

# CS305 Lab 4

## Advanced HTTP & Web Programming

Dept. Computer Science and Engineering  
Southern University of Science and Technology

Part A.

# Advanced HTTP

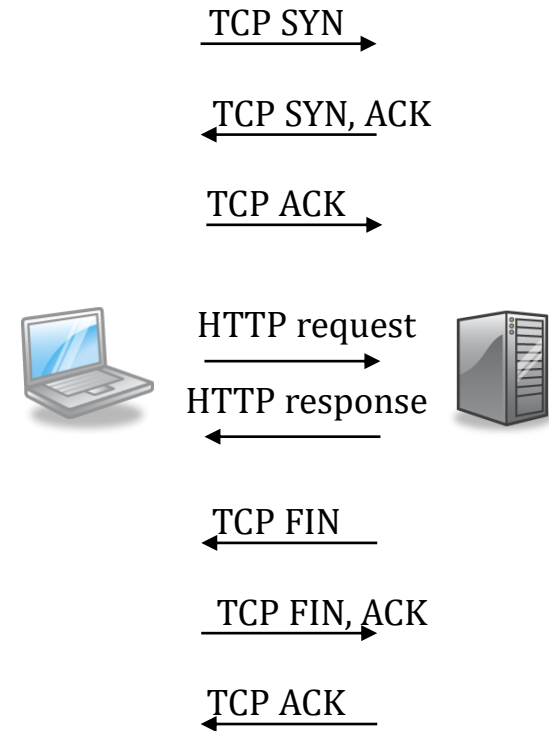
# Part A.1

## Connection and transfer encoding

- Connection management
  - Persistent connection, parallel connection
  - Connection: close
- Content-Length vs. Chunked transfer encoding
  - Reducing latency of response

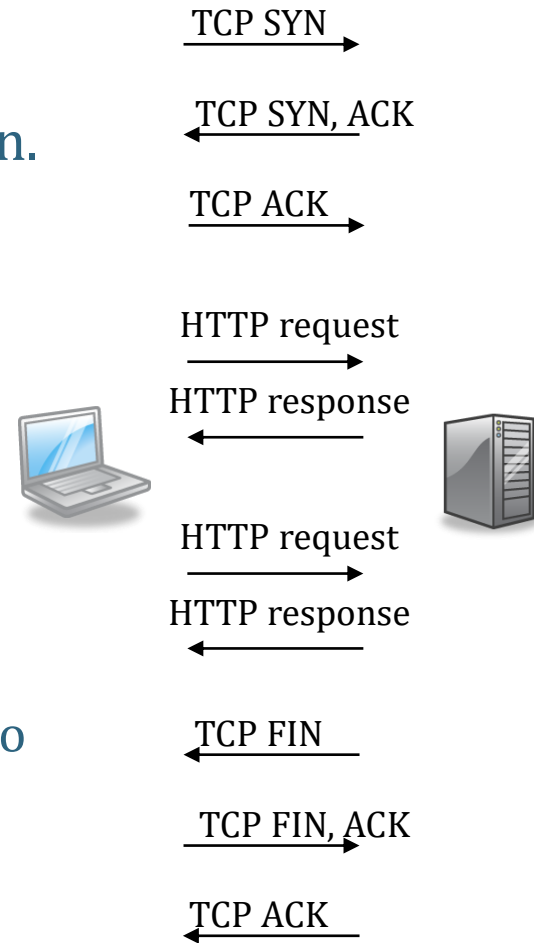
# Problem in HTTP/1.0 connection

- HTTP/1.0 uses a new connection for each HTTP transaction.
- Making TCP connection slow.
  - takes three packets to establish
  - takes three packets to close
- A web page typically contains many embedded images. HTTP/1.0 would make many TCP connections to load a web page.
  - Slow page loading



# Persistent and Parallel Connection

- **Persistent connection:** multiple requests and responses are sent through one TCP connection.
  - Default in HTTP/1.1
  - Browsers keep TCP connection after page load.  
Why?
- **Parallel connection:** A web browser opens several TCP connections to a web site and downloads components of a web page concurrently.
  - using tcp.srcport and tcp.dstport in Wireshark to trace a http session

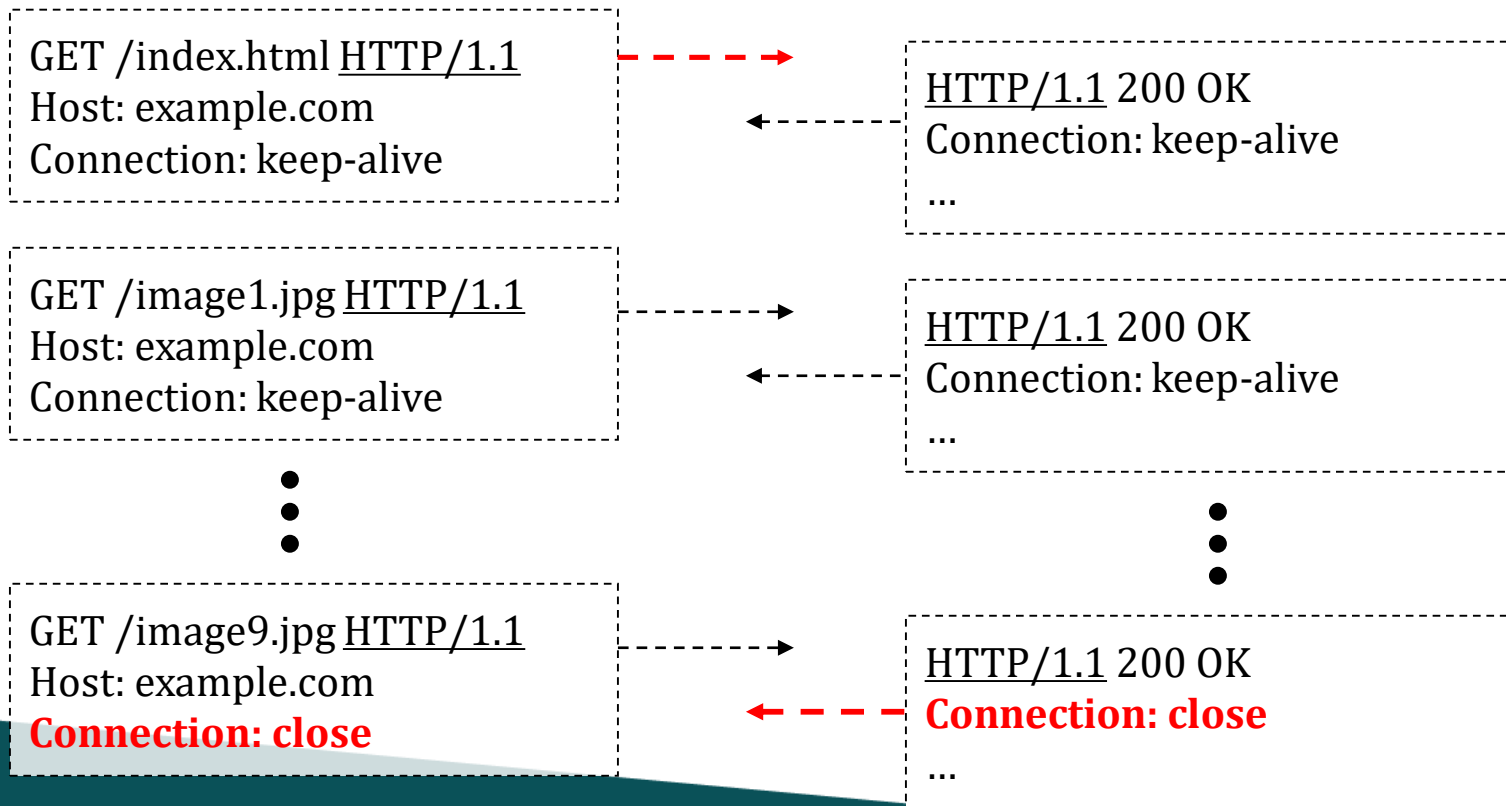


# Connection:

- The Connection: header indicates whether to keep or close the current connection.
- **Connection: keep-alive.** Default, may be omitted.
- **Connection: close**
  - In a request, the client asks the server to close the connection after sending the response
  - In a response, the server indicates that it will close the connection after sending this response

# Persistent connection

*The client creates a connection before sending the first request. Subsequent requests and responses are transferred in this TCP connection.*



# Multiple messages in a connection

- A browser receives multiple responses in a TCP connection.
- To break the byte stream into messages, it must know the end of each message.
- One solution is that the server declares **Content-Length** for each response.

HTTP/1.1 200 OK

Content-Type: ...

Content-Length: 100

... content of first resource ...

... 100 bytes ...

HTTP/1.1 200 OK

Content-Type: ...

Content-Length: 200

... content of second resource ...

... 200 bytes ...

HTTP/1.1 200 OK

Connection: close

Content-Type: ...

Content-Length: 120

... content of third resource ...

... 120 bytes ...



