

OS 2018

Homework2:

Simple myhttp server

(Due date: 2018/11/22 23:59)

Objectives

- Understand HTTP client-server model
- Understand multi-thread programming

Requirements

- A Simple Http-like Server
- A Simple Http-like Client
- Use Internet sockets for client-server communication
- Use thread pool to handle client requests
 - Pthreads
 - One type of requests: GET

Requirements for the Server

- Use a simple http-like protocol, 1.x(not real http protocol)
 - Handle one type of requests: GET
 - Use internet socket to connect with clients
 - Follow the response format, **header+content** (p.5, p.9)
- Support multithreading
 - **Must** implement thread pool and maintain request queue
 - **Main thread** will *accept* for any new connections and put the request into a request queue
 - **The other threads** keep trying to take requests from the request queue and handle the request
 - **lock is required for request queue accesses**
- Usage:
 - `$./myhttpserver -r root -p port -n thread_number`

Server Response Format

Content-Type

Response format:

HTTP/1.x 200 OK\r\nContent-Type: text/html\r\nServer: httpserver/1.x\r\n\r\nCONTENT

HTTP response status line

Server information

File/Directory
content

- HTTP header lines–
 - HTTP response status line: HTTP protocol version, status code and description
 - HTTP protocol version: HTTP/1.x (fixed string)
 - Status code: 200 (You should support all the status codes *in the next slide*)
 - Description: OK\r\n
 - Content-Type:
 - For file, “Content-Type: ”+ filetype + “\r\n” (You should support all the *file types in the next slide*)
 - For directory, “Content-Type: directory\r\n”
 - Server information: (fixed string)
- File/Directory content:
 - For file: file content to header
 - For directory: names of the files and subdirectories in that directory (except “.” and “..”). Names are separated by blank space (similar to ls)

Supported File Types & Status Codes

File
extensions

```
32  extn extensions[] = {
33      {"htm", "text/html"},
34      {"html", "text/html"},
35      {"css", "text/css"},
36      {"h", "text/x-h"},
37      {"hh", "text/x-h"},
38      {"c", "text/x-c"},
39      {"cc", "text/x-c"},
40      {"json", "application/json"},
41      {0, 0}
42  };
```

File type

```
43
44  enum {
45      OK = 0,
46      BAD_REQUEST,
47      NOT_FOUND,
48      METHOD_NOT_ALLOWED,
49      UNSUPPORT_MEDIA_TYPE
50  };
```

```
51
52  const int status_code[] = {
53      200, /* OK */
54      400, /* Bad Request */
55      404, /* Not Found */
56      405, /* Method Not Allowed */
57      415, /* Unsupported Media Type */
58  };
```

Status code

Requirements for the Client

\$./client ^{▽▽}-t QUERY_FILE_OR_DIR ^{▽▽}-h LOCALHOST ^{▽▽}-p PORT

Query file or directory

HTTP web server running on localhost (127.0.0.1)

The format of a simple my_HTTP request is:

"GET QUERY_FILE_OR_DIR HTTP/1.x\r\nHOST: LOCALHOST:PORT \r\n\r\n"

◆ Size limit:

- Maximum size of the **QUERY_FILE_OR_DIR**: **128** bytes

Requirements for the Client(cont.)

- Print out the header+file or directory content.
 - Example: p.9-p.16
- For each file request, save the file content under the client's ./output directory
 - Need to maintain the same directory hierarchy as server
 - Example: p.12
- If the content type is *directory*, create a thread for each file/subdirectory in that directory to get the content of the file/subdirectory (p.11)

Example (1)

Must start with slash




```
miyavi@:hw2_http_server$ ./client -t /example.html -h 127.0.0.1 -p 1234
HTTP/1.x 200 OK
Content-type: text/html
Server: httpserver/1.x
<html>\n
<body>\n
<h1>Hello World</h1>\n
<p>\n
Let's see if this works\n
</p>\n
</body>\n
</html>\n
miyavi@:hw2_http_server$
```

Header

Separates header and file content


File content

Example (2)



```
miyavi@hw2_http_server$ ./client -t /testdir -h 127.0.0.1 -p 12345
HTTP/1.x 200 OK
Content-type: directory
Server: httpserver/1.x

example.html emptyfolder secfolder
```



```
miyavi@hw2_http_server$ ./client -t /testdir/ -h 127.0.0.1 -p 12345
HTTP/1.x 200 OK
Content-type: directory
Server: httpserver/1.x

example.html emptyfolder secfolder
```

- Do **NOT** assume that a directory request will have **trailing slash** in the query string.
- For example.html, emptyfolder and secfolder shown **above**, create a thread to **generate a request to server** for each of the subdir/file.

