Embedded System
&
Embedded Linux Development
Part 11

Index of today's topic

- CGI (Common Gateway Interface)
- HTML form & HTTP header
- Use CGI in FL6410

CGI (Common Gateway Interface)

- CGI
  - is a standard (see RFC 3875: CGI Version 1.1)
  - defines how web server software can delegate the generation of web pages to a stand-alone application, an executable file

Mechanism of CGI

Web Server

- Apache
- nginx
- BOA

FL6410 BOA Configuration

For ARM target:

- 1. backup boa
- #mv /sbin/boa /sbin/bakboa
- 2. vi /etc/boa/boa.conf
- "User nobody" was revised to "User root“
- 3. mkdir -p /usr/lib/cgi-bin
- chmod 777 /usr/lib/cgi-bin
- 4. put boa to /sbin/boa
- chmod 777 /sbin/boa
- 5. put hello.cgi to /usr/lib/cgi-bin/hello.cgi
- chmod 777 /usr/lib/cgi-bin/hello.cgi
- 6. before brower the web, should reboot boa or system

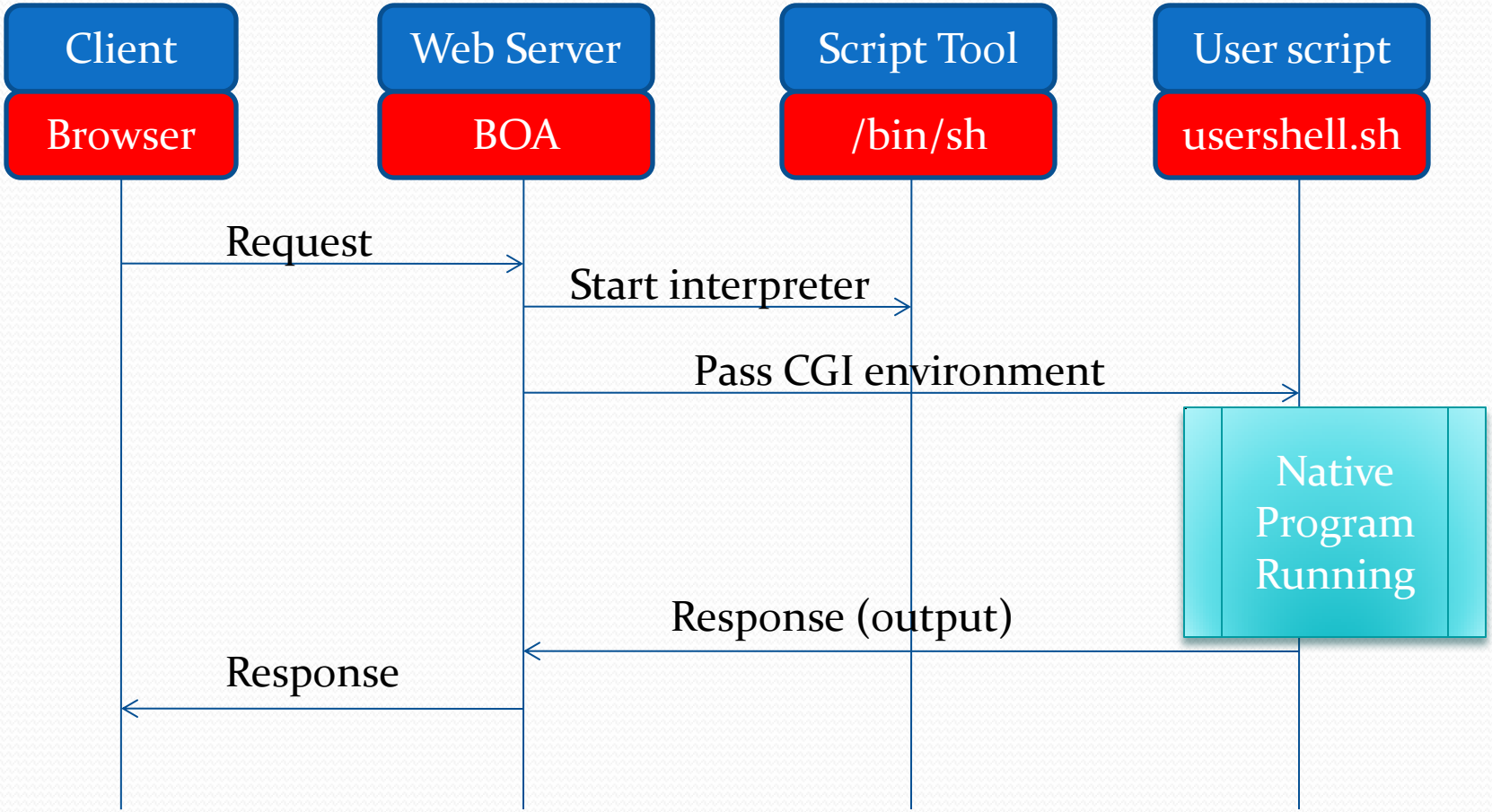
CGI Executable program

- binary executable file (compiled by C/C++)
- shell
- perl
- PHP
- Python
- …

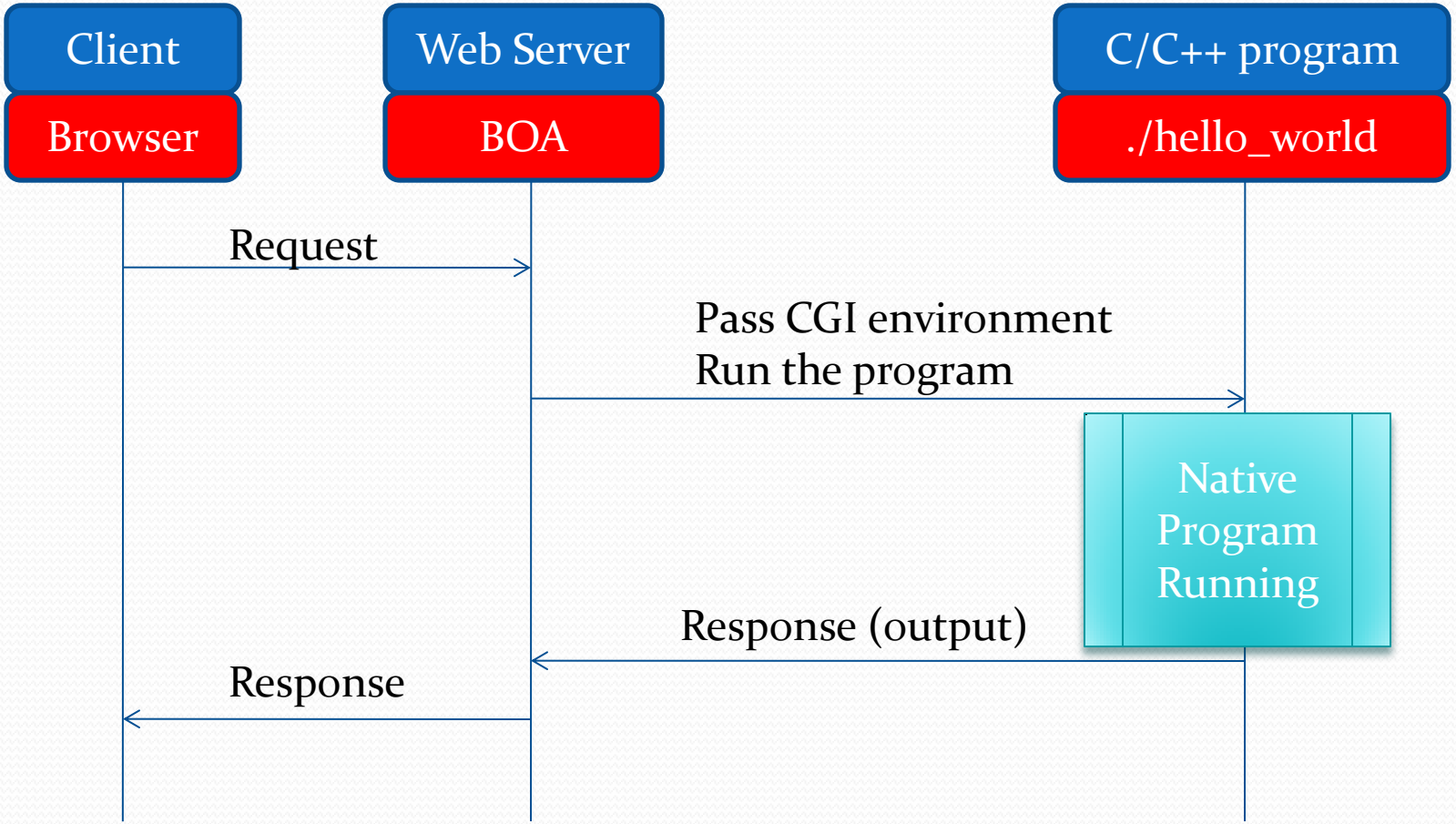
HTML

- The output of an CGI program should be a HTML page
- The browser (client) will display the HTML page

Data flow


Client
Browser
Web Server
BOA
Script Tool
/bin/sh
User script
usershell.sh
Request
Start interpreter
Pass CGI environment