# Problems of Content-Length

- **Content-Length** header is sent before the message body.
- If a resource is generated dynamically by a server-side script (e.g. ASPX, PHP), the web server can determine Content-Length only after the script finishes execution.
  - The server first has to buffer the whole response before it can start sending the response.
- Efficiency problems:
  - Larger memory overhead
  - Slower response time

# Chunked Transfer-Encoding

- **Chunked transfer-encoding** enables a web server to start transmitting the beginning parts of a response while it is still generating the rest.
  - Does not send **Content-Length**. Sends **Transfer-Encoding: chunked** instead.
  - A long response body is divided into several pieces called chunks.
  - Before sending each chunk, the server sends its length in hexadecimal.
  - After sending the last chunk, the server sends a 0.

## Response with Content-Length

HTTP/1.1 200 OK

Date: Wed, 19 Mar 2008 01:46:57 GMT

Content-Type: text/plain

**Content-Length: 42**

abcdefghijklmnopqrstuvwxyz1234567890abcdef

## Response with chunked body

HTTP/1.1 200 OK

Date: Wed, 19 Mar 2008 01:46:57 GMT

Content-Type: text/plain

**Transfer-Encoding: chunked**

**1a**

abcdefghijklmnopqrstuvwxyz

**10**

1234567890abcdef

**0**

*Length of a chunk in Hex*

*Length of a chunk in Hex*

*Length of 0 means no more  
chunks*

# Partial Content

- How to retrieve a slice of resource?
  - Request:
    - Range: <unit>=<range-start>-<range-end>  
e.g. Range: bytes=200-1000, 2000-6576, 19000-
  - Response:
    - HTTP/1.1 206 Partial Content
    - Content-Range: <unit> <range-start>-<range-end>/<size>  
e.g. Content-Range: bytes 21010-47021/47022
- References:
  - <https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Range>
  - <https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Content-Range>
  - <https://developer.mozilla.org/en-US/docs/Web/HTTP/Status/206>

# Example:

**GET** /video.mp4 HTTP/1.1  
Host: example.com  
Connection: keep-alive  
**Range:** bytes=1900-2900



HTTP/1.1 **206 Partial Content**  
Connection: keep-alive  
**Content-Range:** bytes 1900-2900/4702  
...

# Part A.2

## State, session and security

- Session management
  - HTTP is stateless
  - Cookies
  - As in common web framework (e.g. asp.net, php)
  - Session hijacking
- Encryption and SSL
  - Secured login vs. full-session HTTPS
  - Partially secure web page

# HTTP is stateless

- Statelessness means that every HTTP request happens in complete isolation.
- When the client makes a HTTP request, it includes all information necessary for the server to fulfill that request.
- The server never relies on information from previous requests. If that information was important, the client would have sent it again in this request.
  - A web server does not retain info between processing of requests from a user session
  - The client and server do not need to maintain a common state

(from O'Reilly RESTful web service)

# Example

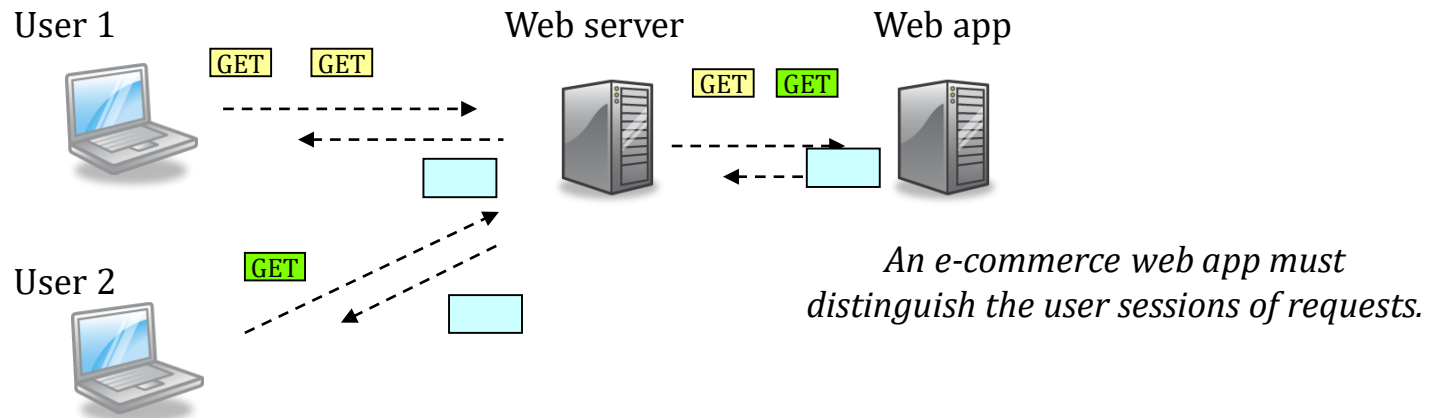
- A browser keeps sending same (or similar) headers to a web server in a series of requests, e.g.
  - Host
  - User-agent
  - Content negotiation
- Each request contain the information from the full URL (absolute URL).

```
GET /wiki/Internet HTTP/1.1
Host: en.wikipedia.org
User-Agent: Mozilla/5.0 ... Firefox/3.5.3
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
```



# Session Management in Web App

- Although HTTP is stateless, web app needs to maintain states in processing requests from a user session.
  - e.g. Has a user logged in?  
Which requests come from the user?
- The client needs to attach session identifier in each request

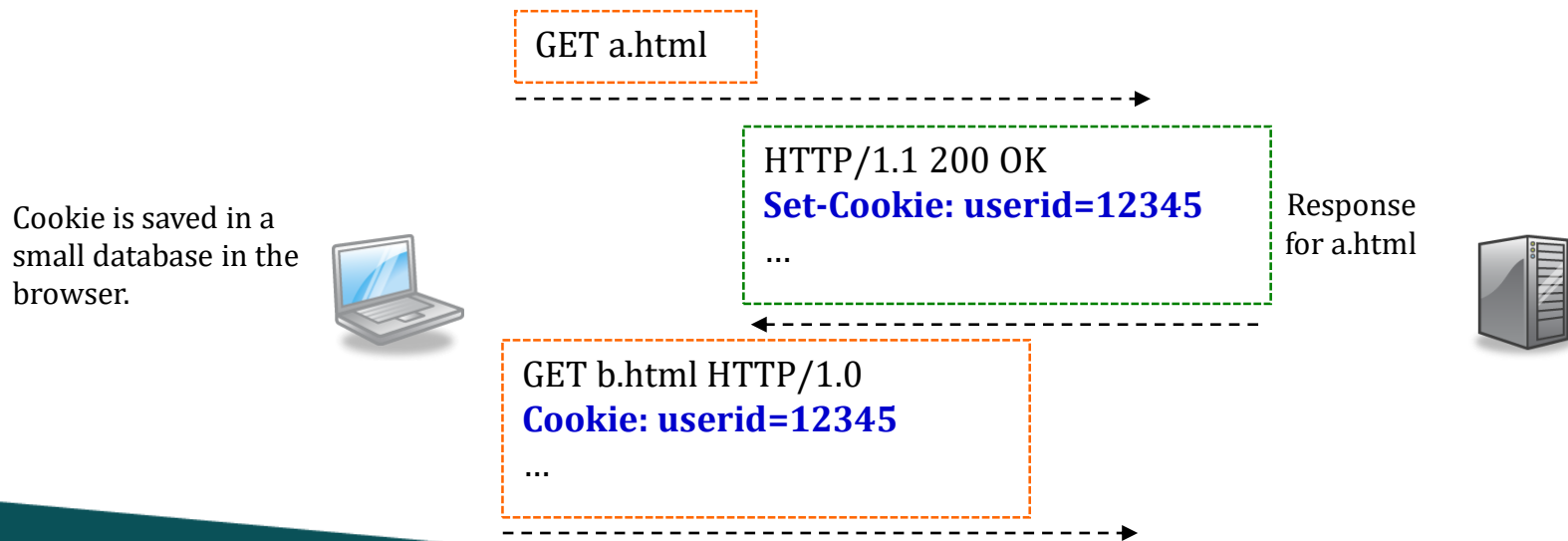


# Session Management

- A web app has to track a user's progress from one request to another.
- Each request has to include some data to identify a user session.
- Common approaches:
  - Cookies
  - Hidden form field (<input type="hidden">)
  - Query string

# HTTP Cookies

- Cookies are small pieces of data a web server asks a client to keep and send back in future requests.
  - Servers add header **Set-Cookie: name=value** in response
  - Clients add header **Cookie: name=value** in future requests



# Example: Typical use of Session id



POST login.php HTTP/1.1  
...  
user=philip&pw=123456



The user logs in by entering user name and password in an HTML form. The web app then creates a session in memory and returns a session ID.

HTTP/1.1 200 OK  
**Set-Cookie: sessionid=3a4b5e**  
...

GET home.php HTTP/1.1  
**Cookie: sessionid=3a4b5e**  
...

HTTP/1.1 200 OK  
...

GET checkmail.php HTTP/1.1  
**Cookie: sessionid=3a4b5e**  
...

HTTP/1.1 200 OK  
...

