interactions Layout shifts

▸ pointer INP div.default-ltr-cache-2lmy8v.e1niq0c40 24 ms

Cookies used for the three websites : Link

No cookies found in the Response header in github.com