Native Program Running
Response (output)
Response

Data flow


Client
Browser
Web Server
BOA
C/C++ program
./hello_world
Request
Pass CGI environment
Run the program
Native
Program
Running
Response (output)
Response

Output of CGI program

- Use **stdout** as the output to the web browser
- The output should follow HTTP protocol
- Example:
  - **printf("Content-type: text/html; charset=gb2312\n\n");**
  - **printf("hello,world
\n");**

Input of CGI program

- Data is passed into the program using environment variables
- C Language
  - **getenv**() to get the environment variables

Example

- Send following http request to web server:
  - **http://192.168.1.6/testcgi?parameter1=hello&parameter2=world**
- In testcgi
  - **char *query_string = getenv("QUERY_STRING");**
  - **printf("query = %s\n", query_string);**
- output is
  - **query = parameter1=hello&parameter2=world**

Environment Variables in CGI

- GATEWAY_INTERFACE
- HTTP_ACCEPT_CHARSET
- HTTP_ACCEPT_ENCODING
- HTTP_ACCEPT_LANGUAGE
- HTTP_CACHE_CONTROL
- HTTP_HOST
- HTTP_KEEP_ALIVE
- HTTP_USER_AGENT
- **QUERY_STRING**
- REMOTE_ADDR
- REMOTE_PORT
- **REQUEST_METHOD**
- REQUEST_URI
- SCRIPT_NAME
- SERVER_ADDR
- SERVER_ADMIN
- SERVER_NAME
- SERVER_PORT
- SERVER_PROTOCOL
- SERVER_SOFTWARE

