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File Transfer Protocol

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Table of contents

Study the protocol[1]

FTP stands for file transfer protocol, and it refers to a set of rules that define how computers transfer files to each other. It is used, among other things, by developers to upload their source files to web hosts, which is a remote server. This protocol is designed on a client-server model, the server has the server-like tool installed on its system and the client has the client-like ftp on its system.

Here is the complete suite of the FTP tool, its arguments and their definitions:[2]

FTP Command	Description of Command
!	This command toggles back and forth between the operating system and ftp. Once back in the operating system, typing exit takes you back to the FTP command line.
?	Accesses the Help screen.
append	Append text to a local file.
ascii	Switch to ASCII transfer mode.
bell	Turns bell mode on or off.
binary	Switches to binary transfer mode.
bye	Exits from FTP.
cd	Changes directory.
close	Exits from FTP.
delete	Deletes a file.
debug	Sets debugging on or off.
dir	Lists files, if connected.
	dir -C = lists the files in wide format.
	dir -1 = Lists the files in bare format in alphabetic order.
	dir -r = Lists directory in reverse alphabetic order.
	dir -R = Lists all files in current directory and sub directories.
	dir -S = Lists files in bare format in alphabetic order.
disconnect	Exits from FTP.
get	Get file from the remote computer.
glob	Sets globbing on or off. When turned off, the file name in the put and get commands is taken literally, and wildcards will not be looked at.
hash	Sets hash mark printing on or off. When turned on, for each 1024 bytes of data received, a hash-mark (#) is displayed.
help	Accesses the Help screen and displays information about the command if the command is typed after help.
lcd	Displays local directory if typed alone or if path typed after lcd will change the local directory.
literal	Sends a literal command to the connected computer with an expected one-line response.
ls	Lists files of the remotely connected computer.

[1] https://www.techtarget.com/searchnetworking/definition/File-Transfer-Protocol-FTP
[2] https://www.serv-u.com/ftp-server-windows/commands

mdelete	Multiple delete.
mdir	Lists contents of multiple remote directories.
mget	Get multiple files.
mkdir	Make directory.
mls	Lists contents of multiple remote directories.
mput	Send multiple files.
open	Opens address.
prompt	Enables or disables the prompt.
put	Send one file.
pwd	Print working directory.
quit	Exits from FTP.
quote	Same as the literal command.
recv	Receive file.
remotehelp	Get help from remote server.
rename	Renames a file.
rmdir	Removes a directory on the remote computer.
send	Send single file.
status	Shows status of currently enabled and disabled options.
trace	Toggles packet tracing.
type	Set file transfer type.
user	Send new user information.
verbose	Sets verbose on or off.

