Instituto Superior de Engenharia de Lisboa

Computer Networks

Phase 1 - Web Server

Projeto ISEL 2023/24 — LEETC

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Acronyms list

API	Application Programming Interface
GUI	Graphical User Interface
HTTP	Hyper Text Transfer Protocol
OS	Operating System
OSS	openSUSE
PHP	PHP: Hypertext Preprocessor
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TUI	Terminal User Interface
UDP	User Datagram Protocol
VPN	Virtual Private Network
WWW	World Wide Web
XAMPP	Cross-Platform, Apache, MySQL, PHP, and Perl

Glossário

Operating system

A program that manages a computer's resources from software to hardware.

Browser

A browser is a internet navigation software. It comes in multiple flavours, nowadays the big three are Microsoft Edge, Mozilla Firefox and Google Chrome.

Windows

Microsoft's operating system. First released in 1985 as a Graphical User Interface (GUI) for MS-DOS, continued to evolve with it's latest version being 11.

Rolling release distribuition

A distribuition where it's software release cycle is more frequent than those of Long Term Support (LTS). It's up to the Linux-based distribuitor to guarantee the testing of a package. Due to it's nature, it's not recommended for server production environment.

openSUSE Tumbleweed

An openSUSE (OSS) is an open-source community driven Linux-based distribuition sponsored by SUSE Software Solutions. Tumbleweed is a rolling release version allowing for up-to-date software releases.

Wireshark

Wireshark is a network protocol analyser software. Allows traffic capture between a computer and a network.

LibreWolf

An internet browser based on Mozilla's Firefox. It's primary purpose is to allow privacy, and with it comes security. It achieves this by removing telemetry and data collection.

XAMPP

A software package environment collection containing Apache2 webserver, MariaDB database, PHP and Perl.

Apache2

Text

Socket

Text

Python

Python is a high-level programming language, object-oriented.

Firewall

Text

VPN

    Text

SSL

    Text

Glossário

    Glossário é uma espécie de pequeno dicionário específico para palavras e expressões pouco conhecidas presentes num texto, seja por serem de natureza técnica, regional ou de outro idioma.

Capítulo 1

Introduction

Capítulo 2

Phase 1

2.1 Milestones

- Setup apache2 web server in localhost

- Access web server locally (http://127.0.0.1/ or http://localhost)

- Access web server from a remote computer (http://172.24.1.12)

- Use wireshark in a remote host to capture packages from the server

- Compare the HTTP headers sent by the client and the server

- Develop a simple barebones HTTP webclient

- Establish a TCP connection to the server

- Request the base webpage

2.2 WebClient requirements

- HTTP library forbidden

- Establish TCP connection using available sockets library - send/receive the HTTP request/reply

- Output HTTP reply to the user

- - Optional - act to the various HTTP replies

- Text-only application

2.2.1 Software

- Local server side

    Operating system: Windows 11 x64

    WebServer: XAMPP x64 8.2.12-0-VS16 for windows Disclaimer: the versions listed below might not be the latest, by present date, given the nature of rolling release distribuitions software updates.

- Client side

    Operating system: openSUSE Tumbleweed

    Browser: LibreWolf version 123.0-1

    Package monitor: Wireshark version 4.2.3 (Git commit b0da86c196d1).

2.2.2 Software install steps

Number one step is to install, start and configure XAMPP. Using the following link we can choose our pre-fered method, for this project the portable version was the best choice since no installation was needed. Af-

The read me file available in the root directory states tha

After completing, just press any button to continue.

Next click in the *xampp_start* executable, windows will

ter uncompressing our downloaded file, we can start the process.

Pick a language for the program.

Apache2 comes with SSL on by default. Since we're stu

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Next up is wireshark, the powerful network analyser. We'll download the installer from here. The install

process is pretty simple, selecting everything available and pressing next.   Wireshark setup.

After completing the installation, reboot the co

2.2.3   WebClient - Python Code

```python
1  """
2  Name: Python TCP Client
3  Description: Simple TCP client using sockets
4  Original code by: Lu s Pires
5  Source: Chapter 2, slide 104
6
7  Commented and adapted by: Nuno Brito
8  """
9
10 # Import from everything from the socket library
11 from socket import *
12
13 # Specify servername and port destination
14 serverName = "172.24.1.12"
15 serverPort = 80
16
17 # GET list
18 httpTestMessages = [
19         "GET /dashboard/ HTTP/1.1\r\n",            # 200 OK
20         "GET /dashboard HTTP/1.1\r\n",             # 301 Moved Permanently
21         "PUT / HTTP/1.1\r\n",                      # 302 Found
22         "GET /dashboard HTTP/1.\r\n",              # 400 Bad Request
23         "GET /dashboard/index.htm HTTP/1.1\r\n",   # 404 Not Found
24         "PUT /d HTTP/1.1\r\n",                     # 405 Method Not Allowed
25         "BREW /coffee/ HTTP/1.1\r\n",              # 501 Not implemented
26         ]
27
28 # Cycle through predefined messages
29 for sentence in httpTestMessages:
30
31     # Socket open and connect
32     clientSocket = socket(AF_INET, SOCK_STREAM)
33     clientSocket.connect((serverName,serverPort))
34
35     # Join serverName to the current sentence
36     sentence += "Host:" + serverName + "\r\n\r\n"
37
38     # Socket encode message and send
39     clientSocket.send(sentence.encode())
40
```

```
41      # Receive and out the response message
42      modifiedSentence = clientSocket.recv(1024)
43
44      # Close socket connection
45      clientSocket.close()
46
47      # Print the requested message
48      print ("-"*60)
49      print ("From Server:", modifiedSentence.decode())
```