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HTTP header

- The output of an http response should contain a header in the beginning of the output stream
- The first line must be content-type
- The second line must be an empty line
  - **content-type: text/html**

Content Type

- HTTP content type is defined in MIME
  - **Multipurpose Internet Mail Extensions (MIME)**
- Example:
  - **content-type: text/html**
  - **content-type: text/plain**
  - **content-type: image/gif**
  - **content-type: image/jpeg**

HTML form

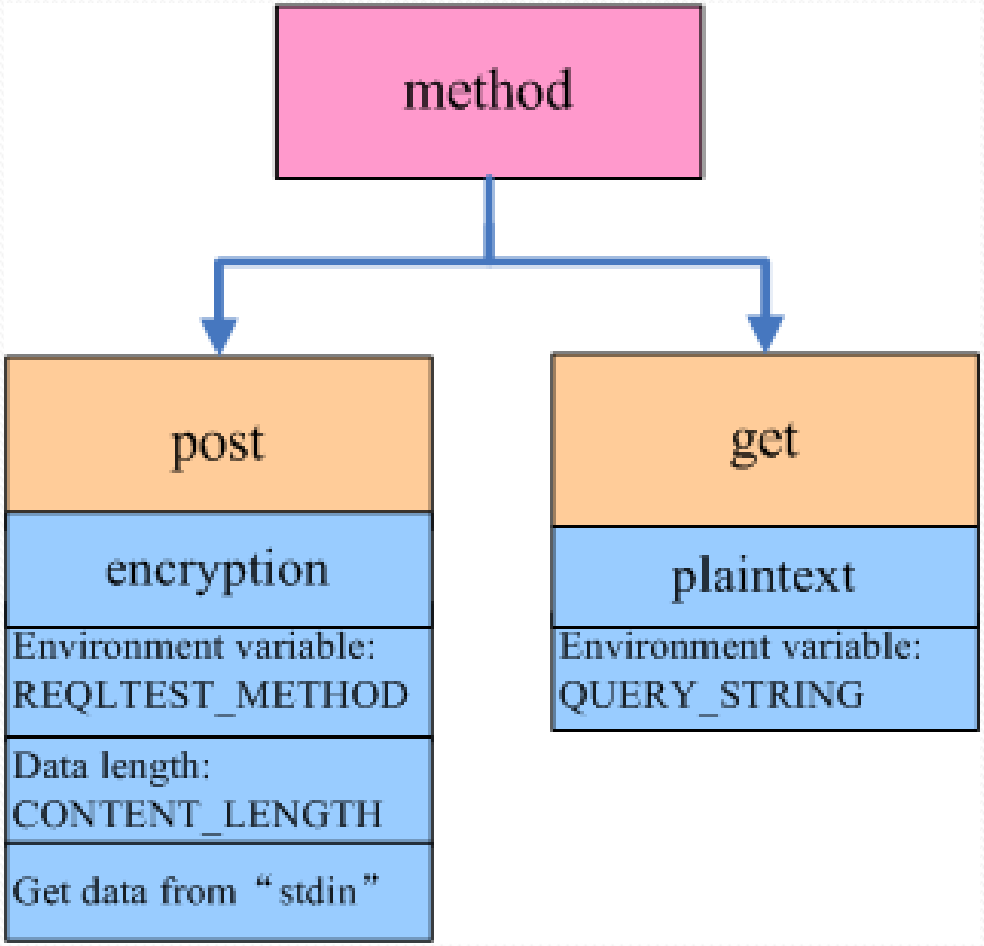
- HTML forms are used to pass data to a server
- It can contain input elements like text fields, checkboxes, radio-buttons, submit buttons and more. A form can also contain select lists, textarea, fieldset, legend, and label elements
- It has an submit action that is used to send data to a specific server URL

HTML form example

```
<form name="input" action="" method="get">
  <input type="checkbox" name="LED1" value="1" />
  LED 1<br/>
  <input type="checkbox" name="LED2" value="1" />
  LED 2<br/>
  <input type="submit" value="Submit" />
</form>
```

