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Event Driven HTTP Server using C++

Description

- This program works in an environment of multiple clients where multiple clients can request for a file and the server will provide the required files along with the embedded files corresponding to the requested file. It uses the single threaded approach, using the `select` linux command. Select command allows it to monitor multiple clients while waiting until one of the clients becomes active. Select command basically works as an interrupt handler (Event Driven Server), which gets activated as soon as any client requests for connection or sends a request after connecting. Data structure used for select : **fd_set**. This approach supports multiple clients concurrently by creating a master socket (i.e. listening socket) which gets activated when a new client wants to connect, it will then create a new file descriptor for that client and master socket will again start listening. It does the maintenance of all the existing as well as new connections.
- The server program accepts the document root and port number as input command line arguments.
- The file which contains embedded links(of supported file types), the server handles them as well. The file types supported by the server are: **gif, png, jpg, jpeg, html, text, css, xml, js, csv**.
- It handles the default file which is `index.html` if the user does not provide filename.
- It supports **HTTP/1.1** protocol. The connection is kept alive based on a **heuristic** method, i.e. timeout is set according to number of active connections and number of possible connections. The amount of time connection will remain open depend on formula: **5 + (Maximum number of connections possible)- (Number of active connections)**, i.e. each connection to client will remain open for at least 5 seconds. If at a time the server has less number of active connections, the keep alive timeout will be more. When the number of connections increase, the keep alive timeout reduces.
- It checks for permission of files and provides access to clients to only those files which are world readable.
- It supports error codes: **400, 403, 404 along with 200** (which is message OK).
- Server currently supports a fixed number of maximum connections (8) and fixed maximum number of pending connections (4), which can be made scalable by

passing the maximum number of connections/pending connections as arguments in the server program.

List of Submitted Files

1. main.cpp is the src file containing server code.
2. “www.scu.edu” folder containing some of the files extracted from www.scu.edu website using “wget” recursively.

Instructions for Running program

1. Command to compile the program: `g++ main.cpp -o server`
2. Command to run the file generated `./server -document_root "www.scu.edu" -port 8000`

Snapshots/Scenarios Demonstration:

1. Server program started by giving document root and port as parameter and any port can be configured from 8000 to 9999

```
> sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./a.out -port 8999 -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code"
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./a.out -port 8999 -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code"
Started server to listen for requests on port 8999
^C
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./a.out -port 8999 -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code/www.scu.edu"
Started server to listen for requests on port 8999
^C
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./a.out -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code/www.scu.edu" -port 8888
Started server to listen for requests on port 8888
```

2. Handling the default scenario when no file name is given, the server sends the index.html to the browser.

The screenshot shows a web browser window displaying the Santa Clara University homepage. The URL in the address bar is `localhost:8888`. The page itself has a red header with the university's name and navigation links like 'ABOUT SCU', 'ACADEMICS', etc. A large banner in the center says 'Go Anywhere From Here' with a call to action 'Invent the life you want to lead at Santa Clara University.' At the bottom of the browser window, the developer tools Network tab is open, showing a list of network requests made by the browser. The table includes columns for Status, Method, Domain, File, Initiator, Type, Transferred, and Size. One request for 'index.html' is highlighted in blue, indicating it's the current selection.

Status	Method	Domain	File	Initiator	Type	Transferred	Size
200	GET	localhost:8888	/	document	html	41.18 kB	41.02 kB
200	GET	www.scu.edu	scu.js	script	js	cached	0 B
200	GET	assets.scu.edu	instant-notification.js	script	js	cached	0 B
200	GET	localhost:8888	lazyloading.js	script	js	3.56 kB	3.39 kB
200	GET	localhost:8888	f.css	stylesheet	css	5.41 kB	5.26 kB
200	GET	lwc.al.scu.edu	lwcw.js	script	js	14.18 kB (raced)	0 B
200	GET	localhost:8888	preloading.css	stylesheet	css	872 B	717 B
200	GET	upload.wikimedia.org	1x1.png	img	png	cached	208 B
200	GET	res.cloudinary.com	SCU-Video-Pause_1chxgu.png	img	png	cached	544 B
200	GET	assets.scu.edu	d4eeff5b1-2f4a-42d6-ae28-6220d71243be.woff2	font	woff2	CORS Missing Allow Origin	18.53 kB
200	GET	assets.scu.edu	610145ac-d311-4024-b833-3ab0ce6b7847.woff2	font	woff2	CORS Missing Allow Origin	25.14 kB

90 requests | 3.44 MB / 416.66 kB transferred | Finish: 2.61 min | DOMContentLoaded: 763 ms | load: 4 s

3. Handling index.html page with URL <http://localhost:8888/index.html>

We're students, teachers, and mentors headquartered in the most innovative place on earth: Silicon Valley.