Listing 2.1: Simple HTTP WebClient using sockets in python

The code was adapted to be simple and cycle through the various request messages without any user input. Modifiable variables include *serverName*, *serverPort* and the *httpTestMessages* list.

./webclient/httpsocketv3_output_20240329.txt

2.2.4 Wireshark captures

First we must ensure the browser being used can connect to the XAMPP server with HTTP. We can do that by enabling the usage of deprecated TLS.
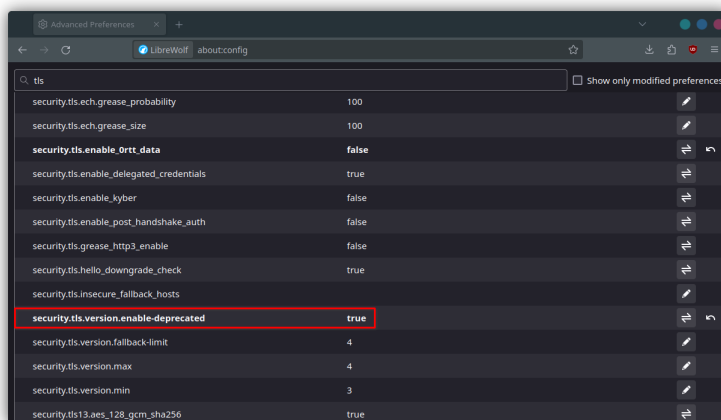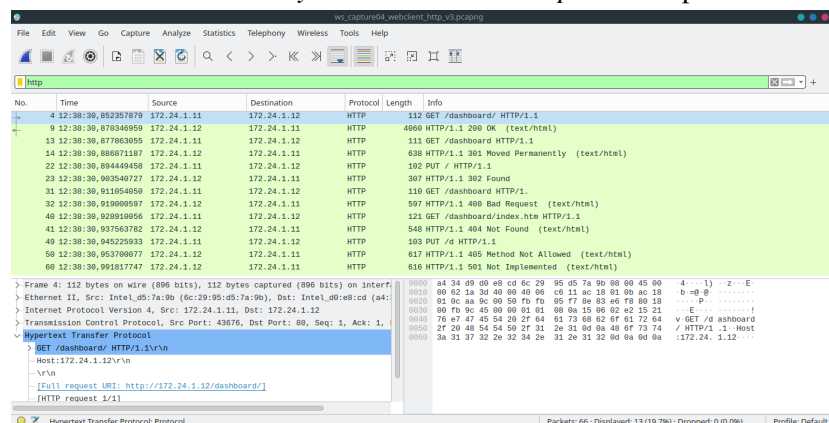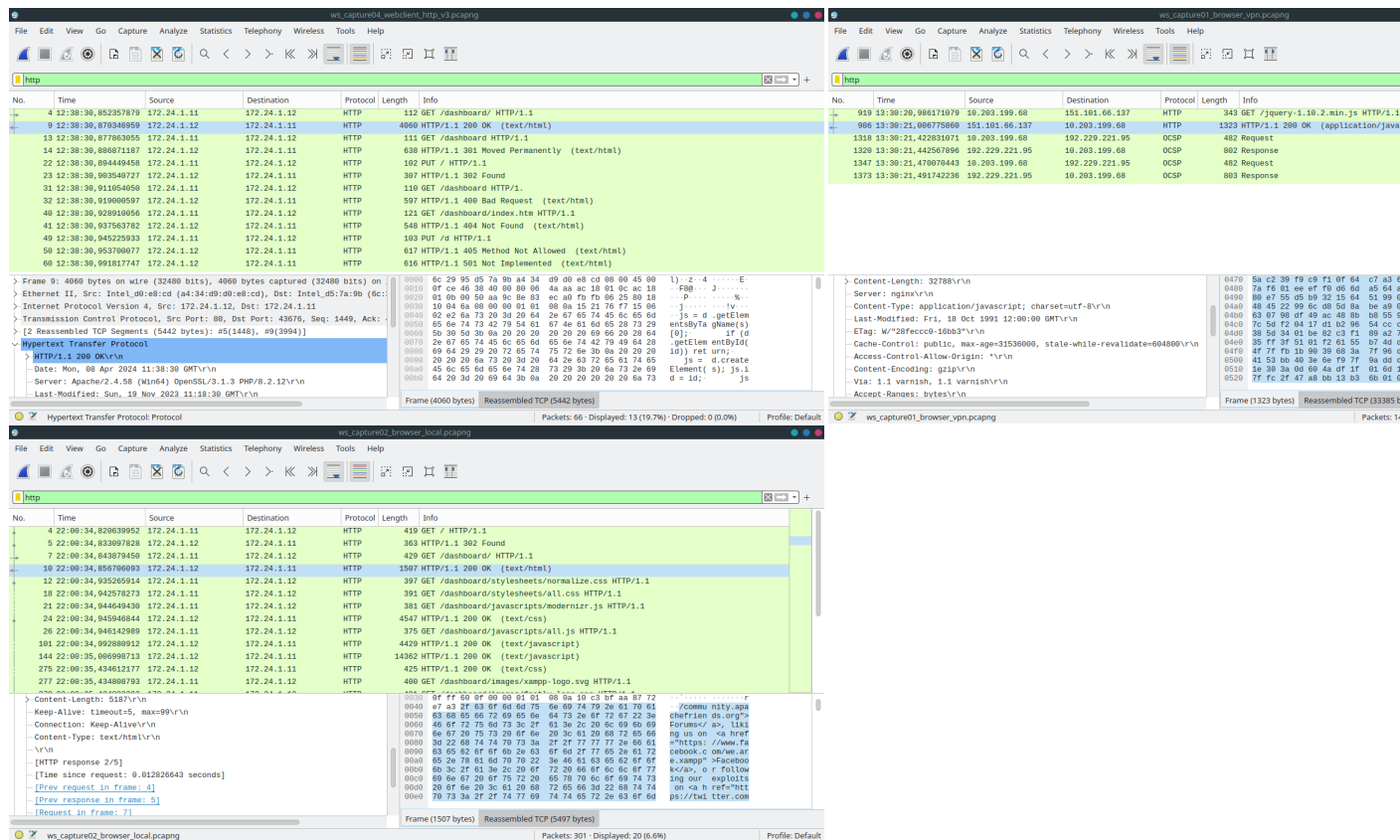