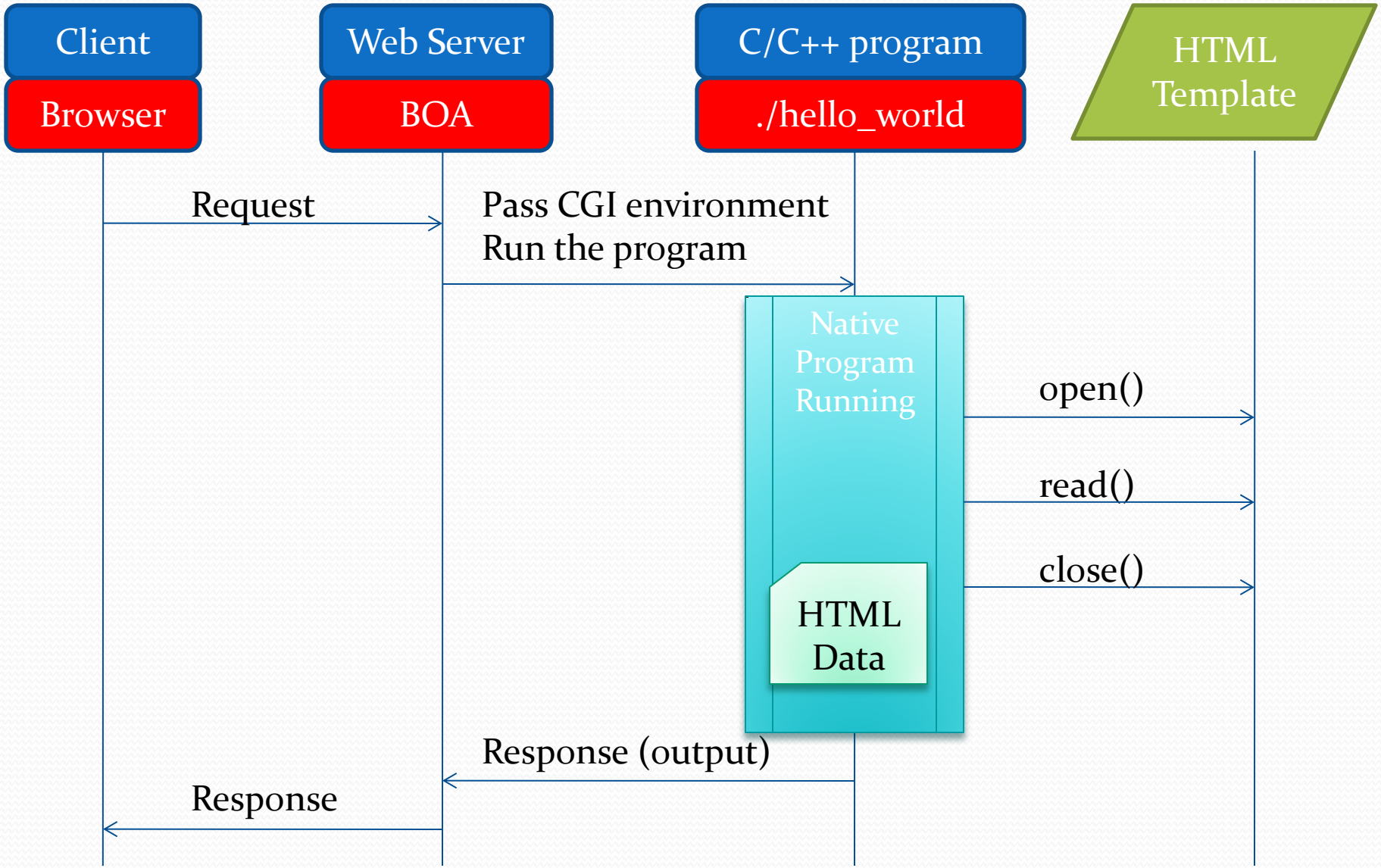
HTTP method

- POST/GET method
  - GET method. The data is stored in QUERY_STRING variable
  - POST method. The data is input from **stdin**.



How C/C++ program manager HTML

- Put a HTML template page in target
- When CGI is executing the C/C++ program, the program should
  - Open the HTML template file
  - Read the content of HTML template file
  - Change the content according to user input(if need)
  - Print to stdout


Client
Browser
Web Server
BOA
C/C++ program
./hello_world
HTML
Template
Request
Pass CGI environment
Run the program
Native
Program
Running
open()
read()
close()
HTML
Data
Response (output)
Response

Why use CGI in Embedded System

- Web based service with very limited resource usage
- Fast, flexible, Easy to develop
- No much requirement in client side
- Often used in network devices

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Web Server on FL6410

- There is a web server named BOA is already installed on FL6410
  - The system resource is too tight to run Apache
- CGI enabled in BOA
  - no PHP, Perl, Python
  - Only sh & binary executable file