94% 11:1 85% 300+

First-year retention rate Student-to-faculty ratio Four-year graduation rate Days of sunshine per year

More Measures of Success

Network tab details:

Status	Method	Domain	File	Initiator	Type	Transferred	Size
200	GET	localhost:8888	index.html	document	html	41.18 kB	41.02 kB
200	POST	analytics.google.com	collect?v=2&id=G-EKHSKHPRBH>m=45je3ap0v8788477286_p=1562196314_10_192	(beacon)	plain	436 B	0 B
200	GET	localhost:8888	f.css		stylesheet	5.41 kB	5.26 kB
200	GET	www.scu.edu	scu.js		script	js	cached
200	GET	assets.scu.edu	instant-notification.js		script	js	cached
200	GET	localhost:8888	lazyloading.js		script	js	3.56 kB
200	GET	localhost:8888	preloading.css		stylesheet	css	872 B
200	GET	fecal.scu.edu	lwcw.js		script	js	14.18 kB (raced)
200	GET	assets.scu.edu	d4eef5b1-2f4a-42f6-ae2d-6220d71243be.woff2		font	woff2	CORS Missing Allow Origin 18.53 kB
200	GET	assets.scu.edu	610145ac-d531-4024-bb33-3ab0ce6b7847.woff2		font	woff2	CORS Missing Allow Origin 25.14 kB
200	GET	assets.scu.edu	fontello.woff88632057		font		14 kB

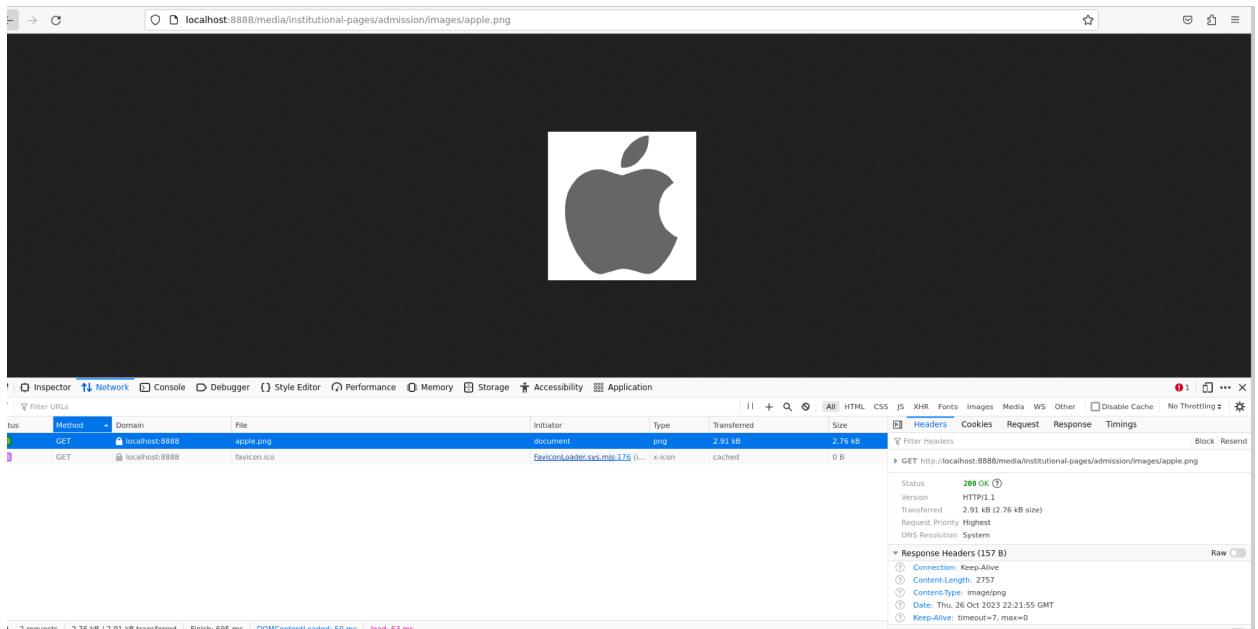
4. Handling .jpg files

t4card_teacher.jpg

Network tab details:

Status	Method	Domain	File	Initiator	Type	Transferred	Size
200	GET	localhost:8888	t4card_teacher.jpg	document	jpeg	72.54 kB	72.38 kB
400	GET	localhost:8888	favicon.ico	PositionLoader.sys.mis-176 (i...)	x-icon	cached	0 B

5. Handling .png files



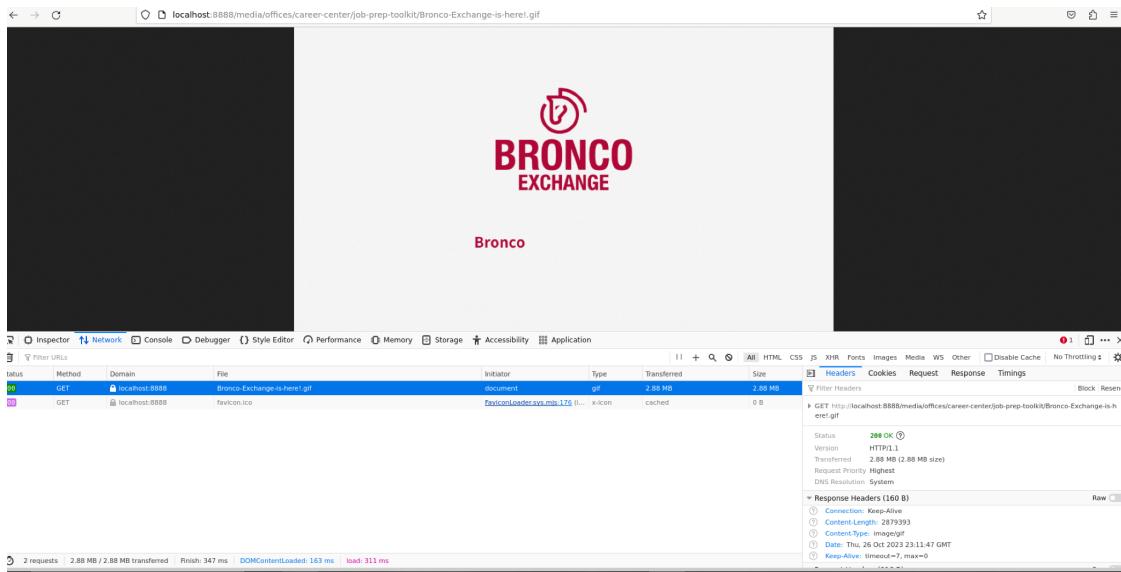
A screenshot of a web browser window. The address bar shows "localhost:8888/media/institutional-pages/admission/images/apple.png". The main content area displays a grayscale Apple logo. Below the browser window is the developer tools Network tab. It lists two requests:

Method	Domain	File	Initiator	Type	Transferred	Size
GET	localhost:8888	apple.png	document	png	2.91 kB	2.76 kB
GET	localhost:8888	favicon.ico	favicon-loader.sys.msp.176	x-icon	cached	0 B

The "apple.png" request has a status of 200 OK, version HTTP/1.1, transferred 2.91 kB (2.76 kB size), request priority highest, and DNS resolution system. The "apple.png" response header includes:

- Connection: Keep-Alive
- Content-Length: 2757
- Content-Type: image/png
- Date: Thu, 26 Oct 2023 22:21:55 GMT
- Keep-Alive: timeout=7, max=0

6. Handling .gif files



A screenshot of a web browser window. The address bar shows "localhost:8888/media/offices/career-center/job-prep-toolkit/Bronco-Exchange-is-here!.gif". The main content area displays the Bronco Exchange logo and the word "Bronco". Below the browser window is the developer tools Network tab. It lists two requests:

Method	Domain	File	Initiator	Type	Transferred	Size
GET	localhost:8888	Bronco-Exchange-is-here!.gif	document	gif	2.88 MB	2.88 MB
GET	localhost:8888	favicon.ico	favicon-loader.sys.msp.176	x-icon	cached	0 B