Figura 2.1: Changing from false to true the *security.tls.version.enable-deprecated* option

Printscreen

Capture output ./wireshark/ws_capture01_export.txt ./wireshark/ws_capture02_export.txt ./wireshark/ws_capture04_export.txt

2.2.5 List of headers and replies

Request: GET /dashboard/ HTTP/1.1°:127.24.1.12°°
Reply: HTTP/1.1 200 OK
Meaning: this header complies with what the server expects from a webclient request.
Request: GET /dashboard HTTP/1.1°:127.24.1.12°°
Reply: HTTP/1.1 301 Moved Permanently Meaning: this header request a relative directory without a forward slash at the end, prompting the server to reply with a "moved"answer. **Request:** PUT / HTTP/1.1°:127.24.1.12°°**Reply:** HTTP/1.1 302 Found Meaning: this header request is an upload request to an unexistent directory. **Request:** GET /dashboard HTTP/1.°:127.24.1.12°°**Reply:** HTTP/1.1 400 Bad Request Meaning: this header request, although it has an invalid directory, has the HTTP protocol version badly writen (HTTP/1.1 vs. actual HTTP/1.) which causes a "bad request"reply from the server. **Request:** GET /dashboard/index.htm HTTP/1.1°:127.24.1.12°°**Reply:** HTTP/1.1 404 Not Found Meaning: this header request tries to get a file that doesn't exist in the local server. **Request:** PUT /d HTTP/1.1°:127.24.1.12°°**Reply:** HTTP/1.1 405 Method Not Allowed Meaning: this header request tries to upload something to the relative directory "d". **Request:** BREW /coffee/ HTTP/1.1°:127.24.1.12°°**Reply:** HTTP/1.1 501 Not Implemented Meaning: A poorly attempt to get the 1998 April fool's day. It should have replied with 418 I'm a teapot. Even with GET instead of BREW it didn't work. Apache doesn't have the implementation.

2.3 Issues and fixes

Running python code: Python3 wasn't installed by default. Then had to run the code with: $ python3 httpsocketv3.py. Encrypted html body in wireshark: Initially I had to run wireshark in a remote virtual private network (VPN) connection. Fortunately I could see the VPN doing it's magic but also couldn't

see the HTTP body, since it was encrypted. Default HTTP protocol, HTTPS: To guarantee the HTTP connection I had to disable SSLEngine in Apache2 WebServer.

Apêndice A

Um Apêndice