URL map

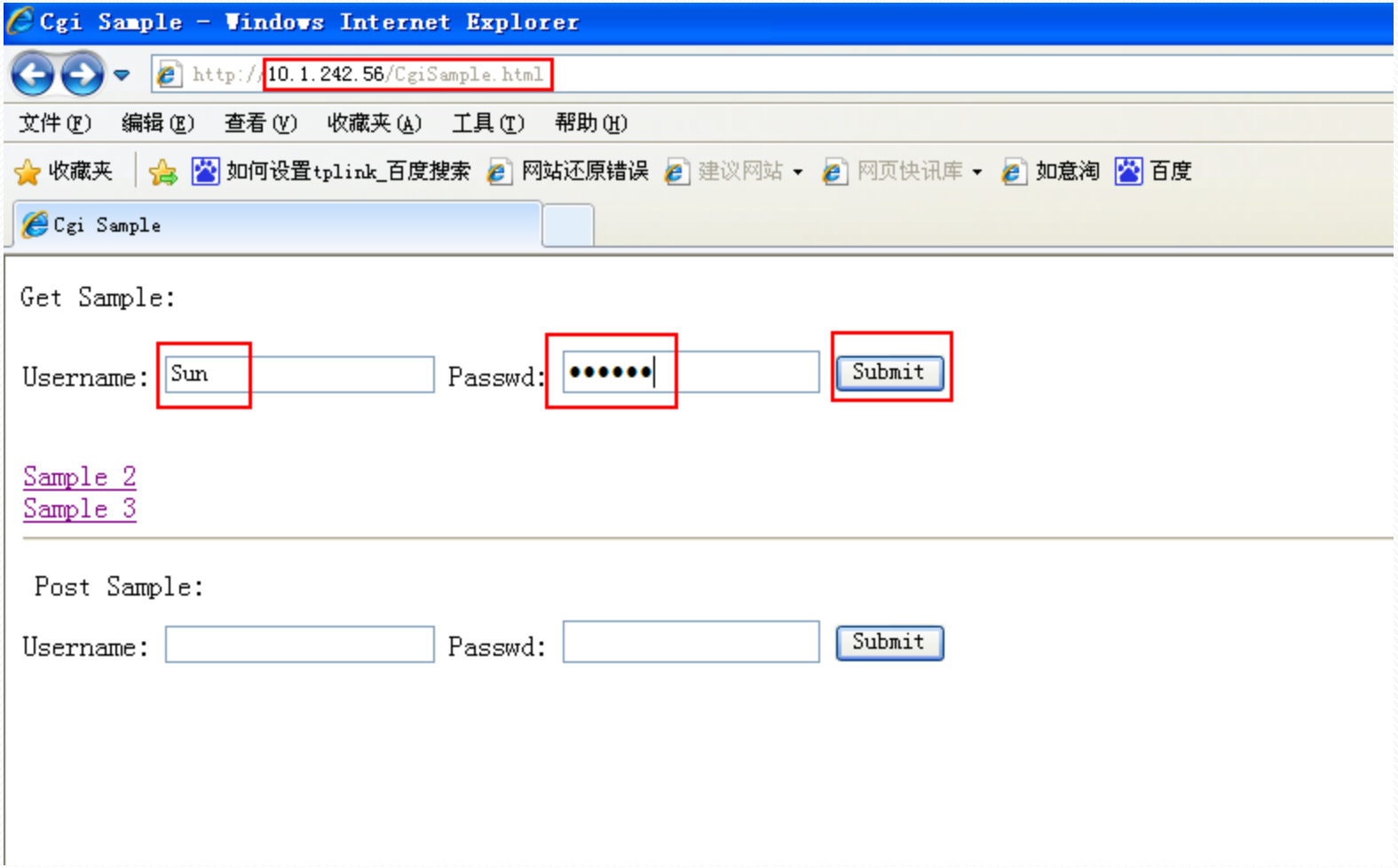
vim /etc/boa/boa.conf

```
# DocumentRoot: The root directory of the HTML documents.
# Comment out to disable server non user files.

DocumentRoot /usr/local/boa

# UserDir: The name of the directory which is appended onto a user's home
# directory if a ~user request is recieved.

# ScriptAlias: Maps a virtual path to a directory for serving scripts
# Example: ScriptAlias /htbin/ /www/htbin/

ScriptAlias /cgi-bin/ /usr/lib/cgi-bin/
```