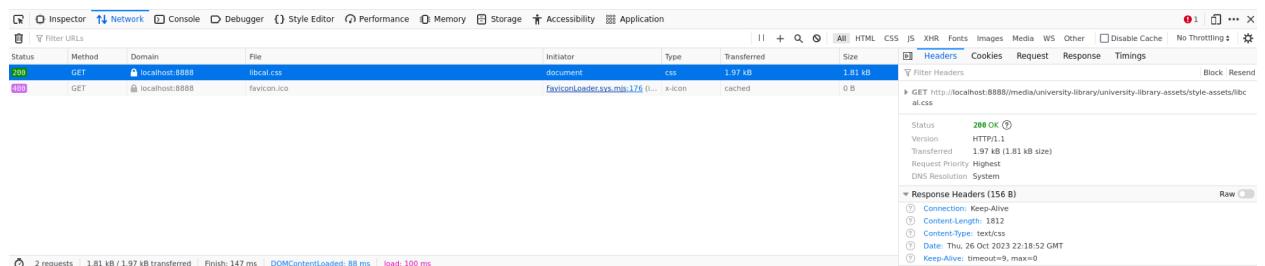
The "Bronco-Exchange-is-here!.gif" request has a status of 200 OK, version HTTP/1.1, transferred 2.88 MB (2.88 MB size), request priority highest, and DNS resolution system. The "Bronco-Exchange-is-here!.gif" response header includes:

- Connection: Keep-Alive
- Content-Length: 297393
- Content-Type: image/gif
- Date: Thu, 26 Oct 2023 23:11:47 GMT
- Keep-Alive: timeout=7, max=0

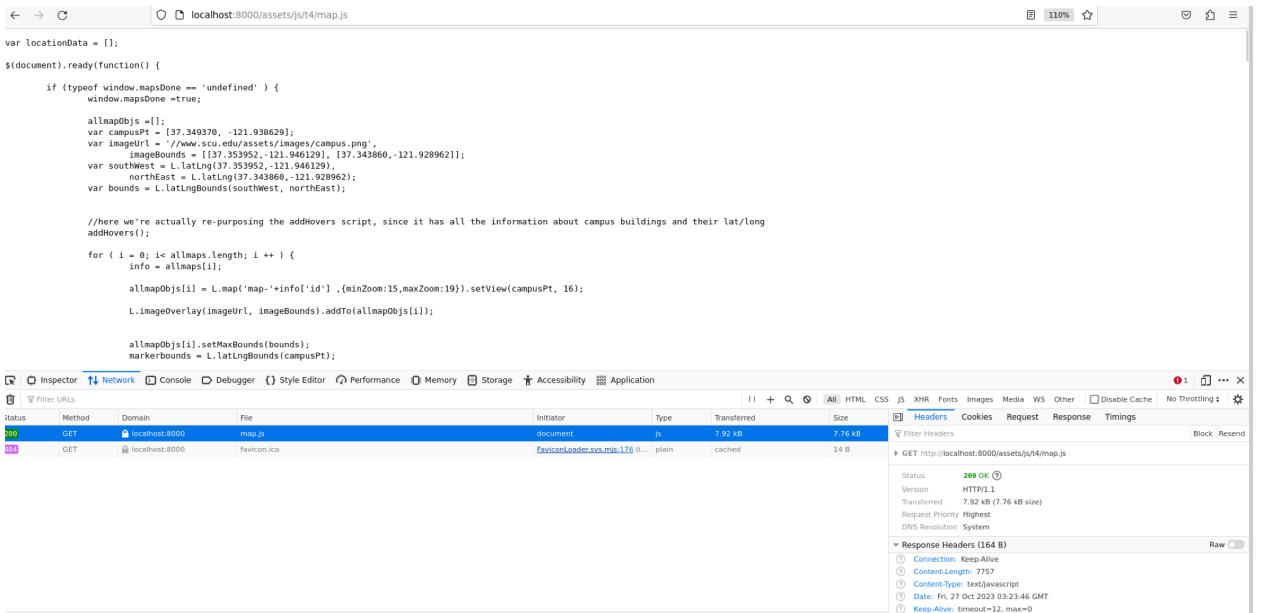
7. Handling .txt files

This file was edited 2023-05-14 mechanic
User agent: SitchCheck-internal by SiteSprout.com
Sitemap: https://www.scu.edu/media/scuodis/xnl-assets/sitemap-253740.xml
User agent: *
Disallow: /internal/
Disallow: /internal/privacy
Disallow: /internal/cookies
Disallow: /internal/sector-ethics/
Disallow: /sector/
Disallow: /sector/privacy/
Sitemap: https://www.scu.edu/media/scuodis/xnl-assets/sitemap-253740.xml