The browser attaches the cookie in all future requests to the web app. The web app can use the session id to look up application state (e.g. current user, 'session variables')

# Cookie attributes

- A web server can restrict the scope of a cookie with attributes:
  - **expires** : date/time after which this cookie can be deleted
    - If not set, the cookie is deleted when user quits the browser
  - **path, domain** : the client should only include this cookie for requests in this domain and URL under this path
    - If not set, the default is the domain and path of the response
  - **secure**: a secure cookie may only be sent through SSL

```
HTTP/1.1 200 OK
```

```
Set-Cookie: userid=12345; expires=Fri, 31-Dec-2010  
23:59:59 GMT; path=/; domain=.example.com
```

```
...
```

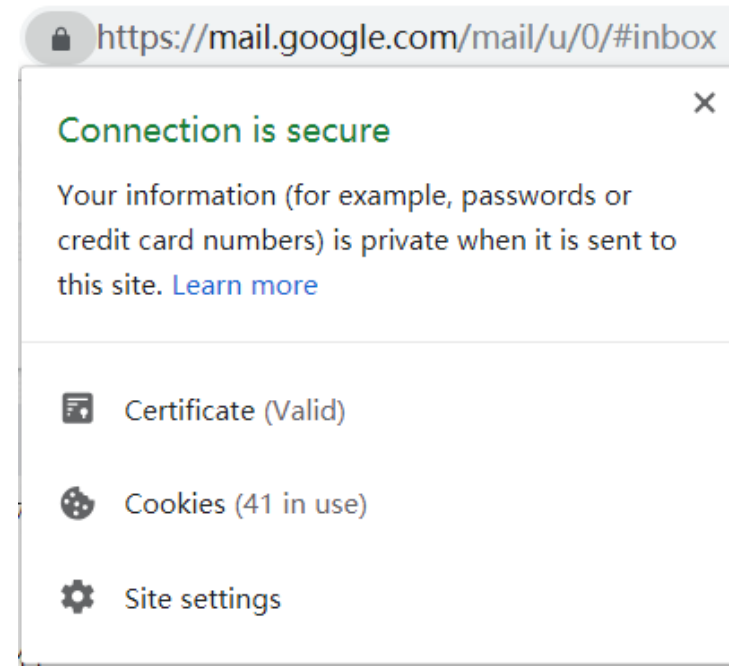
# Encryption for HTTP

- **TLS (Transport Layer Security, aka. SSL)** are cryptographic protocols that encrypt data transmitted over a TCP connection.
  - Common versions: TLS1.2, TLS1.3
  - Can run different protocols over TLS, e.g. HTTP, SMTP, IMAP
- Two purposes:
  - Prevent eavesdropping and tampering
    - e.g. Only the client and server of an HTTP transaction can read the request/response
  - Verify the authenticity of the server
    - The server has a valid digital certificate issued by a certificate authority known by the browser

# HTTPS

<https://mail.google.com/mail/#inbox>

- Need to install/trust a digital certificate in the web server
- https – runs HTTP over a secured TCP connection
  - Use port 443
  - Usually TLSv1.2/TLSv1.3
- A secure HTTP transaction
  - Attackers cannot read the request and response
  - Proxy (including cache servers) cannot read the messages either



# Partially secure web page

- A secure web page (https) that refers to unsecure resources (http)
  - e.g. the HTML page is using https, but the images inside are using http only
  - Unsecure resources may be modified and then added to the supposedly secure HTML page
    - Very serious if these are JavaScript files
  - HTTP requests to unsecure resources may contain cookies and eavesdropped by attackers
    - Problem solved by 'secure' attribute of cookies

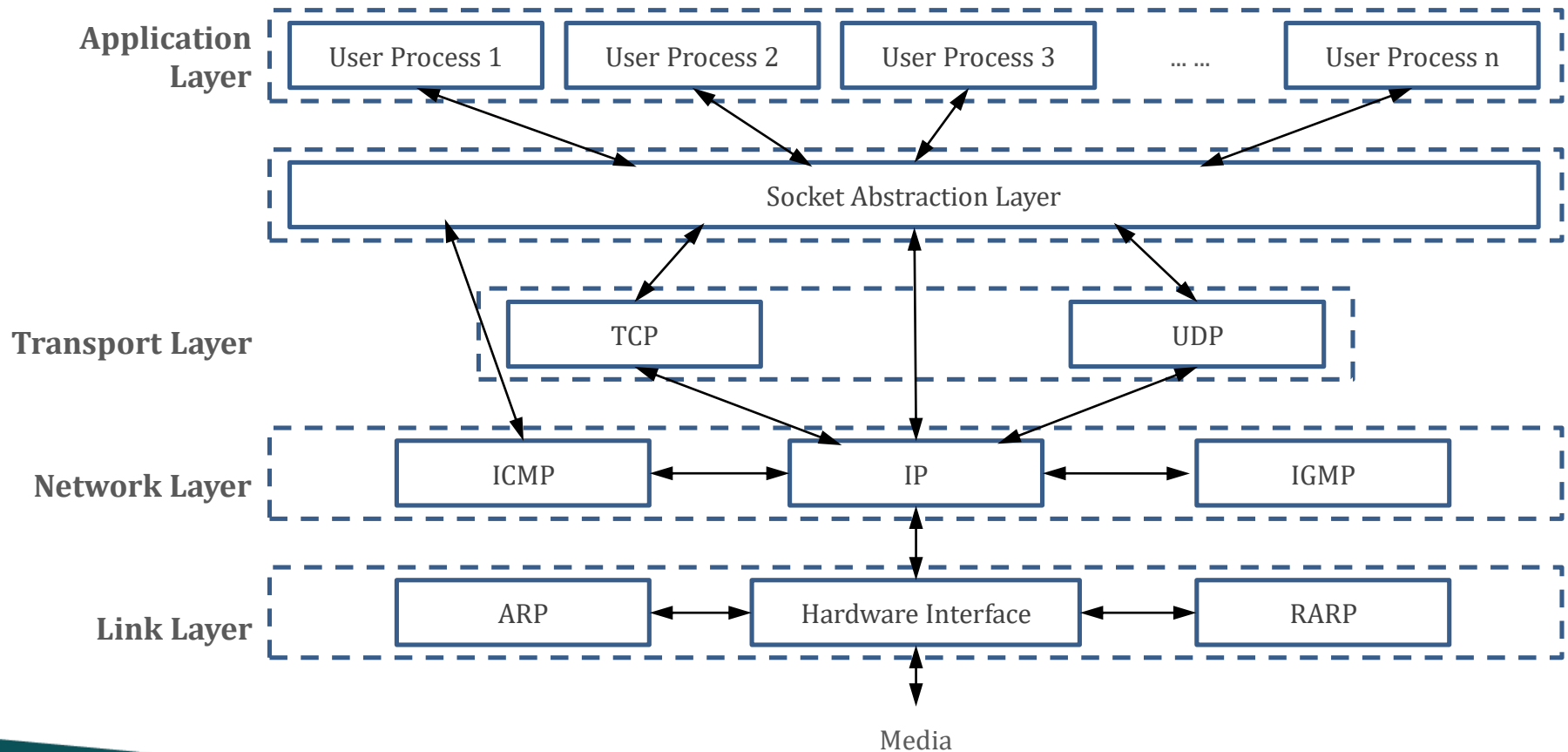
✖ Mixed Content: The page at 'https://[redacted] index.html' was loaded over HTTPS, but requested an insecure resource 'http://player.[redacted]'. This request has been blocked; the content must be served over HTTPS.