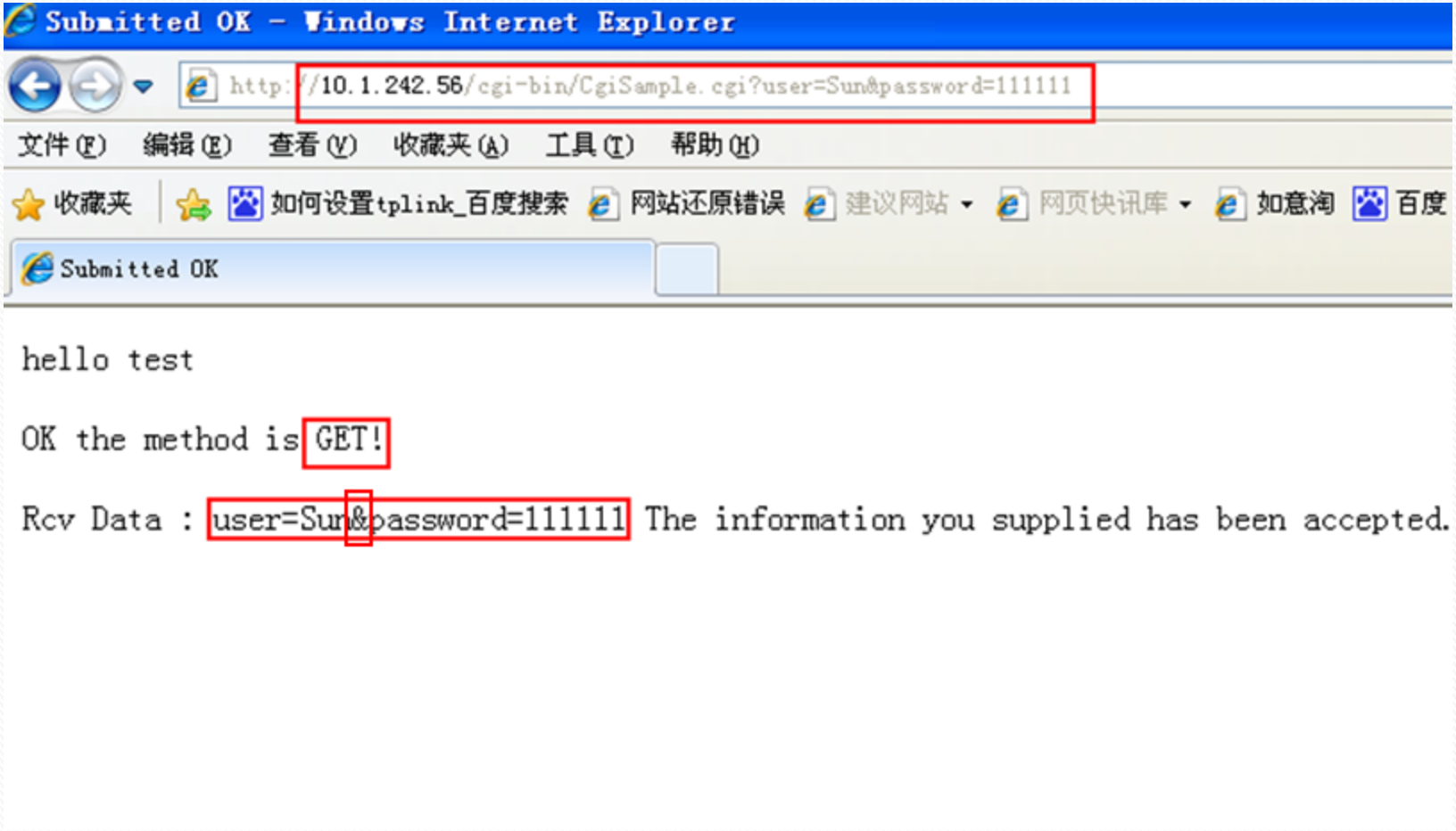
URL map

- default web root directory is
  - **/usr/local/boa**
- **http://target_ip/hello.html**
  - The web server find **/usr/local/boa/hello.html** and send this page to browser
- Compile your helloworld program and rename it to
  - **helloworld.cgi**
- **http://target_ip/cgi-bin/helloworld.cgi**
  - The web server will try to run **/usr/lib/cgi-bin/helloworld.cgi** program and send the output(stdout) to browser

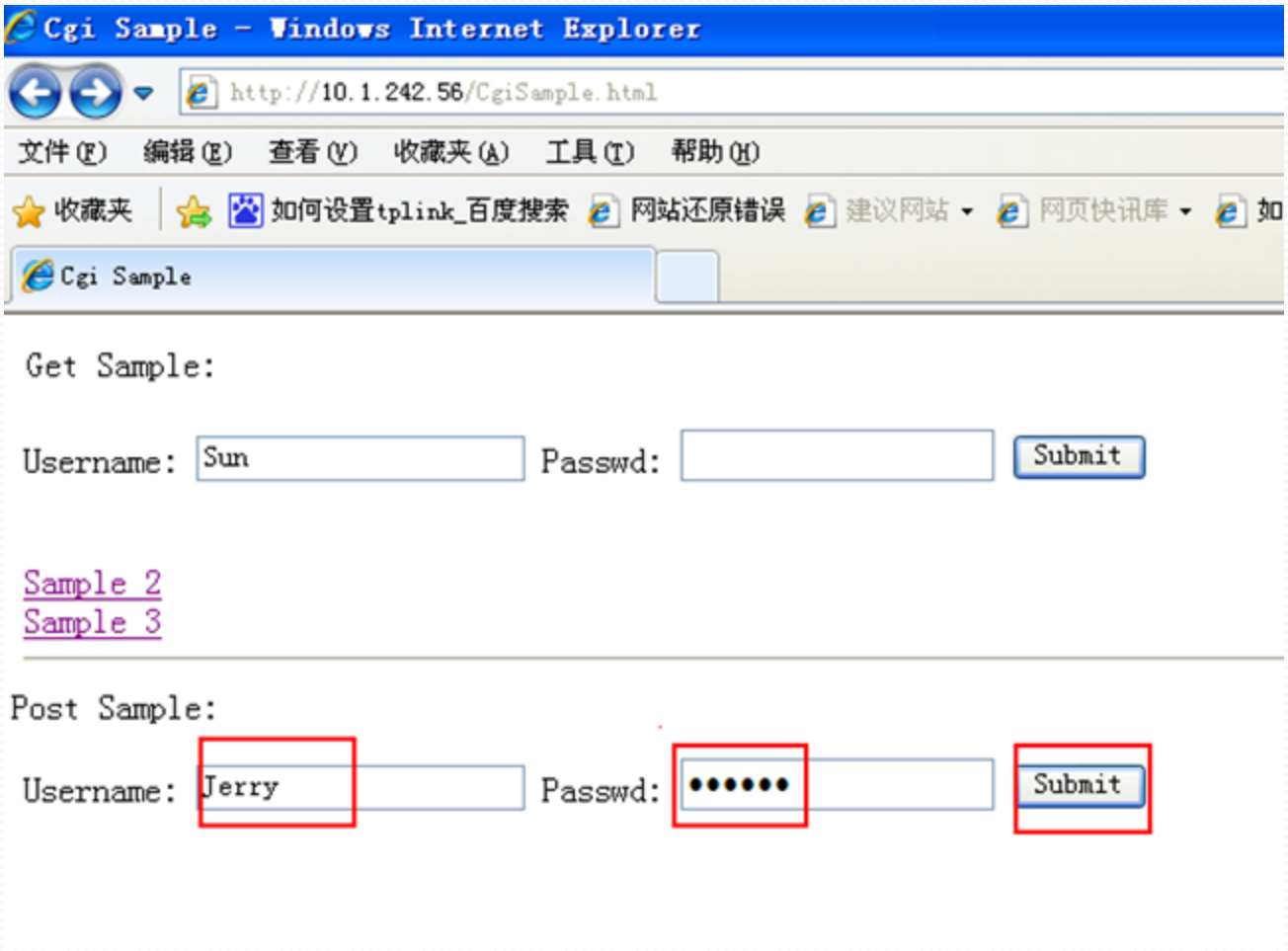
HTML sample


Cgi Sample - Windows Internet Explorer
http://10.1.242.56/CgiSample.html
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
如何设置tplink_百度搜索
网站还原错误
建议网站
网页快讯库
如意淘
百度
Cgi Sample
Get Sample:
Username: Sun
Passwd: ••••••
Submit
Sample 2
Sample 3
Post Sample:
Username:
Passwd:
Submit

HTML sample


Submitted OK - Windows Internet Explorer
http://10.1.242.56/cgi-bin/CgiSample.cgi?user=Sun&password=111111
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
如何设置tplink_百度搜索
网站还原错误
建议网站
网页快讯库
如意淘
百度
Submitted OK
hello test
OK the method is GET!
Rcv Data : user=Sun&password=111111 The information you supplied has been accepted.