8. Handling .cas files



9. Handling .js

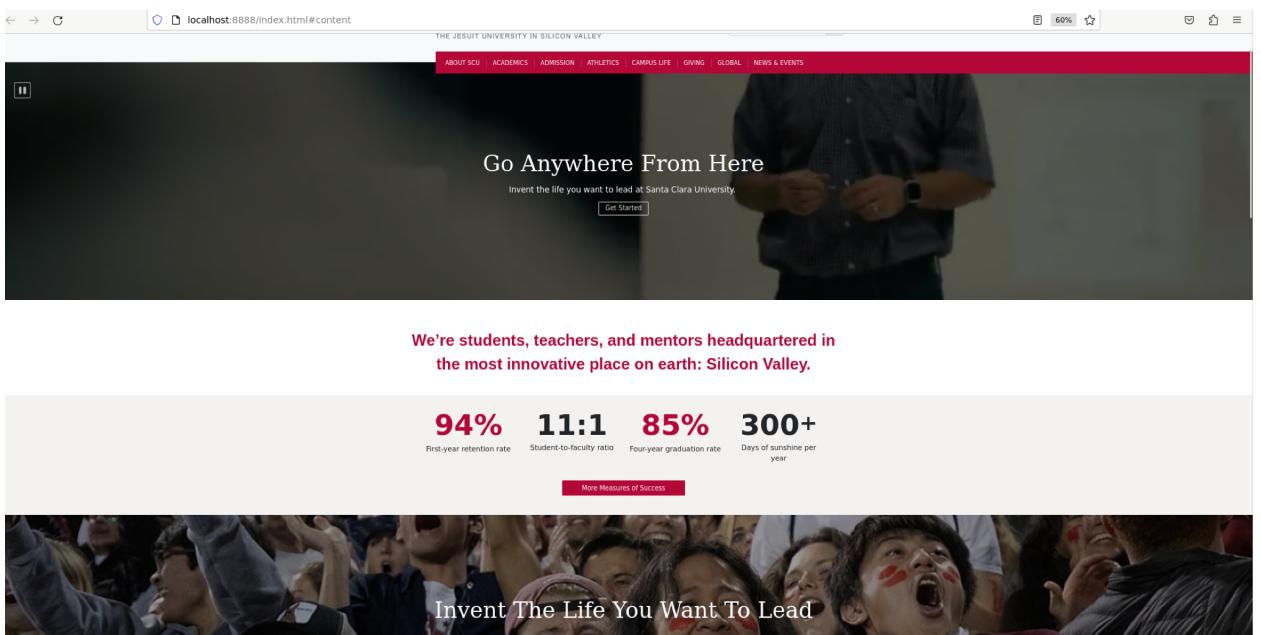


```
var locationData = [];

$(document).ready(function() {
    if (typeof window.mapsDone == 'undefined') {
        window.mapsDone =true;
        allmapObjs = [];
        var campusPt = [37.349370, -121.938629];
        var imageUrl = '//www.scu.edu/assets/images/campus.png',
            imageBounds = [[37.353952, -121.946129], [37.343860, -121.928962]];
        var southWest = L.latLng(37.353952, -121.946129),
            northEast = L.latLng(37.343860, -121.928962);
        var bounds = L.latLngBounds(southWest, northEast);

        //here we're actually re-purposing the addHovers script, since it has all the information about campus buildings and their lat/long addHovers();
        for ( i = 0; i< allmaps.length; i++ ) {
            info = allmaps[i];
            allmapObjs[i] = L.map('map-'+info['id'], {minZoom:15,maxZoom:19}).setView(campusPt, 16);
            L.imageOverlay(imageUrl, imageBounds).addTo(allmapObjs[i]);
            allmapObjs[i].setMaxBounds(bounds);
            markerbounds = L.latLngBounds(campusPt);
        }
    }
});
```