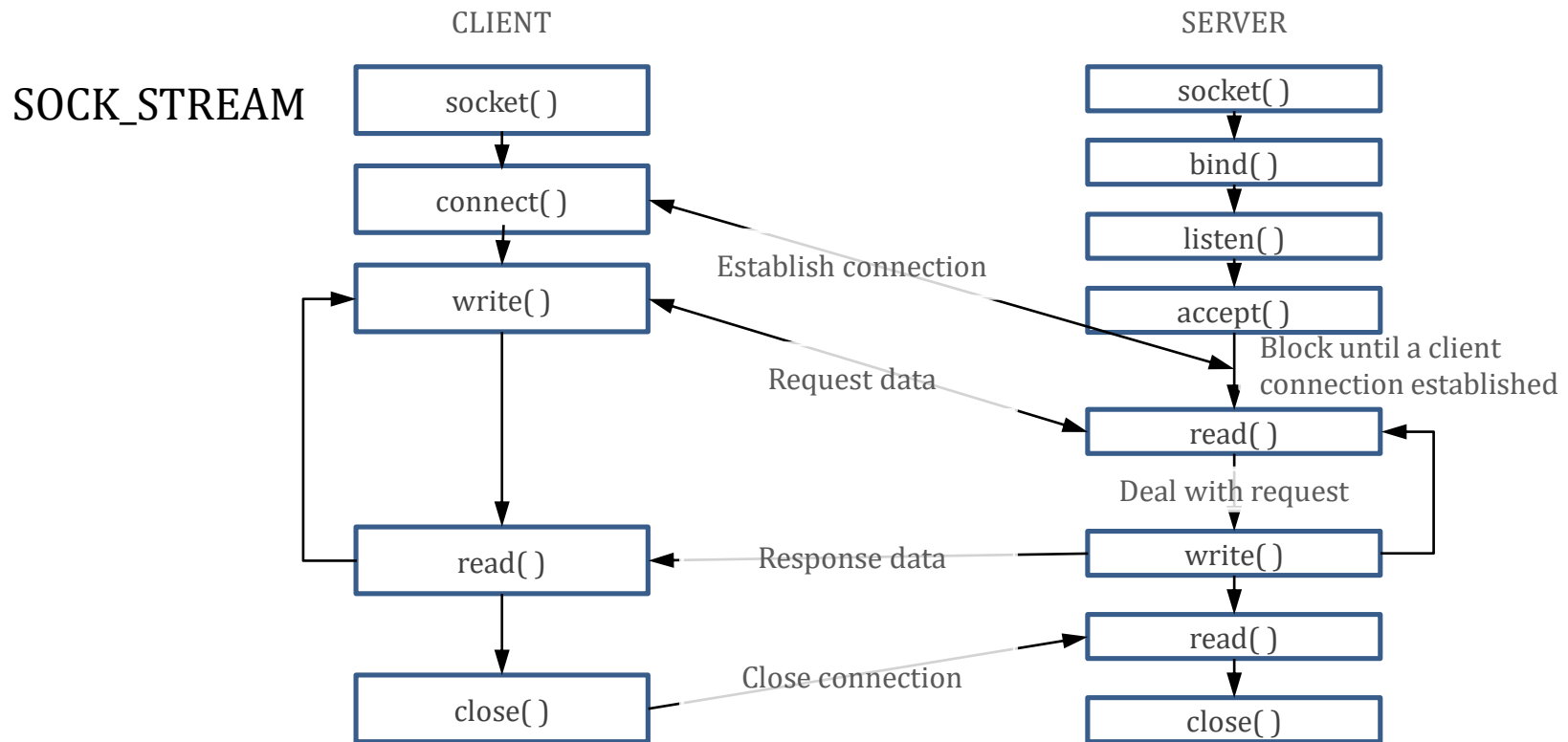
Part B.

# Socket Programming

# Socket (1)



# Socket (2)



# Socket Example 1: Echo Server (1)

```
import socket

def echo():
    sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    sock.bind(('127.0.0.1', 5555))
    sock.listen(10)
    sock.settimeout(0.5)

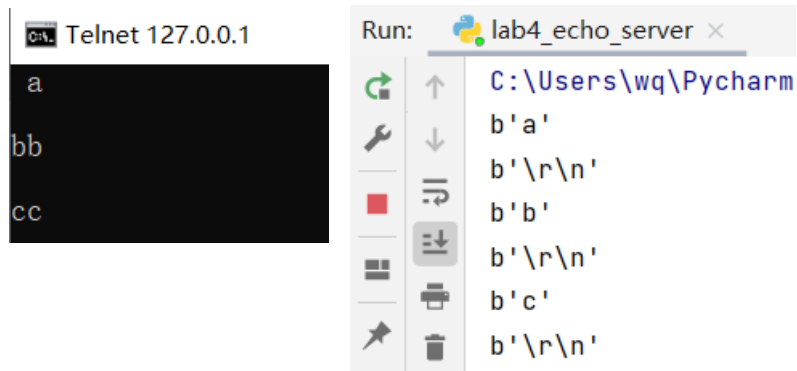
    while True:
        try:
            conn, address = sock.accept()
            while True:
                data = conn.recv(2048)
                if data and data != b'exit':
                    conn.send(data)
                    print(data)
                else:
                    conn.close()
                    break
        except socket.timeout:
            continue

if __name__ == "__main__":
    try:
        echo()
    except KeyboardInterrupt:
        pass
```

# Socket Example 1: Echo Server (2)

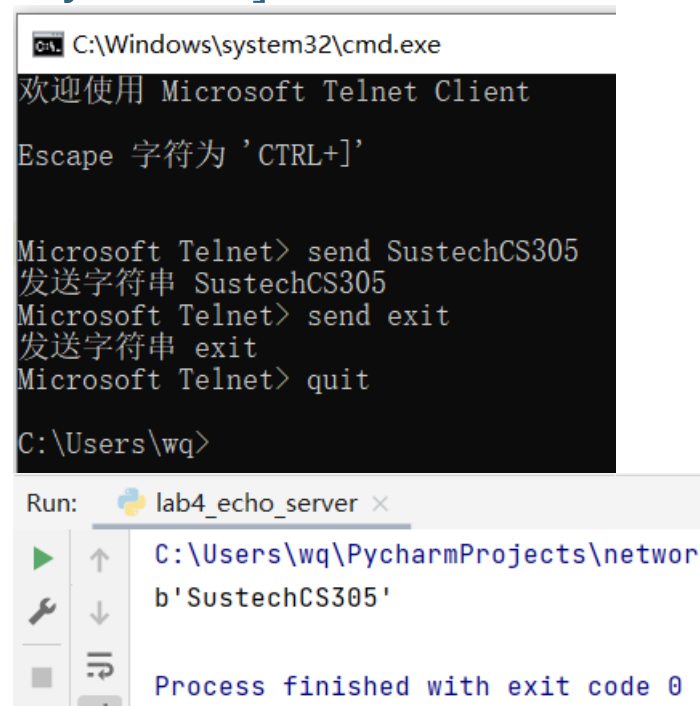
## Running under Windows

```
C:\Users\wq>telnet 127.0.0.1 5555
```



The image shows two windows side-by-side. On the left is a Telnet client window titled 'Telnet 127.0.0.1' with a black background. It displays the input 'a' followed by 'bb' and 'cc' on separate lines. On the right is a PyCharm Run console window titled 'lab4\_echo\_server'. It shows the output of the server: 'b'a'', 'b'\r\n'', 'b'b'', 'b'\r\n'', 'b'c'', and 'b'\r\n''.

If we want to send a string instead of characters, shortcut keys “ctrl+” can be used.



The image shows two windows. The top window is a Windows command prompt titled 'C:\Windows\system32\cmd.exe'. It displays the output of the Telnet client: '欢迎使用 Microsoft Telnet Client', 'Escape 字符为 'CTRL+]', 'Microsoft Telnet> send SustechCS305', '发送字符串 SustechCS305', 'Microsoft Telnet> send exit', '发送字符串 exit', and 'Microsoft Telnet> quit'. The bottom window is a PyCharm Run console window titled 'lab4\_echo\_server'. It shows the output of the server: 'b'SustechCS305'' and 'Process finished with exit code 0'.

Tips: using command “quit” can exit sending mode.

# Socket Example 1: Echo Server (3)

## Running under other OS



```
/c/Users/light/PycharmProjects/CS305-2
light@DESKTOP-K4SPJVV MINGW64 /c/Users/light/PycharmProjects/CS305-2
$ python echo.py
b'test\r\n'
b'CS305 is Awsome.\r\n'

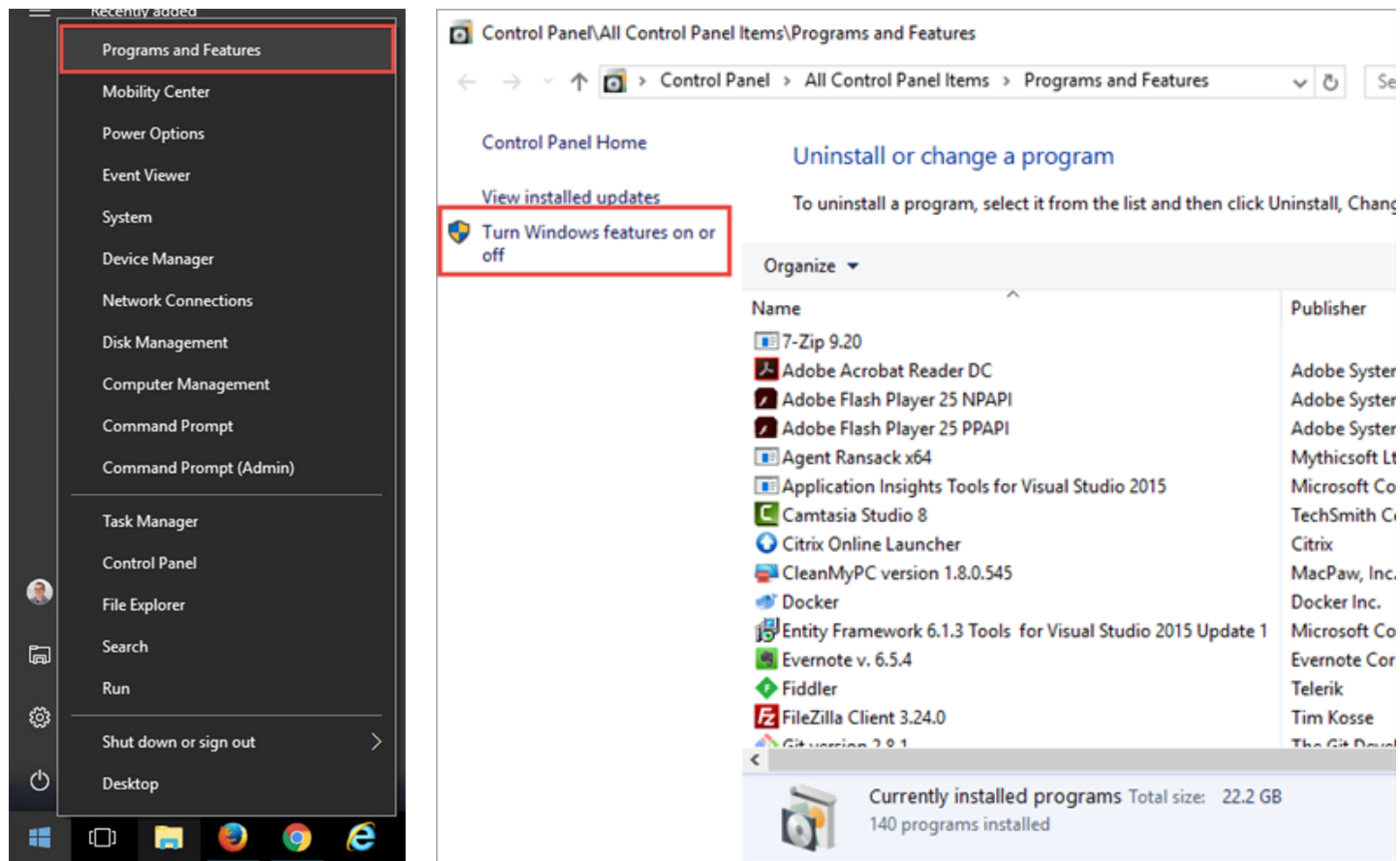
/
light@DESKTOP-K4SPJVV MINGW64 /
$ telnet 127.0.0.1 5555
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.
test
test
CS305 is Awsome.
CS305 is Awsome.
exit
Connection closed by foreign host.

light@DESKTOP-K4SPJVV MINGW64 /
$
```