HTML sample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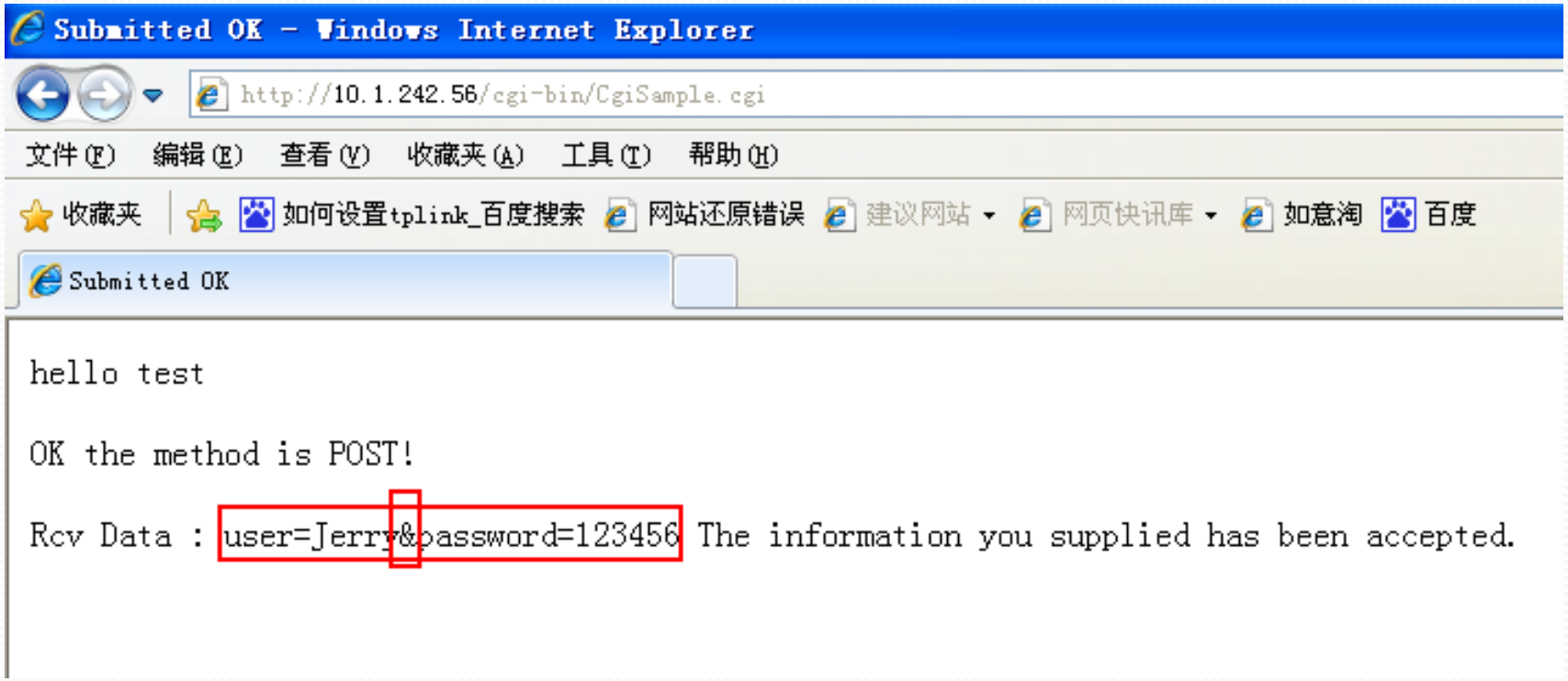
网站还原错误
建议网站
网页快讯库
Cgi Sample
Get Sample:
Username: Sun
Passwd:
Submit
Sample 2
Sample 3
Post Sample:
Username: Jerry
Passwd: ••••••
Submit

HTML sample


Submitted OK - Windows Internet Explorer
http://10.1.242.56/cgi-bin/CgiSample.cgi
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
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如何设置tplink_百度搜索
网站还原错误
建议网站
网页快讯库
如意淘
百度
Submitted OK
hello test
OK the method is POST!
Rcv Data : user=Jerry&password=123456 The information you supplied has been accepted.