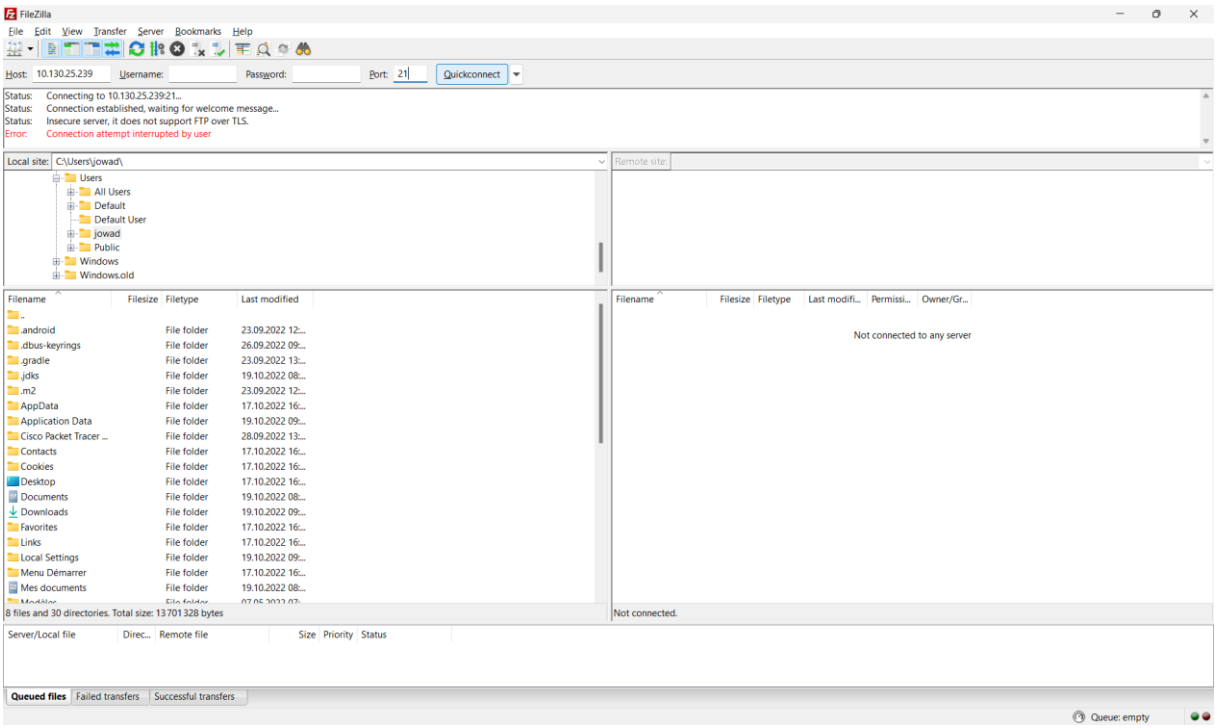
We can refer to this list for the rest of the exercises. all these arguments allow us to activate a function of the FTP tool on our terminal.

Usage of FTP

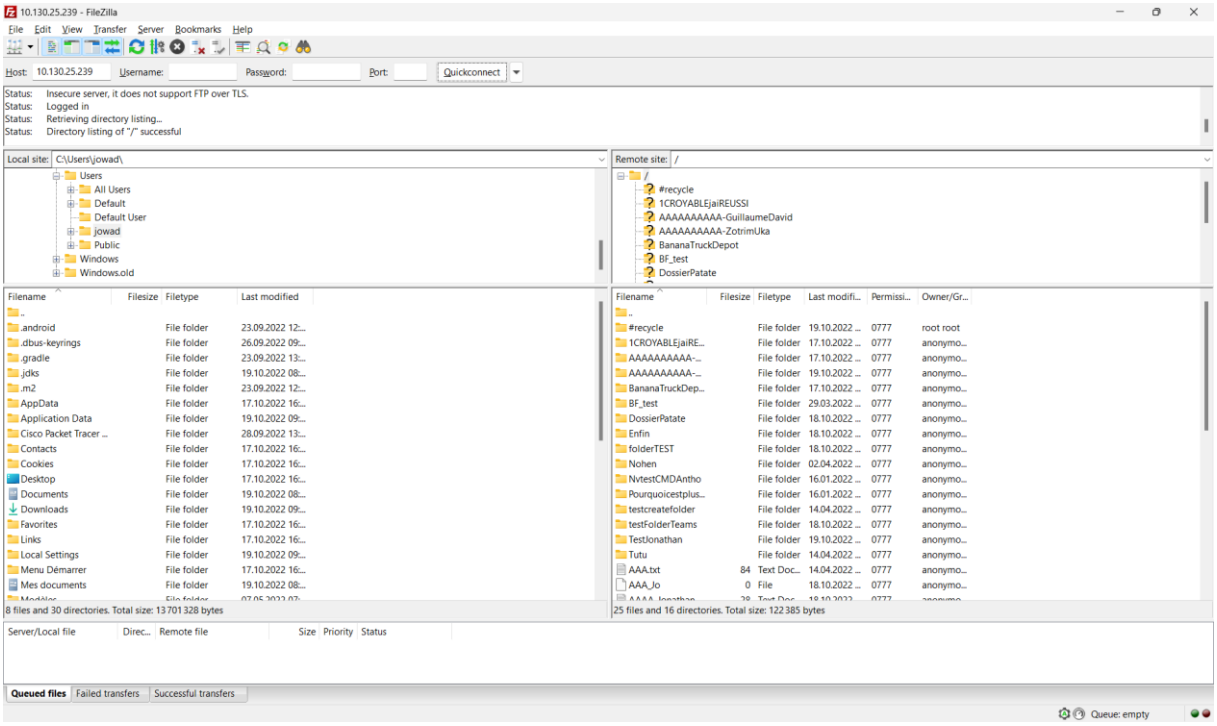
First thing to do, you must install FileZilla-client to be able to connect to the FTP server, here is the official link: Download link. After installing it we can talk a little about the graphical interface of this software. We see a bar with the labels Host, username, password and port. These elements are essential to establish a connection between the client and the server.