# Socket Example 1: Echo Server (4)

- 1. Run the server echo on Linux(or macOS) and Windows separately, is there any difference?
- 2. How to exit the loop? Can you design a method to quit elegantly?
- 3. Is there anyway to improve the server to make it work the same on different OS?

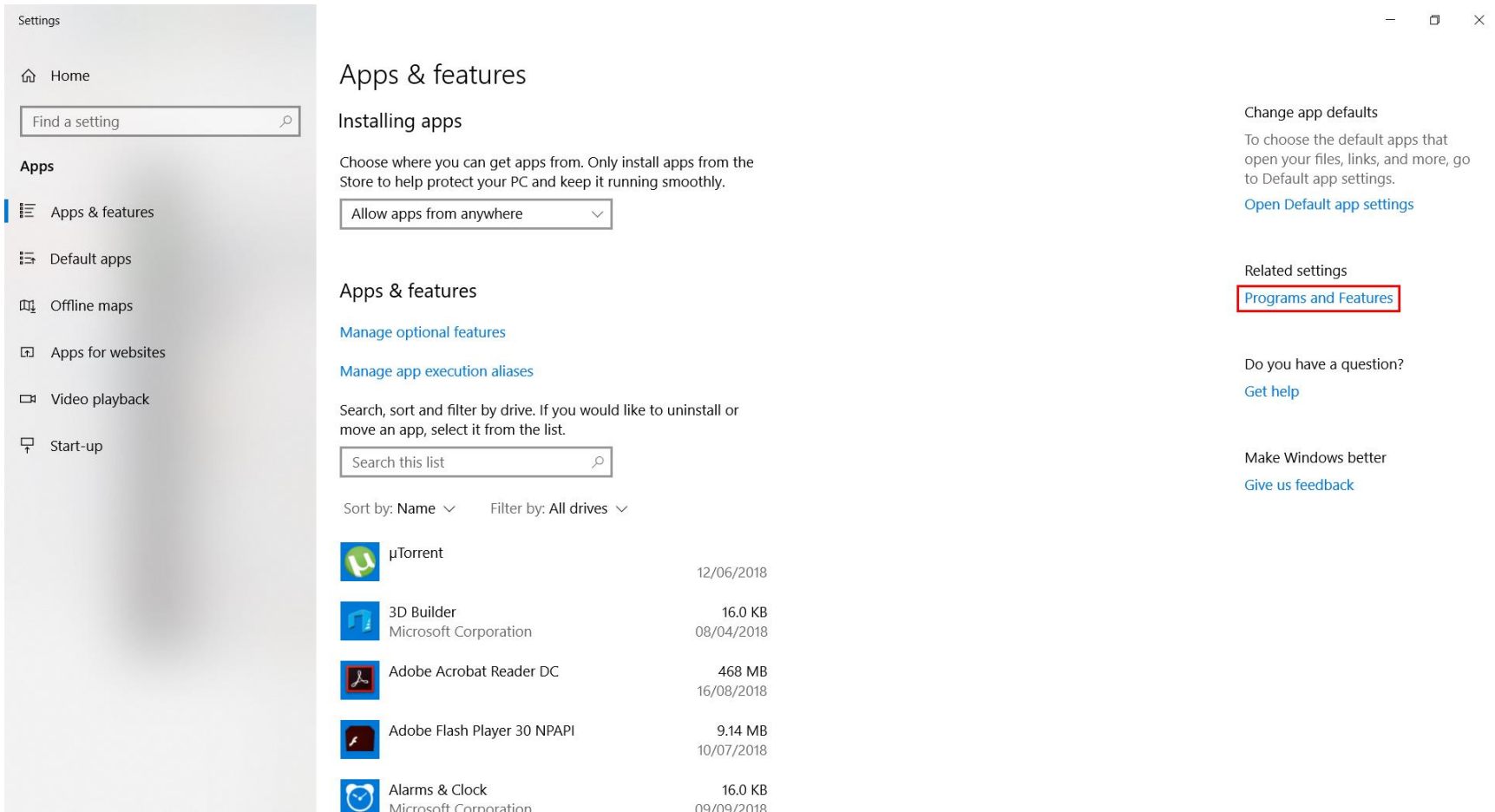
# Tip 1: Enable Telnet on Windows (1)



Reference: <https://social.technet.microsoft.com/wiki/contents/articles/38433.windows-10-enabling-telnet-client.aspx>



# Tip 1: Enable Telnet on Windows (2)

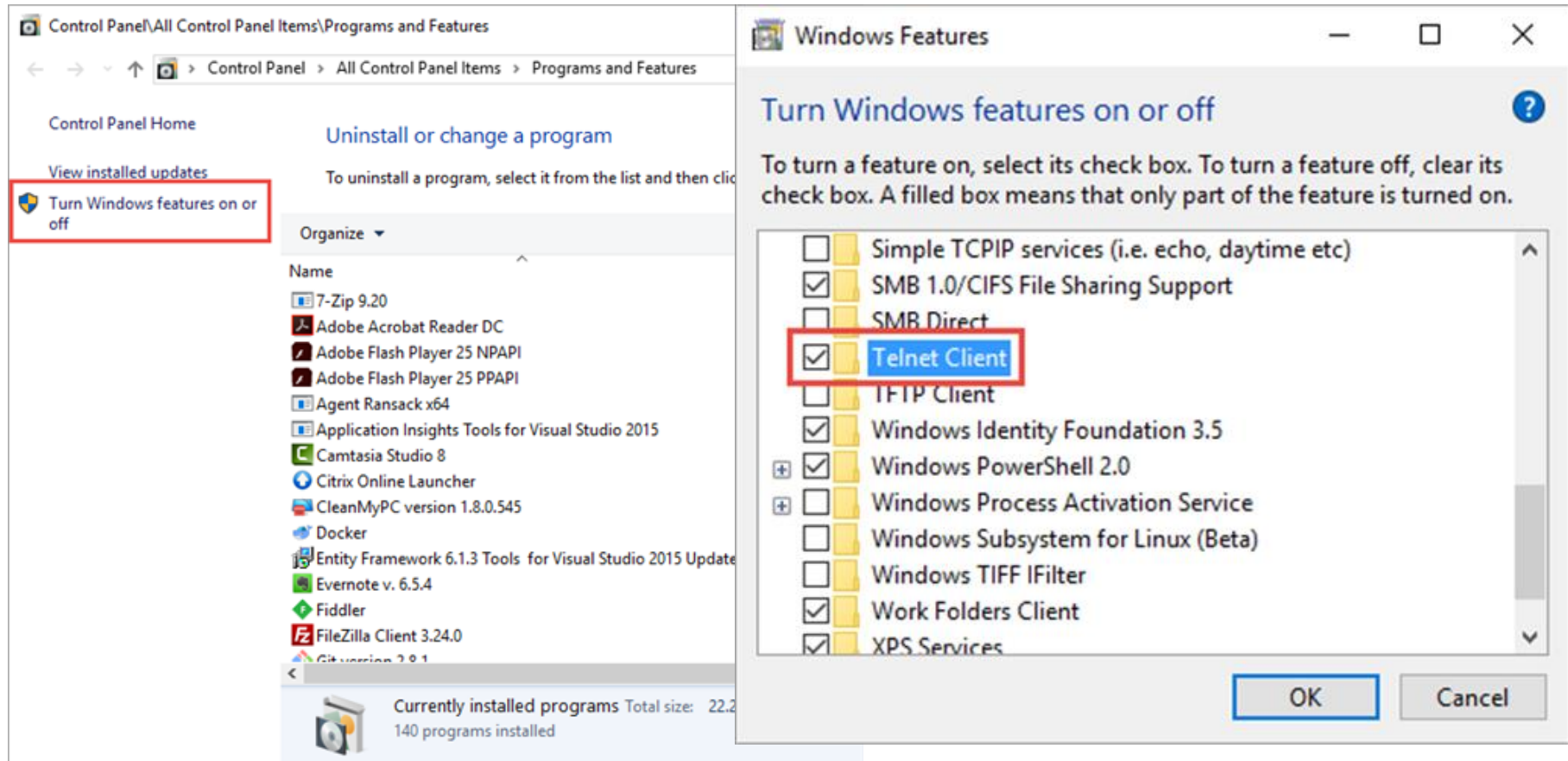


The screenshot shows the Windows Settings application, specifically the 'Apps & features' section. The left sidebar contains a list of settings categories: Home, Find a setting, Apps, Apps & features (selected), Default apps, Offline maps, Apps for websites, Video playback, and Start-up. The main content area is titled 'Apps & features' and includes a sub-section 'Installing apps' with a dropdown menu set to 'Allow apps from anywhere'. Below this, there is a search bar and a list of installed applications. The applications listed are:

Application	Size	Installation Date
µTorrent		12/06/2018
3D Builder	16.0 KB	08/04/2018
Microsoft Corporation		
Adobe Acrobat Reader DC	468 MB	16/08/2018
Adobe Flash Player 30 NPAPI	9.14 MB	10/07/2018
Alarms & Clock	16.0 KB	09/09/2018
Microsoft Corporation		

On the right side of the window, there are links for 'Change app defaults', 'Open Default app settings', 'Related settings' (with 'Programs and Features' highlighted in a red box), 'Do you have a question? Get help', and 'Make Windows better Give us feedback'.

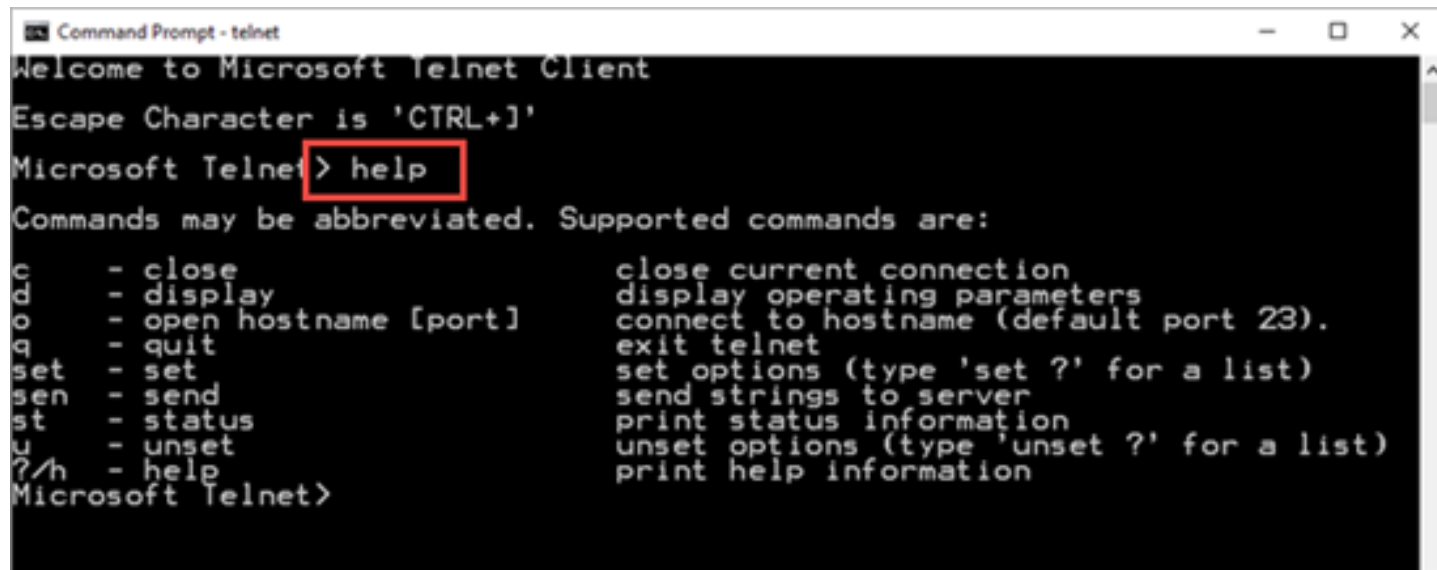
# Tip 1: Enable Telnet on Windows (3)



Reference: <https://social.technet.microsoft.com/wiki/contents/articles/38433.windows-10-enabling-telnet-client.aspx>

# Tip 1: Enable Telnet on Windows (4)

- Verify
  - Win+R, run “cmd”
  - Type “telnet”, press enter



```
Command Prompt - telnet
Welcome to Microsoft Telnet Client
Escape Character is 'CTRL+]'
Microsoft Telnet> help
Commands may be abbreviated. Supported commands are:
c      - close           close current connection
d      - display        display operating parameters
o      - open hostname [port] connect to hostname (default port 23).
q      - quit           exit telnet
set    - set            set options (type 'set ?' for a list)
sen    - send           send strings to server
st     - status         print status information
u      - unset          unset options (type 'unset ?' for a list)
?/h    - help           print help information
Microsoft Telnet>
```

Reference:

<https://social.technet.microsoft.com/wiki/contents/articles/38433.windows-10-enabling-telnet-client.aspx>

# Example 2: Mimic a Simple Web Server (1)

```
def web():
```

```
    sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
```

```
    sock.bind(('127.0.0.1', 8080))
```

```
    sock.listen(10)
```

```
    while True:
```

```
        conn, address = sock.accept()
```

```
        data = conn.recv(2048).decode().split('\r\n')
```

```
        print(data[0].split(' '))
```

```
        res = err404
```

```
        if data[0].split(' ')[1] == '/':
```

```
            res = hello
```

```
        for line in res :
```

```
            conn.send(line)
```

```
        conn.close()
```

```
if __name__ == "__main__":
```

```
    try:
```

```
        web()
```

```
    except KeyboardInterrupt:
```

```
        pass
```

```
import socket
```

```
hello = [b'HTTP/1.0 200 OK\r\n',
```

```
        b'Connection: close'
```

```
        b'Content-Type:text/html; charset=utf-8\r\n',
```

```
        b'\r\n',
```

```
        b'<html><body>Hello World!<body></html>\r\n',
```

```
        b'\r\n']
```

```
err404 = [b'HTTP/1.0 404 Not Found\r\n',
```

```
        b'Connection: close'
```

```
        b'Content-Type:text/html; charset=utf-8\r\n',
```

```
        b'\r\n',
```

```
        b'<html><body>404 Not Found<body></html>\r\n',
```

```
        b'\r\n']
```

# Example 2: Mimic a Simple Web Server (2)



The image shows two terminal windows. The top window is titled '/c/Users/light/PycharmProjects/CS305-2' and shows a user running a Python script 'web\_hello.py'. The script outputs two lines of data: ['GET', '/', 'HTTP/1.1'] and ['GET', '/not-exist', 'HTTP/1.1']. The bottom window is titled '/' and shows a user running 'curl' commands to test the server. The first curl command to '127.0.0.1:8080' returns an HTML response with the text 'Hello World!'. The second curl command to '127.0.0.1:8080/not-exist' returns an HTML response with the text '404 Not Found'.

```
/c/Users/light/PycharmProjects/CS305-2

light@DESKTOP-K4SPJVV MINGW64 /c/Users/light/PycharmProjects/CS305-2
$ python web_hello.py
['GET', '/', 'HTTP/1.1']
['GET', '/not-exist', 'HTTP/1.1']

/

light@DESKTOP-K4SPJVV MINGW64 /
$ curl 127.0.0.1:8080
<html><body>Hello World!<body></html>

light@DESKTOP-K4SPJVV MINGW64 /
$ curl 127.0.0.1:8080/not-exist
<html><body>404 Not Found<body></html>
```

# Example 3: Echo Server Multithreading (1)

```
import socket, threading
```

```
class Echo(threading.Thread):
```

```
    def __init__(self, conn, address):
```

```
        threading.Thread.__init__(self)
```

```
        self.conn = conn
```

```
        self.address = address
```

```
    def run(self):
```

```
        while True:
```

```
            data = self.conn.recv(2048)
```

```
            if data and data != b'exit':
```

```
                self.conn.send(data)
```

```
                print('{} sent: {}'.format(self.address, data))
```

```
            else:
```

```
                self.conn.close()
```

```
            return
```

```
def echo():
```

```
    sock = socket.socket(socket.AF_INET,  
                          socket.SOCK_STREAM)
```

```
    sock.bind(('127.0.0.1', 5555))
```

```
    sock.listen(10)
```

```
    while True:
```

```
        conn, address = sock.accept()
```

```
        Echo(conn, address).start()
```

```
if __name__ == "__main__":
```

```
    try:
```

```
        echo()
```

```
    except KeyboardInterrupt:
```

```
        pass
```

