

Design Document: Adding Aliases to HTTP Server

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1) Goals

The goal for Assignment 3 is to add aliases to our http server. An alias is another name that can refer to the target file in the HTTP server's key-value store. In order to do this we need to find a way to support the PATCH command and use a hash table.

*Another goal is to make sure the previous assignment works and Netcat.

2) Design

For this assignment, the first part we need to do is to set up the hash table. I will be using a hash table from a previous class. The hash table is going to deal with the PATCH function and help handle the alias names.

* I redid my design for asgn 2 to get multithreading, netcat and logging working.

2.1 Completed Multithreading, Netcat, and Logging

I redid my assignment so my logic and code changed from the assignment before. I created 7 functions.

Main

```
local : nthreads ← 4 (default threads)
local : option ← for getopt(3)
local : font, back ← both initialized to 0, meant for queuing
local : log, d_rc
Global : LOG_FILE, SERVER_NAME_STRING, PORT_NUMBER
Global mutex locks : queue_lock, worker_lock
Global conditional lock : worker_signal

1) main(argc, argv)
   Parsing the header using getopt(3)
2)   | while (option = getopt(argc, argv, "N:l:") is not -1 ← we use : to indicate
      | required arg after flag
3)   | switch option
4)   |   case "N"
5)   |     nthreads = number that is entered in args after "-N"
6)   |     if nthreads < 4 then error and exit failure
7)   |     break
8)   |   case "l"
```

```

9)          | LOG_FILE = log file name that is entered in args after "-l"
10)         | create log file using open
11)         | if log file cannot be created, then error: "Cannot open", exit
12)         | break
13)         | default
14)         | exit

15) if server name or port number is NULL
16)     | error: Missing server name and/or port address
17)     | exit
18) SERVER_NAME_STRING ← whatever the args has, ex: "localhost"
19) PORT_NUMBER ← whatever the args has, ex: "8080"

20) log ← when we open the file, we also create it and then need to close after
creation
21) front = back = 0
22) Using pthread_mutex_init: queue_lock ← NULL, worker_lock ← NULL
23) Using pthread_cond_init: worker_signal ← NULL
24) Using pthread_t: dispatch_thread, worker_id[nthreads] ← pool of workers

25) struct dispatch_params dp;
26) dp.bindaddr ← SERVER_NAME_STRING
27) dp.port ← PORT_NUMBER
28) Create dispatcher thread using pthread_create

29) starting the worker threads
30) for 1 to nthreads

```

Create Socket

Created a function that creates the socket and binds to the server. This was originally in my main, but then decided to make it a function to improve modularity. All code in this function was provided in section for ASGN2.

```

1) function create_socket(bindaddr, port)
2)   create sockaddr in
3)   | struct hostent *hent = gethostbyname(bindaddr)
4)   | struct sockaddr_in addr
5)   | memcpy(&addr.sin_addr.s_addr, hent->h_addr, hent->h_length)
6)   | addr.sin_port = htons(port)
7)   | addr.sin_family = AF_INET
8)   | sock = socket(AF_INET, SOCK_STREAM, 0)
9)   | if sock = 0 then error: "In socket" and exit

10)  bind socket to server
11)  | enable ← 1
12)  | setsockopt(sock, SOL_SOCKET, SO_REUSEADDR, &enable, sizeof(enable))
13)  | if bind of the sock is < 0, then error: "In bind" and exit

14)  | return sock

```

GET Function

This function performs the GET request and prints out the appropriate status codes. This was also in my main in ASGN1 and moved it to a function for ASGN2.

```
local : resp_buff[80] ← will store the 200 OK status code
local : file_buff[BUFSIZE]
Global: BUFSIZE = 16000
local : file_read ← will use for read

1) function get_function(con_l, r_target)
2)   | struct stat st;

3)   | fd ← open the r_target file and have read write permissions
4)   | if fd cannot be opened ← if fd = -1
5)   |   | write to cl : file not found status code
6)   | else if fd can be opened
7)   |   | file_read ← read the fd and put contents into file_buff, with BUFSIZE
8)   |   | stat ← of r_target and st
9)   |   | write to con_cl, the client, the 200 OK status code
10)  |   | while file_read >= BUFSIZE ← this is a large file
11)  |       | write the content from the resp_buff to the client, con_l
12)  |       | then read from the fd again
13)  |   | write the last portion of content or if it's not a large file, then just write out
        the contents
14)  | else
15)  |   | write to client: 500 Internal server error status code
16)  |   | close the fd
```

Logging Function

The logging function will take in the file descriptor, the lines, and the logging file. It will take the request and the target file as well as content length and write it to the logging file. After it write it to the logging file, it will covert the contents of the target files into hex and write it 5 bytes at a time per line. It will also log status codes for FAIL.