The IP address is provided, we could also insert a domain name which is therefore linked with the IP address, without authentication, and the default port is 21. You can establish a connection by pressing "quickconnect".

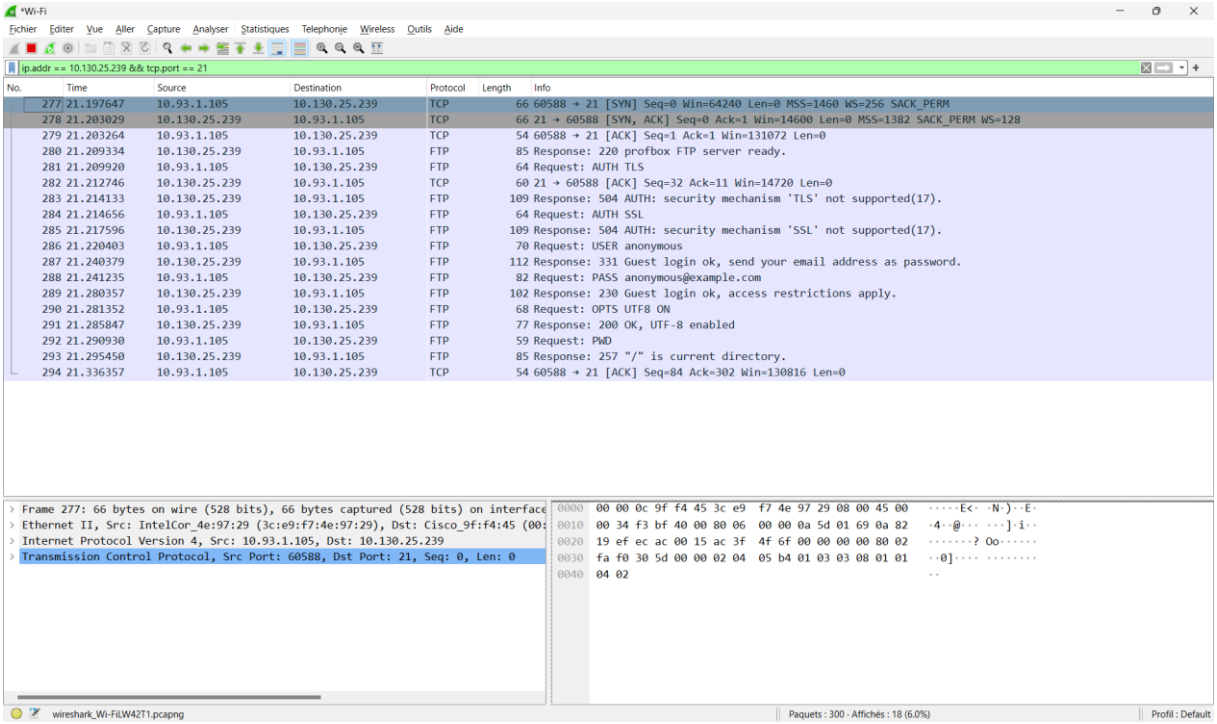
Under this same bar is the verbose console. The left side is the local file system, i.e., the client side, and the right side is the file explorer on the server side. Under this part we have the inside of the tree of the folder selected in the upper part. And for the last part of this software is the historical or pending queue of files transiting between client and server.