10. Server handling all the embedded links which can be gif, png, jpg, txt, js etc



11. Server closing the connections after client requests to close.

```
request token: GET
request token: /media/institutional-pages/giving/images/campaign-banner.png
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 21:50:14 GMT]
Checking pageName: /media/institutional-pages/giving/images/campaign-banner.png
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: image/png
Content-Length: 26150
Host disconnected , ip 127.0.0.1 , port 58944
num_active_connections: 1
Host disconnected , ip 127.0.0.1 , port 58954
num_active_connections: 0
New connection , socket fd is 4 , ip is : 127.0.0.1 , port : 46072
Adding to list of sockets as 0, num_active_connections: 1
Host disconnected , ip 127.0.0.1 , port 46072
num_active_connections: 0
New connection , socket fd is 4 , ip is : 127.0.0.1 , port : 54480
Adding to list of sockets as 0, num_active_connections: 1
Host disconnected , ip 127.0.0.1 , port 54480
num_active_connections: 0
```

12. Comparing two images : keep alive timeout is different for two images(because it depends on the number of active connections), heuristic handling

The screenshot shows a browser window for Santa Clara University. The Network tab of the developer tools is open, displaying a list of requests made to the local host. The requests include various files like scripts, CSS, and images, all originating from localhost:8888. The 'Timings' column shows the duration for each request, with some taking longer than others. The browser interface includes a header bar with tabs for Students, Faculty & Staff, Families, Alumni, Visitors, Offices & Services, and Schools & Centers. Below the header is a navigation bar with links for About SCU, Academics, Admission, Athletics, Campus Life, Giving, Global, and News & Events. The main content area features a banner with the text "Go Anywhere From Here" and "Invent the life you want to lead at Santa Clara University".

Status	Method	Domain	File	Initiator	Type	Transferred	Size
200	GET	localhost:8888	/		document	html	41.02 kB
200	GET	site-typekit.net	gzb1my.css		stylesheet	css	12 kB
200	GET	localhost:8888	t.css		stylesheet	css	5.41 kB
200	GET	www.scu.edu	scu.js		script	js	0 B
200	GET	upload.wikimedia.org	1x1.png		img	png	99 B (raced)
200	GET	local.scu.edu	lccw.js		script	js	14.18 kB (raced)
200	GET	assets.scu.edu	instant-notification.js		script	js	0 B
200	GET	localhost:8888	lazyloading.js		script	js	3.56 kB
200	GET	localhost:8888	preloading.css		stylesheet	css	872 B
200	GET	local.scu.edu	lccw.js		script	js	0 B
200	GET	upload.wikimedia.org	1x1.png		img	png	cached
200	GET	res.cloudinary.com	SCU-Video-Pause_1chgu.png		img	png	cached

Host disconnected , ip 127.0.0.1 , port 37356
num_active_connections: 4
Host disconnected , ip 127.0.0.1 , port 37340
num_active_connections: 3
Host disconnected , ip 127.0.0.1 , port 37324
num_active_connections: 2

