**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:  $HTTP/1.x 200 OK\r\nContent-Type: text/html\r\nServer: httpserver/1.x\r\n\r\nCONTENT$ Server information HTTP response status line File/Directory content

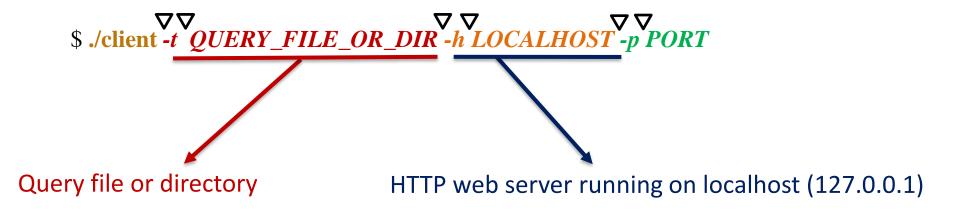
- HTTP header lines—
  - HTTP response status line: HTTP protocol version, status code and description
    - HTTP protocol version: HTTP/1.x (fixed string)
    - Status code: 200 (You should support all the status codes in the next slide)
    - Description: OK\r\n
  - Content-Type:
    - For file, "Content-Type: "+ 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

extn extensions[] = { "text/html"}, 33 34 {"html<mark>"</mark>, "text/html"}, File type "text/css"}, 35 File 'text/x-h"}, 30 extensions "text/x-h"}, 37 'text/x-c"}, 39 {"cc", "text/x-c"}, {"json", "application/json"}, {0, 0} 41 **}**; 42 43 44 enum { 45 0K = 0, BAD REQUEST, 47 NOT FOUND, METHOD NOT ALLOWED, UNSUPPORT MEDIA TYPE 49 **}**; 50 51 Status code const int status code[] = { 52 200, /\* OK \*/ 53 **400,** /\* Bad Request \*/ 54 **404,** /\* Not Found \*/ 55 **405,** /\* Method Not Allowed \*/ 57 415, /\* Unsupported Media Type \*/



## Requirements for the Client



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"

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- ◆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
                           Header
Content-type: text/html
Server: httpserver/1.x
                           Separates header and
<html>\n
                           file content
<body>\n
<h1>Hello World</h1>\n
\n
                           File content
Let's see if this works\n
\n
</body>\n
</html>\n
miyavi@:hw2_http_server$
```



## 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

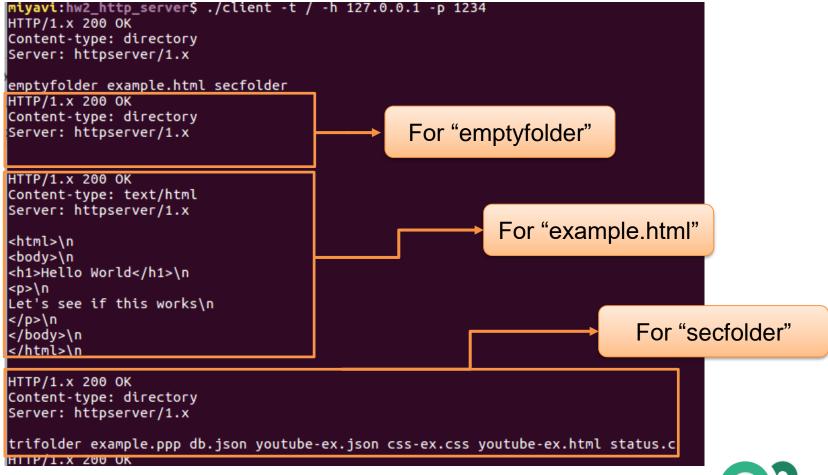
example.html emptyfolder secfolder
```

- ➤ 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.



# Example (4)

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

#### 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