We can see the connection established in the following image:



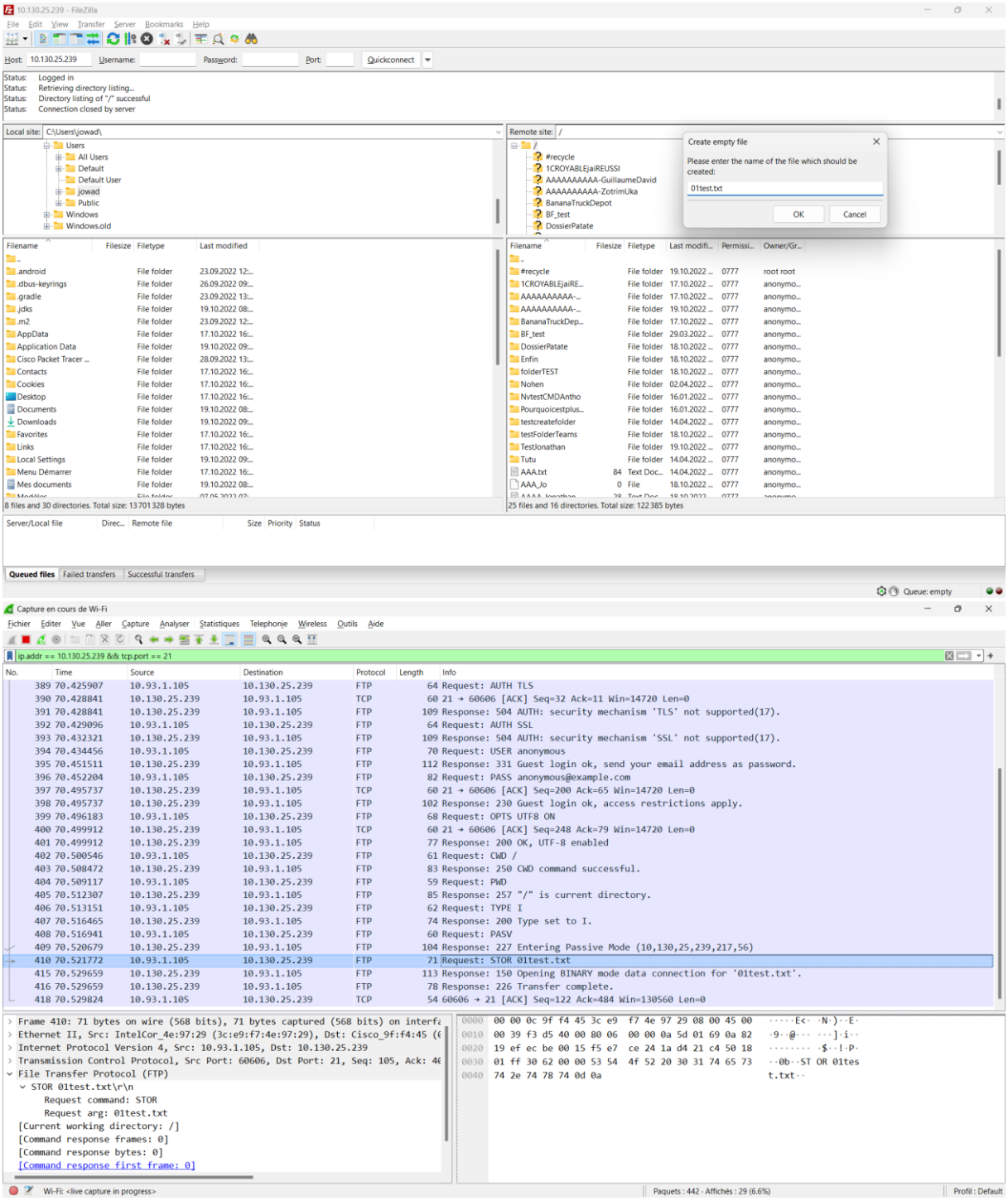
Wireshark let us know the exchange of requests between the client and the server. In these unsecured exchanges, we find the anonymous connection and the default password, as well as the port, the commands of connection, file listing etc...