Client Making server request

The following are snippets at the server, when the web browser(client) requested for index.html. Here we can see that index.html is the first request that client sends to server and once server responds to it, then it sends another requests to the server (corresponding to embedded files). The server handles these by creating multiple connections as we can see from logs. Also after timeout time exceeds it closes the connection as well.

```
request token: GET
request token: /
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /index.html
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: text/html
Content-Length: 41017
Host disconnected , ip 127.0.0.1 , port 35304
num_active_connections: 4
Host disconnected , ip 127.0.0.1 , port 35312
num_active_connections: 3
Received at server: GET /media/scuedu/style-assets/stylesheets/f.css HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: text/css,*/*;q=0.1
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Referer: http://localhost:8888/
Cookie: _gcl_au=1.933397737.1698301964; _ga_KPFG4EBS18=GS1.1.1698361817.6.1.1698361844.0.0.0; _ga=GA1.1.677684390.1698301965; _ga_KPMH5PMCC=GS1.1.1698361817.6.1.1698361844.0.0.0; _gid=GA1.1.1865904775.1698301965; _ga_EKH5KHPRBH=GS1.1.1698361846.6.0.1698361846.60.0.0; _fbp=fb.0.1698301965901.1075972032
Sec-Fetch-Dest: style
Sec-Fetch-Mode: no-cors
Sec-Fetch-Site: same-origin

request token: GET
request token: /media/scuedu/style-assets/stylesheets/f.css
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /media/scuedu/style-assets/stylesheets/f.css
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: text/css
Content-Length: 5256
New connection , socket fd is 7 , ip is : 127.0.0.1 , port : 56214
Adding to list of sockets as 3 , num_active_connections: 4

New connection , socket fd is 8 , ip is : 127.0.0.1 , port : 56224
Adding to list of sockets as 4 , num_active_connections: 5
Received at server: GET /media/scuedu/style-assets/javascript/lazyloading.js HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: */*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Referer: http://localhost:8888/
Cookie: _gcl_au=1.933397737.1698301964; _ga_KPFG4EBS18=GS1.1.1698361817.6.1.1698361844.0.0.0; _ga=GA1.1.677684390.1698301965; _ga_KPMH5PMCC=GS1.1.1698361817.6.1.1698361844.0.0.0; _gid=GA1.1.1865904775.1698301965; _ga_EKH5KHPRBH=GS1.1.1698361846.6.0.1698361846.60.0.0; _fbp=fb.0.1698301965901.1075972032
Sec-Fetch-Dest: script
Sec-Fetch-Mode: no-cors
Sec-Fetch-Site: same-origin

request token: GET
request token: /media/scuedu/style-assets/javascript/lazyloading.js
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /media/scuedu/style-assets/javascript/lazyloading.js
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: text/javascript
Content-Length: 3394
Received at server: GET /media/scuedu/style-assets/stylesheets/preloading.css HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: text/css,*/*;q=0.1
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Referer: http://localhost:8888/
Cookie: _gcl_au=1.933397737.1698301964; _ga_KPFG4EBS18=GS1.1.1698361817.6.1.1698361844.0.0.0; _ga=GA1.1.677684390.1698301965; _ga_KPMH5PMCC=GS1.1.1698361817.6.1.1698361844.0.0.0; _gid=GA1.1.1865904775.1698301965; _ga_EKH5KHPRBH=GS1.1.1698361846.6.0.1698361846.60.0.0; _fbp=fb.0.1698301965901.1075972032
Sec-Fetch-Dest: style
Sec-Fetch-Mode: no-cors
Sec-Fetch-Site: same-origin
```

```
request token: GET
request token: /media/scuedu/style-assets/stylesheets/preloading.css
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /media/scuedu/style-assets/stylesheets/preloading.css
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: text/css
Content-Length: 717
Received at server: GET /media/institutional-pages/giving/images/campaign-banner.png HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: image/avif,image/webp,/*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Referer: http://localhost:8888/
Cookie: __gcl_au=1.1.933397737.1698301964; _ga_KPFG4EBS18=GS1.1.1698361817.6.1.1698361844.0.0.0; _ga=GA1.1.677684390.1698301965; _ga_KPMH5WPCC=GS1.1.1698361817.6.1.1698361844.0.0.0; _gid=GA1.1.1865904775.1698301965; _ga_EKH5KHPRBH=GS1.1.1698361846.6.0.1698361846.60.0.0; _fbp=fb.0.1698301965901.1075972032
Sec-Fetch-Dest: image
Sec-Fetch-Mode: no-cors
Sec-Fetch-Site: same-origin

request token: GET
request token: /media/institutional-pages/giving/images/campaign-banner.png
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /media/institutional-pages/giving/images/campaign-banner.png
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: image/png
Content-Length: 26150
Received at server: GET /media/offices/umc/web-design/crowd-pic-NEW_0001_20211203_Soccer_Fans_4446.jpg HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: image/avif,image/webp,/*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: image/png
Content-Length: 26150
Received at server: GET /media/offices/umc/web-design/crowd-pic-NEW_0001_20211203_Soccer_Fans_4446.jpg HTTP/1.1
Host: localhost:8888
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/118.0
Accept: image/avif,image/webp,/*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Referer: http://localhost:8888/
Cookie: __gcl_au=1.1.933397737.1698301964; _ga_KPFG4EBS18=GS1.1.1698361817.6.1.1698361844.0.0.0; _ga=GA1.1.677684390.1698301965; _ga_KPMH5WPCC=GS1.1.1698361817.6.1.1698361844.0.0.0; _gid=GA1.1.1865904775.1698301965; _ga_EKH5KHPRBH=GS1.1.1698361846.6.0.1698361846.60.0.0; _fbp=fb.0.1698301965901.1075972032
Sec-Fetch-Dest: image
Sec-Fetch-Mode: no-cors
Sec-Fetch-Site: same-origin

request token: GET
request token: /media/offices/umc/web-design/crowd-pic-NEW_0001_20211203_Soccer_Fans_4446.jpg
request token: HTTP/1.1
request token: Host:
Time is: [Thu, 26 Oct 2023 23:20:44 GMT]
Checking pageName: /media/offices/umc/web-design/crowd-pic-NEW_0001_20211203_Soccer_Fans_4446.jpg
status: HTTP/1.1 200 OK
returning:
HTTP/1.1 200 OK
Content-Type: image/jpeg
Content-Length: 132900
Host disconnected , ip 127.0.0.1 , port 56224
num_active_connections: 4
Host disconnected , ip 127.0.0.1 , port 56212
num_active_connections: 3
Host disconnected , ip 127.0.0.1 , port 56214
num_active_connections: 2
```