# Example 3: Echo Server Multithreading (2)

```
light@DESKTOP-K4SPJVV MINGW64 /c/Users/light/PycharmProjects/CS305-2
$ python echo_multithreading.py
('127.0.0.1', 8761) sent: b'client 1\r\n'
('127.0.0.1', 8782) sent: b'client 2\r\n'
```

```
light@DESKTOP-K4SPJVV MINGW64 /
$ telnet 127.0.0.1 5555
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.
client 1
client 1
```

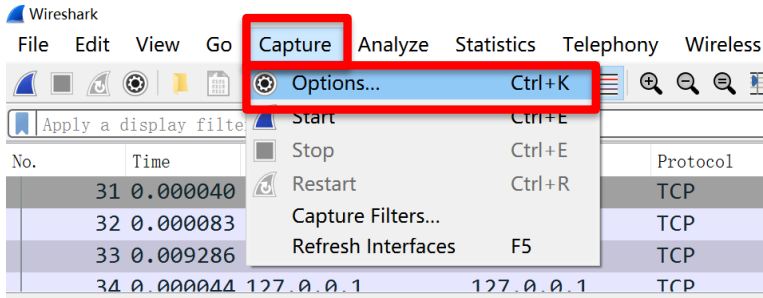
```
light@DESKTOP-K4SPJVV MINGW64 /
$ telnet 127.0.0.1 5555
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.
client 2
client 2
```

# Practice 4.1 (Optional)

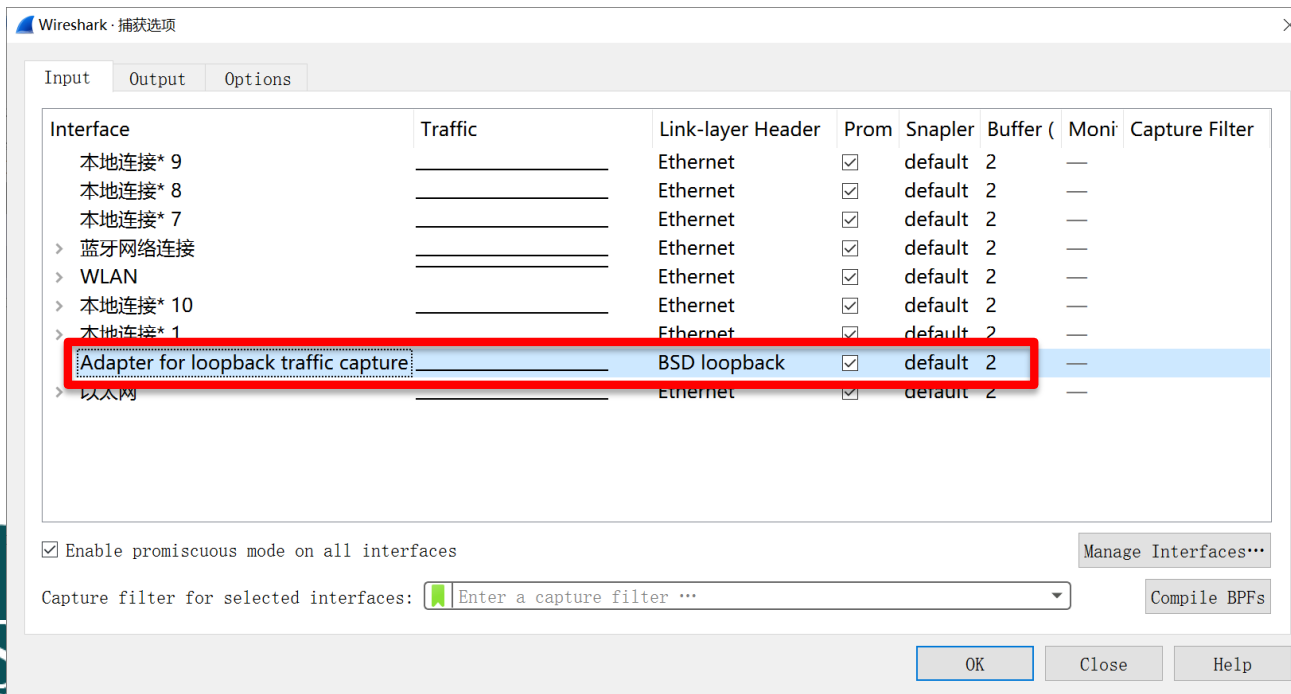
- Run all the demos on your PC.
- Use Wireshark to capture and analyze the packets when running the demos, list the source IPs, source port numbers, destination IPs, destination port numbers and response's status code of each connections.



# Tip 2: capture loopback traffic



No.	Time	Source	Destination	Protocol
16	0.000241	127.0.0.1	127.0.0.1	TCP
17	0.000022	127.0.0.1	127.0.0.1	TCP
18	0.000023	127.0.0.1	127.0.0.1	TCP
19	0.000012	127.0.0.1	127.0.0.1	TCP



Part C.

# Configure your PC as an HTTP server

# Using http.server(1)

- Run command “python -m http.server” on your PC to create the simplest HTTP server.
- Official documentation:  
<https://docs.python.org/3/library/http.server.html>
- The server listens to port 8000 by default. The default can be overridden by passing the desired port number as an argument.
- By default, the server binds itself to all interfaces. The option -b/--bind specifies a specific address to which it should bind.
- By default, the server uses the current directory. The option -d/--directory specifies a directory to which it serves the files.

# Using http.server(2)

- Server

```
C:\Users\wq>python -m http.server
Serving HTTP on :: port 8000 (http://[::]:8000/) ...
::ffff:10.25.70.41 - - [06/Mar/2023 10:03:31] "GET / HTTP/1.1" 200 -
::ffff:10.25.70.41 - - [06/Mar/2023 10:03:31] code 404, message File not found
::ffff:10.25.70.41 - - [06/Mar/2023 10:03:31] "GET /favicon.ico HTTP/1.1" 404 -
::ffff:10.25.70.41 - - [06/Mar/2023 10:03:46] "GET /test.txt HTTP/1.1" 200 -
::ffff:10.16.6.199 - - [06/Mar/2023 10:03:57] "GET / HTTP/1.1" 200 -
::ffff:10.16.6.199 - - [06/Mar/2023 10:04:08] "GET /Documents/ HTTP/1.1" 200 -
::ffff:10.16.6.199 - - [06/Mar/2023 10:04:11] code 404, message No permission to list directory
::ffff:10.16.6.199 - - [06/Mar/2023 10:04:11] "GET /Documents/My%20Pictures/ HTTP/1.1" 404 -
::ffff:10.16.6.199 - - [06/Mar/2023 10:04:22] code 404, message No permission to list directory
::ffff:10.16.6.199 - - [06/Mar/2023 10:04:22] "GET /Cookies/ HTTP/1.1" 404 -
::ffff:10.25. [REDACTED] - - [06/Mar/2023 10:04:39] "GET / HTTP/1.1" 200 -
::ffff:10.25. [REDACTED] - - [06/Mar/2023 10:04:44] "GET /Downloads/ HTTP/1.1" 200 -
```

# Using http.server(3)

- Client 1(PC)



## Directory listing for /

- [.android/](#)
- [.conda/](#)
- [.condarc](#)
- [.continuum/](#)
- [.m2/](#)
- [.packettracer](#)
- [.stm32cubeide/](#)
- [.stm32cubemx/](#)
- [.stmcube/](#)
- [.stmcufinder/](#)
- [.vscode/](#)
- [.Xilinx/](#)
- [1.txt](#)
- [3D Objects/](#)
- [AppData/](#)
- [Application Data/](#)

- Client 2 (mobile phone)

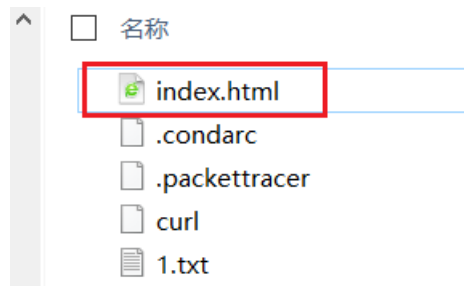
## Directory listing for /

- [.android/](#)
- [.conda/](#)
- [.condarc](#)
- [.continuum/](#)
- [.m2/](#)
- [.packettracer](#)
- [.stm32cubeide/](#)
- [.stm32cubemx/](#)
- [.stmcube/](#)
- [.stmcufinder/](#)
- [.vscode/](#)
- [.Xilinx/](#)
- [1.txt](#)
- [3D Objects/](#)
- [AppData/](#)
- [Application Data/](#)
- [PycharmProjects/](#)
- [Recent/](#)
- [Saved Games/](#)



# Using http.server(4)

- Add a file named “index.html” under the root of server.



File content:

```
<html>
This is a test demo of CS305
</html>
```

- Access the URL again.