Upload and Download a file

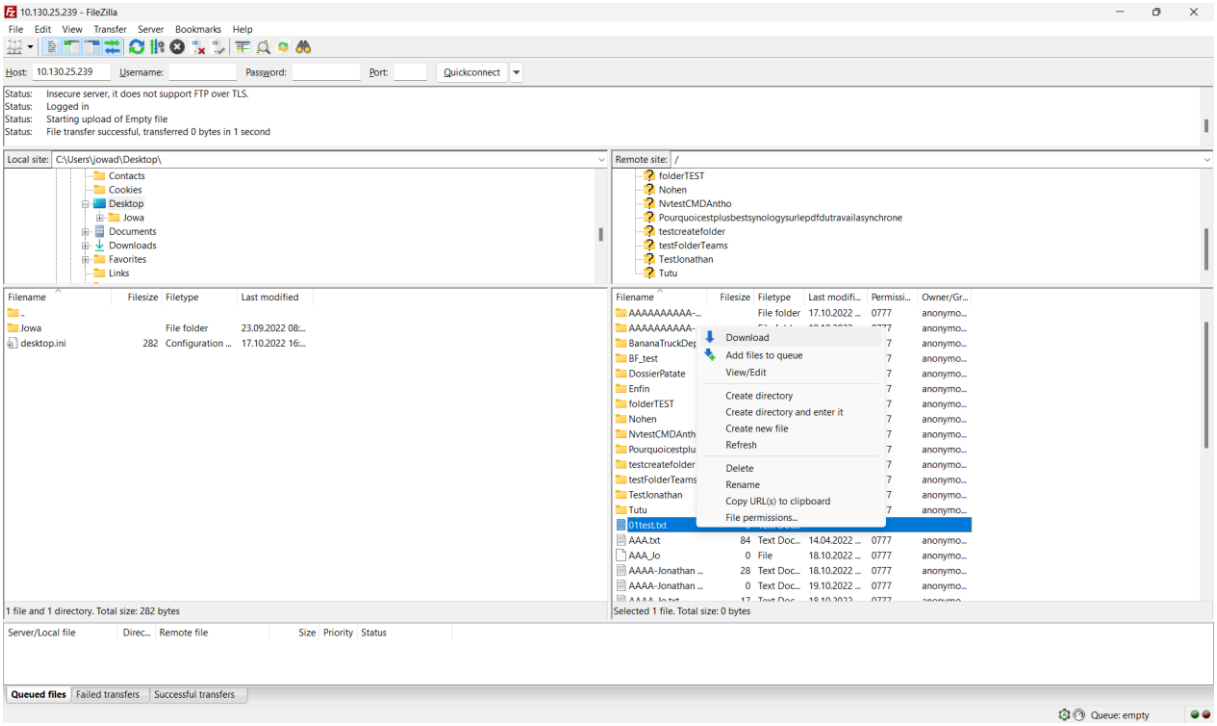
Upload

Create an empty file on the server side as follows and name it 01test.txt. Wireshark will capture this request. In the blue line, selected in the Wireshark image we can see the command "STOR" which allows to create a file on the server side.