Queue Insert Function

This queue function will insert sockets into a stack. It will take in a value.

```
parameter : value ← int
Global : MAX ← 20
Global : queue[MAX] ← the queue/stack
Global : front, back ← both of these defined in main

1) function queue_insert(value)
2)   | if back = MAX, then this indicates our queue is full
3)   | else if back < MAX insert the socket at the back of the queue
```

Queue Pop Function

This queue function will take the socket out of the queue from the front. This function takes in no parameters.

```
local : pop_value ← int
Global : front, back ← both of these defined in main

1) function queue_pop()
2)   | if font = back, the the queue is empty
3)   | else assign queue[front] to pop_value
4)   | shift all elements over
5)   | for 0 to back, shift queue by 1
6)   | decrement back
7)   | return the pop_value
```

Dispatcher

This is the function that the dispatcher thread uses. It listens to the socket and accepts connections. When connections arrive, they get placed into the queue.

```
parameters : d_params ← void value, will be used in a struct
local : sock ← int, this will create the socket
local : cl ← the client socket

1) function dispatcher(d_params)
2)   | struct dispatch_params d_par = d_params
3)   | sock ← use create_socket and have d_par point to the server name in
      | bindaddr and the port number in port
4)   | listen ← take in sock and 10

5)   | while(1) ← infinite
6)   |   | cl ← accept with sock and NULL values
7)   |   | ↑ this will establish the connection
8)   |   | we then lock the queue with pthread_mutex_lock so we can insert the
      |   | socket.
9)   |   | call queue_insert to insert the socket cl
10)  |   | we then want to release the queue lock using pthread_mutex_unlock
11)  |   | and then send a signal to the server using pthread_cond_signal
```

Worker

This is the function that the worker threads will use. The worker will wait until the dispatcher signals that the queue is ready. Then one of the workers will take the socket out of the queue and start processing the socket and parse the header and perform the GET and PUT requests. This function takes in no parameters. For the netcat portion of the code, it goes line by line.

```
local : myid, valread
local : write_line_mode ← this is a flag for put, this will indicate if the client is
sending in a curl or netcat command

1) function worker()
2)   | lock the worker lock so the worker can do work using pthread_mutex_lock
3)   | have the make the worker thread wait until it receives a signal
4)   | after we get a signal and a lock, we need to lock the queue so we can pop
      | from the queue
5)   | unlock worker, so other threads can pick up items from the queue
6)   | process connection
7)   | read from client and put it in a buffer
8)   | if valread is -1 then it is an error: "In read". exit
```

```

9)      | while valread > 0 ← keep reading until end of file stream
10)     | copy over the buffer to a process_buffer and then process line by line
11)     | while the next line is not null
12)     | if write_line_mode = 1 ← this means that this is a netcat command
13)     | check if putbytes_left > 0 ← checks if there are still bytes left for
      file
14)     | if file_d > 0 ← write if file_d is good
15)     | else just move on to the next request
16)     | the program still needs to go through the rest of the buffer.
      It will continue to count the number of bytes, but will not write, just pass
      the content
17)     | else
18)     | there is no more data to write
19)     | reset write_line_mode back to 0
20)     | close the file

```

GET REQUEST

```

21)     | if write_line_mode is 0 and the request is a GET
22)     | parse the header to get the request, target, and HTTP type
23)     | check if there's a slash at the beginning of the target file and remove it
24)     | if there's a slash in the middle of the target name and not at the
      beginning, return a 403 forbidden error
25)     | if the target name is not 27 characters long, return a 404 bad request
      error
26)     | else call the get_function

```

PUT REQUEST

```

27)     | if write_line_mode is 0 and the request is a PUT
28)     | parse the header to get the request, target, and HTTP type
29)     | check if there's a slash at the beginning of the target file and remove it
30)     | if there's a slash in the middle of the target name and not at the
      beginning, return a 403 forbidden error
31)     | if the target name is not 27 characters long, return a 404 bad request
      error
32)     | if there is no target name then return a 404 bad request error
33)     | else
34)     | create a file using open
35)     | if file cannot be created, open returns a -1, then return a 500 internal
      internal server error
36)     | we want to keep track of how many bytes we write by setting
      putbytes_left to content_len
37)     | look for a put continue or blank with next line ← this will tell us if it is a
      curl or netcat command
38)     | if there is a put continue then we know this is a curl command and
      will read from a file.
39)     | if it is a large file keep track of putbytes_left
40)     | if putbytes_left > 0 then clear the buffer and read from the file again
      and put all the contents into the newly cleared buffer
41)     | if large file, keep reading and writing from buffer and file
42)     | close file
43)     | write the created message
44)     | else it is netcat
45)     | set write_line_mode to 1
46)     | close(client)

```

2.2 Implemented Aliases

First we want to edit getopt to include the -a argument. If there is no -a in the argument we pass to the command line, the our program fails.

```
1) | while (option = getopt(argc, argv, "N:l:a") is not -1 ← we use : to indicate
   | required arg after flag
2) | switch option
3) | case "N"
4) | | nthreads = number that is entered in args after "-N"
5) | | if nthreads < 4 then error and exit failure
6) | | break
7) | case "l"
8) | | LOG_FILE = log file name that is entered in args after "-l"
9) | | create log file using open
10) | | if log file cannot be created, then error: "Cannot open", exit
10) | | break
11) | case "a"
12) | | ALIAS = the new name
13) | | create the mapping file ← holds all key and value pairs
14) | | if mapping file cannot be created, then error: "file cannot be
15) | | once file is created, then
14) | default
15) | | if ALIAS is still NULL
16) | | calls an error: "Not found"
17) | | exit
18) | exit
```