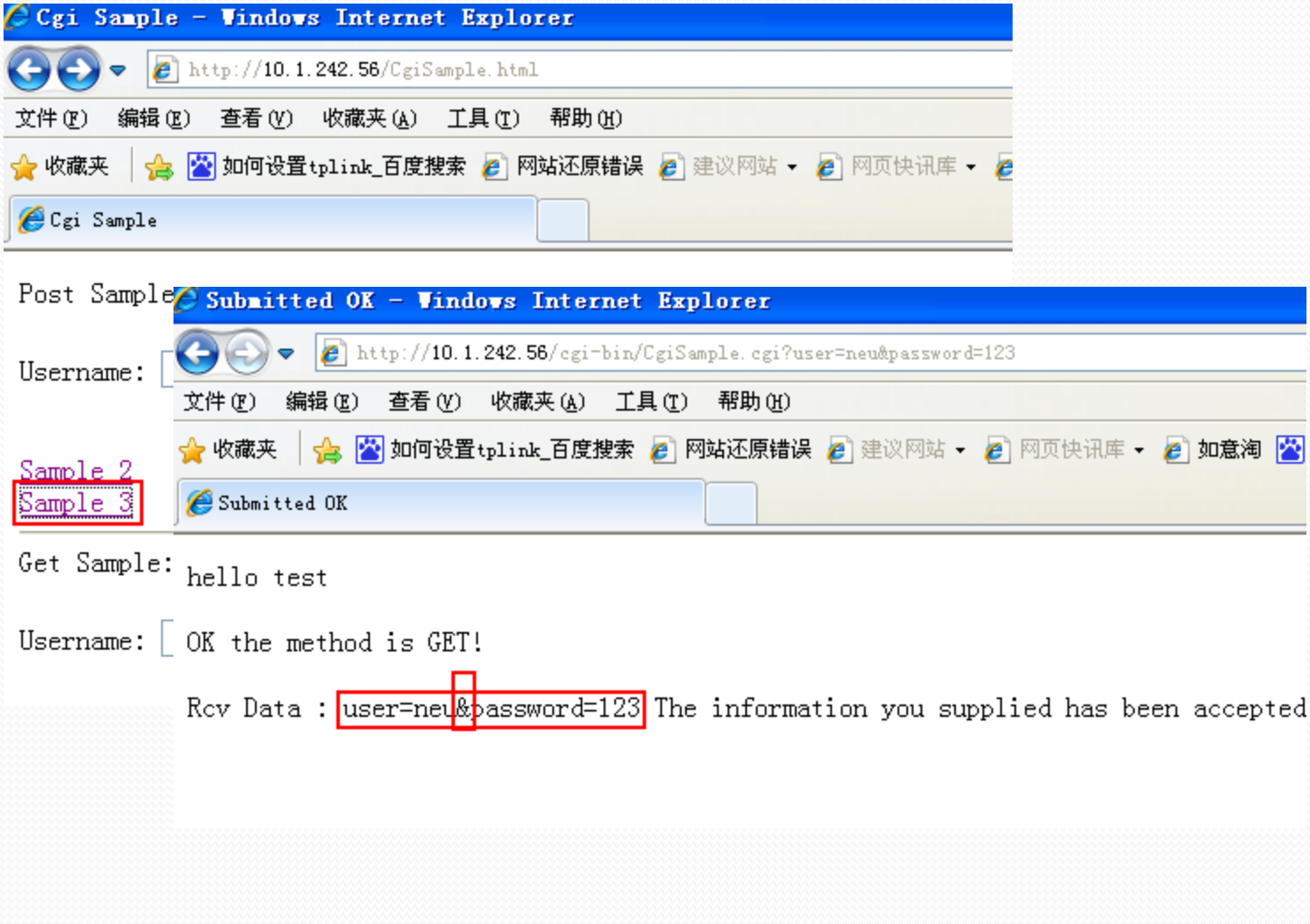
CGI sample

http://10.1.242.56/cgi-bin/hello.cgi - Windows Internet Explorer
http://10.1.242.56/cgi-bin/hello.cgi
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
如何设置tplink_百度搜索
网站还原错误
建议网站
网页快讯库
如意淘
百度
http://10.1.242.56/cgi-bin/hello.cgi
helloworld

Hyperlinks

Cgi Sample - Windows Internet Explorer
http://10.1.242.56/CgiSample.html
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
如何设置tplink_百度搜索
网站还原错误
建议网站
网页快讯库
Cgi Sample
Post Sample:
Username:
Sample 2
Sample 3
Submitted OK - Windows Internet Explorer
http://10.1.242.56/cgi-bin/CgiSample.cgi
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹
如何设置tplink_百度搜索
网站还原错误
建议网站
网页快
Submitted OK
Get Sample:
hello test
Username:
OK the method is GET!
The information you supplied has been accepted.

Hyperlinks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收藏夹 如何设置tplink_百度搜索 网站还原错误 建议网站 网页快讯库
Cgi Sample
Post Sample
Submitted OK - Windows Internet Explorer
http://10.1.242.56/cgi-bin/CgiSample.cgi?user=neu&password=123
文件(F) 编辑(E) 查看(V) 收藏夹(A) 工具(T) 帮助(H)
收藏夹 如何设置tplink_百度搜索 网站还原错误 建议网站 网页快讯库 如意淘
Submitted OK
Username:
Sample 2
Sample 3
Get Sample:
hello test
Username:
OK the method is GET!
Rcv Data : user=neu&password=123 The information you supplied has been accepted

Exercise

- write a CGI program on FL6410
  - output a hello world HTML page
  - within HTML page, put a form with GET method
  - within the form, put 4 check box represent LED1-LED4
  - if user submit the form, the program turn ON/OFF LED1-LED4 depends on the user's selection

Tips

- For ARM target:
- 1. put CgiSample.html to /usr/local/boa
- 2. put CgiSample.cgi to /usr/lib/cgi-bin

- For Host PC
- 1. access webserver
- http://10.1.242.56/CgiSample.html
- http://10.1.242.56/cgi-bin/hello.cgi