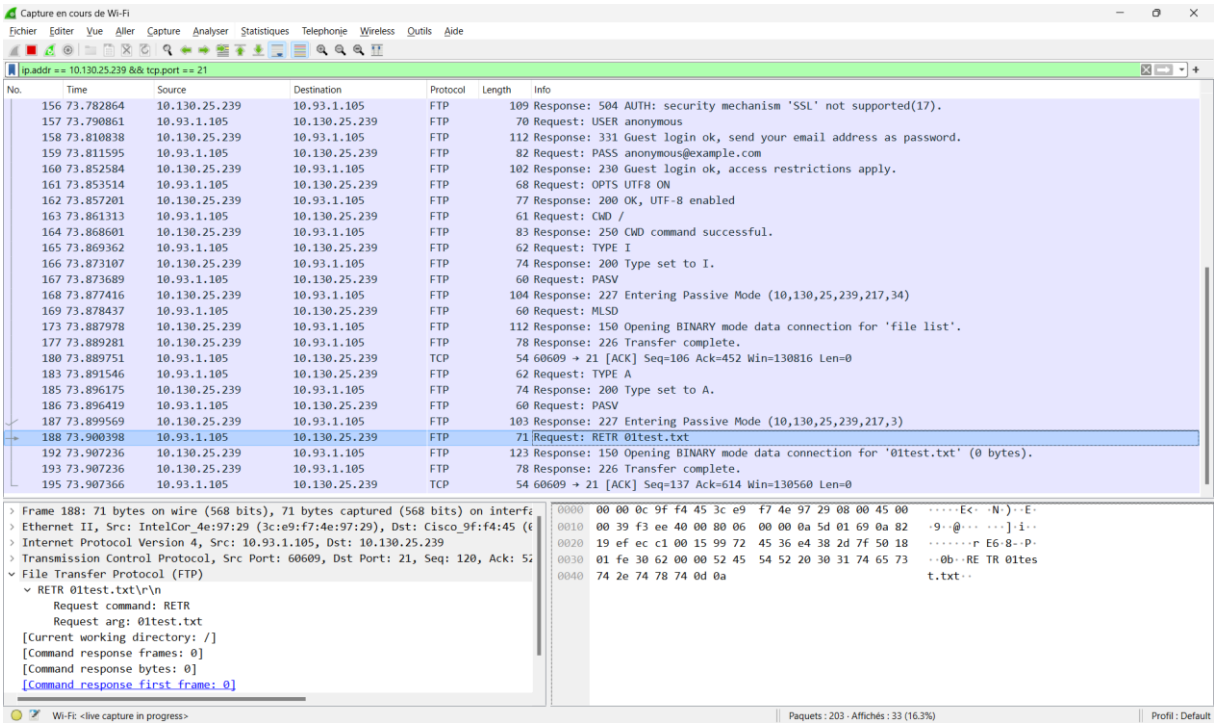


Download

It's pretty much the same for downloading files, we must right click on the server side on the file we have previously created. Then press download. This same file will be uploaded to the client in the current folder on the left side.