# Practice 4.2

- Suppose your IP address is `***.***.***.***`
- Run command “python -m http.server” on your PC.
- Use Wireshark to capture and analyze the packets.
  - 2-1. When accessing the web server from your own PC, which URL will work, “`***.***.***.***:8000`” or “`127.0.0.1:8000`”? Both will work
  - 2-2. When accessing the web server from your own PC, which interface should you choose? loopback interface
  - 2-3. Let your classmate to access your web server, which URL will work, “`***.***.***.***:8000`” or “`127.0.0.1:8000`”? `***.***.***.***:8080`
  - 2-4. Let your classmate to access your web server, which interface should you choose if you want to capture the traffic? WLAN
- Capture and analyze the packets, list the source IPs, source port numbers, destination IPs, destination port numbers and response’s status code of each connections.

Adapter for loopback traffic capture

文件(F) 编辑(E) 视图(V) 跳转(G) 捕获(C) 分析(A) 统计(S) 电话(Y) 无线(W) 工具(T) 帮助(H)

应用显示过滤器 ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
43	8.250994	10.24.118.137	10.24.118.137	HTTP	502	HTTP/1.0 200 OK (text/html)
44	8.251032	10.24.118.137	10.24.118.137	TCP	44	12816 → 8000 [ACK] Seq=506 Ack=614 Win=326656
45	8.251124	10.24.118.137	10.24.118.137	TCP	44	8000 → 12816 [FIN, ACK] Seq=614 Ack=506 Win=2
46	8.251156	10.24.118.137	10.24.118.137	TCP	44	12816 → 8000 [ACK] Seq=506 Ack=615 Win=326656
47	8.251538	10.24.118.137	10.24.118.137	TCP	44	12816 → 8000 [FIN, ACK] Seq=506 Ack=615 Win=3

WLAN (host 10.24.118.137)

文件(F) 编辑(E) 视图(V) 跳转(G) 捕获(C) 分析(A) 统计(S) 电话(Y) 无线(W) 工具(T) 帮助(H)

应用显示过滤器 ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
31	3.444962	183.47.101.221	10.24.118.137	TCP	1085	80 → 11498 [PSH, ACK] Seq=943 Ack=1 Win=251 Len=0
32	3.489493	10.24.118.137	183.47.101.221	TCP	54	11498 → 80 [ACK] Seq=1 Ack=1974 Win=513 Len=0
33	3.772642	10.24.114.91	10.24.118.137	TCP	74	43326 → 8000 [SYN] Seq=0 Win=65535 Len=0 MSS=
34	3.772642	10.24.114.91	10.24.118.137	HTTP	554	GET / HTTP/1.1
35	3.772749	10.24.118.137	10.24.114.91	TCP	74	8000 → 43326 [SYN, ACK] Seq=0 Ack=1 Win=65535
36	3.774534	10.24.118.137	10.24.114.91	TCP	221	8000 → 43324 [PSH, ACK] Seq=1 Ack=489 Win=409
37	3.774660	10.24.118.137	10.24.114.91	HTTP	474	HTTP/1.0 200 OK (text/html)
38	3.861207	183.47.101.221	10.24.118.137	TCP	589	80 → 11498 [PSH, ACK] Seq=1974 Ack=1 Win=251
39	3.913926	10.24.118.137	183.47.101.221	TCP	54	11498 → 80 [ACK] Seq=1 Ack=2509 Win=517 Len=0
40	3.939198	10.24.114.91	10.24.118.137	TCP	66	43326 → 8000 [ACK] Seq=1 Ack=1 Win=65536 Len=
41	3.939198	10.24.114.91	10.24.118.137	TCP	66	43324 → 8000 [ACK] Seq=489 Ack=156 Win=131 Le
42	3.940318	10.24.114.91	10.24.118.137	TCP	66	43324 → 8000 [FIN, ACK] Seq=489 Ack=565 Win=1



# Using flask(1)

- A lightweight web application framework written in Python.
- Official documentation:  
<https://flask.palletsprojects.com/en/2.2.x/>
- Flask depends on the Jinja template engine and the Werkzeug WSGI toolkit.
- Jinja is a fast, expressive, extensible templating engine.
- Werkzeug is a comprehensive WSGI web application library.  
(WSGI: Web Server Gateway Interface)

# Using flask(2)

```
from flask import Flask
from flask import request
from flask import render_template

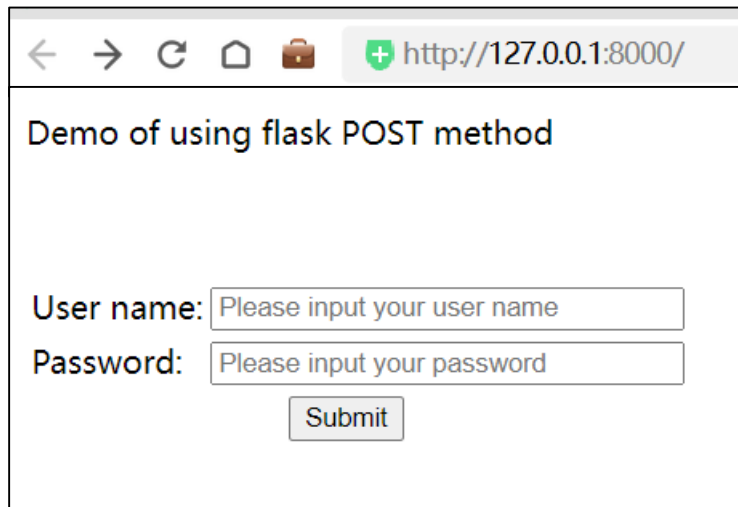
app = Flask(__name__)

@app.route("/", methods=['GET', 'POST'])
def main():
    if request.method == 'GET':
        return render_template('main.html')
    if request.method == 'POST':
        user = request.form.get('user')
        password = request.form.get('password')
        res = "User: %s\nPassword: %s" % (user, password)
        return res

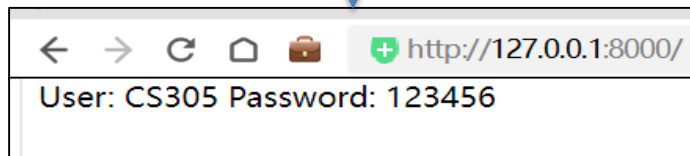
if __name__ == "__main__":
    app.run(host='0.0.0.0', port=8000, debug=True)
```

# Using flask(3)

- Client 1

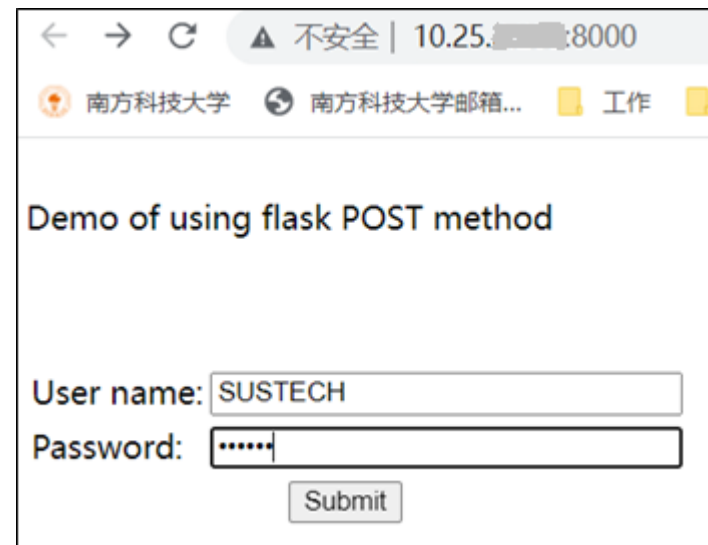


A screenshot of a web browser window. The address bar shows 'http://127.0.0.1:8000/'. The page title is 'Demo of using flask POST method'. Below the title, there are two input fields: 'User name:' with placeholder text 'Please input your user name' and 'Password:' with placeholder text 'Please input your password'. A 'Submit' button is located below the password field.



A screenshot of the browser's console output. It shows the text 'User: CS305 Password: 123456'.

- Client 2



A screenshot of a web browser window. The address bar shows '10.25.8000'. The page title is 'Demo of using flask POST method'. Below the title, there are two input fields: 'User name:' with the value 'SUSTECH' and 'Password:' with masked characters '.....'. A 'Submit' button is located below the password field.



A screenshot of the browser's console output. It shows the text 'User: SUSTECH Password: 654321'.

## Tip 3:

- Flask uses port 5000 by default, you can choose other port numbers when running as demo shows.
- When running the demo, you should put main.html in a folder named “templates”. For example, suppose the python project locates under “D:\CS305\http”, and then you should put main.html in “D:\CS305\http\templates”.

# Practice 4.3

- Suppose your IP address is `***.***.***.***`
- Run the demo using flask on your PC.
- Use Wireshark to capture and analyze the packets.
  - 3-1. When accessing the web server from your own PC, which interface should you choose? `loopback`
  - 3-2. Let your classmate to access your web server, which interface should you choose if you want to capture the traffic? `WLAN`
- If we need analyze the packages using POST method, what display filter should be set? Are the packages request messages or response messages?

351	0.000340	10.25.2.205	10.25.2.205	HTTP	667	POST / HTTP/1.1 (application/x-www-form-urlencoded)
454	0.000267	127.0.0.1	127.0.0.1	HTTP	868	POST / HTTP/1.1 (application/x-www-form-urlencoded)