HTTP Response Header Contents Sent by Server

This represents the headers of http response

This represents the actual content in file

```
GET robots.txt HTTP/1.1
HTTP/1.1 200 OK
Content-Type: text/plain
Content-Length: 501
Connection: Keep-Alive
Keep-Alive: timeout=12, max=0
Date: Fri, 27 Oct 2023 00:55:35 GMT
#This file was edited 2023-05-16 apehanich

User-agent: SiteCheck-sitecrawl by Siteimprove.com
Allow: /
Sitemap: https://www.scu.edu/media/scuedu/xml-assets/sitemap-2537
        XML
```

Error Handling

1. If an incorrect port is set at server for listening during passing the arguments, the server will respond via sending a message at terminal proving the correct range of terminals on which server can listen to is from 8000 to 9999 as per specifications.

```
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./a.out -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code/www.scu.edu" -port 7000
Incorrect server port number try sending request at port 8000 to 9999
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$
```

- For running the program, if incorrect arguments are sent to the server program then the server program will send an error message and exit.

```
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ g++ main.cpp -o server
main.cpp:537:66: warning: backslash and newline separated by space
      537 |     ername(sd, (struct sockaddr *)&address, \
           |
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./server
The program should have 4 input arguments
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ ./server -document_root "/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code/www.scu.edu" -port 8000
Started server to listen for requests on port 8000
```

- Bad Request 400 is handled when the GET request sent is not having correct format. Only supported protocols are HTTP 1.0 /1.1. Also 400 is sent when a file format is not supported by the server.

```
sdhawan@DESKTOP-5G2787P:/mnt/d/simrdhaw/Distributed Systems/Assignments/Programming Assignment 1/code$ telnet localhost 8000
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
GET index.html HTTP/2.0
HTTP/1.1 400 Bad Request
Content-Type: text/plain
Content-Length: 11
Connection: Keep-Alive
Keep-Alive: timeout=11, max=0
Date: Fri, 27 Oct 2023 00:35:11 GMT
Bad Request
```

- Not found 404 is sent when a file is not found, at location.

Page not found

Status	Method	Domain	File	Initiator	Type	Transferred	Size
404	GET	localhost:8000	abc	document	plain	178 B	14 B
200	GET	localhost:8000	favicon.ico	favicon.ico.msi.176 (img)	plain	178 B	14 B

Headers

Status	404 Not Found
Version	HTTP/1.1
Transfered	178 B (14 B size)
Request Priority	Highest
DNS Resolution	System

Response Headers (164 B)

Connection	Keep-Alive
Content-Length:	14
Content-Type:	text/plain
Date:	Fri, 27 Oct 2023 00:32:29 GMT
Keep-Alive:	timeout=11, max=0

5. Permission error 403 is sent when the file is not world readable.

Permission error

Status	Method	Domain	File	Initiator	Type	Transferred	Size
403	GET	localhost:9000	temp_file	document	plain	180 B	0 B
200	GET	localhost:9000	favicon.ico	favicon.ico.msi.176 (img)	plain	16 B	1 ms

Note: Status 200 Message OK is seen in all successful requests as seen in above snapshots.