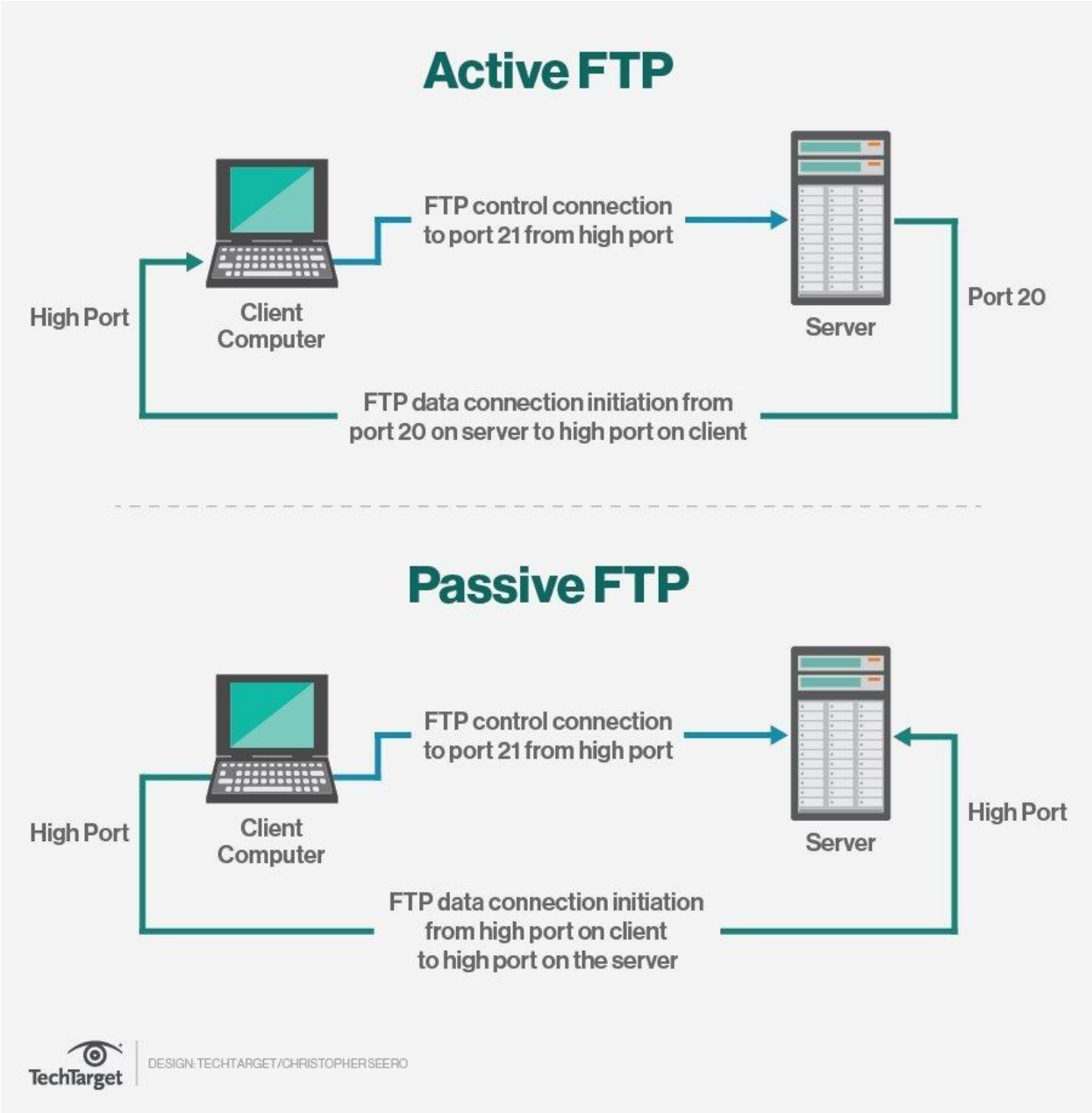
With Wireshark we see in blue the request line with the command "RETR" followed by the name of the file, in our case "01test.txt".



What are active/passive modes[3]

- For the active mode, this was originally the only mode available. The client will first establish a connection to the server with the "ACTV" command on the terminal and send its ports, the FTP server will create a data tunnel to the client and start the transfer.

- In passive mode, the client will have to issue the "PASSV" command and this time the server will send information such as the port to establish a data connection with the server. This method is useful to counteract the firewall which could block incoming connections to the client.



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[3] https://www.techtarget.com/searchnetworking/definition/File-Transfer-Protocol-FTP
[4] https://cdn.ttgtmedia.com/rms/onlineImages/FTP_active_passive.jpg

Data port

I use active mode on FileZilla, so the control port is 21 and the data transfer port is 20. But when in passive mode. When the client sends the command to be in passive then the server responds with this: "227 Entering Passive Mode: (192,168,150,90,195,149).