Example (3)

- For a directory request, create a thread to generate a new request to the server for each subdir/file.

```
miyavi:hw2_http_server$ ./client -t / -h 127.0.0.1 -p 1234
HTTP/1.x 200 OK
Content-type: directory
Server: httpserver/1.x

emptyfolder example.html secfolder
HTTP/1.x 200 OK
Content-type: directory
Server: httpserver/1.x

HTTP/1.x 200 OK
Content-type: text/html
Server: httpserver/1.x

<html>\n
<body>\n
<h1>Hello World</h1>\n
<p>\n
Let's see if this works\n
</p>\n
</body>\n
</html>\n

HTTP/1.x 200 OK
Content-type: directory
Server: httpserver/1.x

trifolder example.ppp db.json youtube-ex.json css-ex.css youtube-ex.html status.c
HTTP/1.x 200 OK
```

For “emptyfolder”

For “example.html”

For “secfolder”

Example (4)

- When saving file content, create subdirectories if needed to maintain the same directory hierarchy with the server.

```
miyavi@hw2_http_server$ ./client -t /secfolder/trifolder/db.json -h 127.0.0.1 -p 1234
HTTP/1.x 200 OK
Content-type: application/json
Server: httpserver/1.x

{
  "clients": [
    {
      "id": "59761c23b30d971669fb42ff",

```

Directories not exist under "output"

Result:

```
miyavi@output$ ls ./secfolder/trifolder/
db.json
miyavi@output$
```

Example (5) – Error Conditions(1)

- **QUERY_FILE_OR_DIR** in request doesn't start with a slash.
- Status code: 400
- Content-type: empty
- Status description: BAD_REQUEST



```
miyavi@hw2_http_server$ ./client -t example.html -h 127.0.0.1 -p 1234
HTTP/1.x 400 BAD_REQUEST
Content-type:
Server: httpserver/1.x

miyavi@hw2_http_server$
```

Example (6) – Error Conditions(2)

- **No such file or directory**
- Status code: 404
- Content-type: empty
- Status description: NOT_FOUND

```
miyavi@hw2_http_server$ ./client -t /noexist.html -h 127.0.0.1 -p 1234
HTTP/1.x 404 NOT_FOUND
Content-type:
Server: httpserver/1.x

miyavi@hw2_http_server$
```

Example (7) – Error Conditions(3)

- **Unsupported file types**
- Status code: 415
- Content-type: empty
- Status description: UNSUPPORT_MEDIA_TYPE

```
miyavi@hw2_http_server$ ./client -t /example.ppp -h 127.0.0.1 -p 1234
HTTP/1.x 415 UNSUPPORT_MEDIA_TYPE
Content-type:
Server: httpserver/1.x

miyavi@hw2_http_server$
```

Example (8) – Error Conditions(4)

- Unsupported Method
 - Support “GET” only
 - Others like POST/HEAD/get is not allowed
- Status code: 405
- Content-type: empty
- Status description: METHOD_NOT_ALLOWED

The format of request message send to server:

“get /testfolder HTTP/1.x\r\nHOST: 127.0.0.1:1234\r\n\r\n”

```
miyavi@hw2_http_server$ ./client -t /testfolder -h 127.0.0.1 -p 1234
HTTP/1.x 405 METHOD_NOT_ALLOWED
Content-type:
Server: httpserver/1.x

miyavi@hw2_http_server$
```


References

- Manual Page
 - [Thread_pool](#)
 - [pthreads](#)
 - [pthread_mutex_lock, pthread_mutex_init](#)
 - [pthread_spin_lock, pthread_spin_init](#)
 - [socket](#)
 - [sem_overview](#)
- HTTP
 - [http_introduction](#)