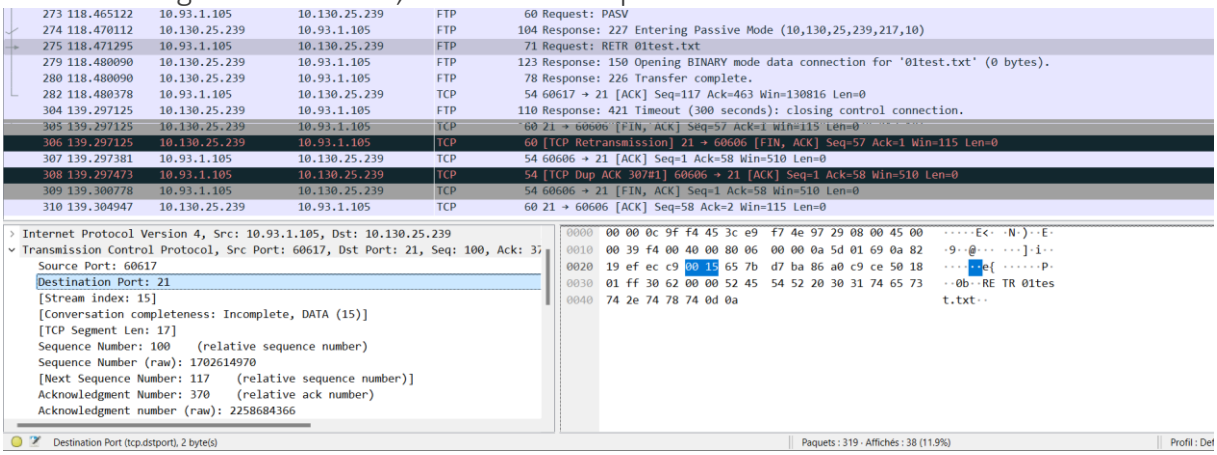
The representation of the parenthesis is (B1, B2, B3, B4, P1, P2), B means Byte so Byte number 1 of the IP address of the server then we have the P's, these are the ports. Here is the calculation so that the client knows which port to connect to and establish a data connection. P1 * 256 + P2, in this example it would be 195 * 256 + 149 = 50'069. So, we have found our port.

```
testbox1: {/home/p-t/slacker/public_html} % ftp -d testbox2
Connected to testbox2.slacksite.com.
220 testbox2.slacksite.com FTP server ready.
Name (testbox2:slacker): slacker
---> USER slacker
331 Password required for slacker.
Password: TmpPass
---> PASS XXXX
230 User slacker logged in.
---> SYST
215 UNIX Type: L8
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> passive
Passive mode on.
ftp> ls
ftp: setsockopt (ignored): Permission denied
---> PASV
227 Entering Passive Mode (192,168,150,90,195,149).
---> LIST
150 Opening ASCII mode data connection for file list
drwx------   3 slacker    users         104 Jul 27 01:45 public_html
226 Transfer complete.
ftp> quit
---> QUIT
221 Goodbye.
```

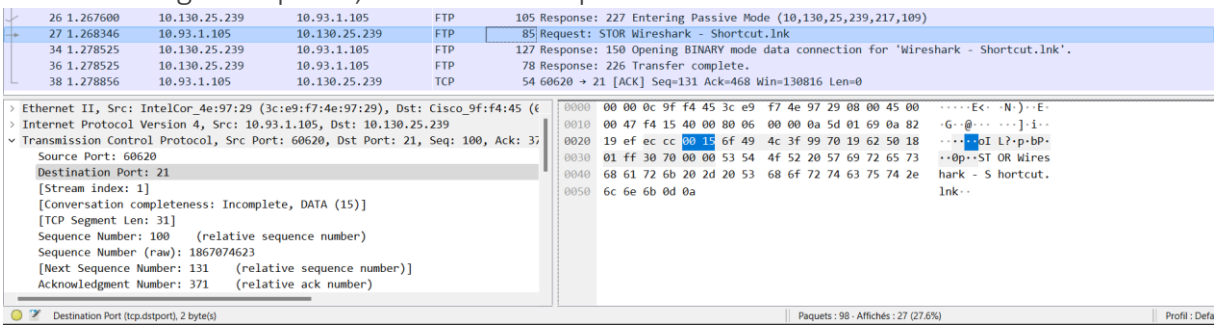
[5]

[5] https://www.cosmos.esa.int/documents/772136/977578/psa_activeVsPassiveFtp.pdf/5e36a7b8-8732-4e65-ab6b-6cf94a742ea6

1. During the Download, which server's port was used to transfer the file.



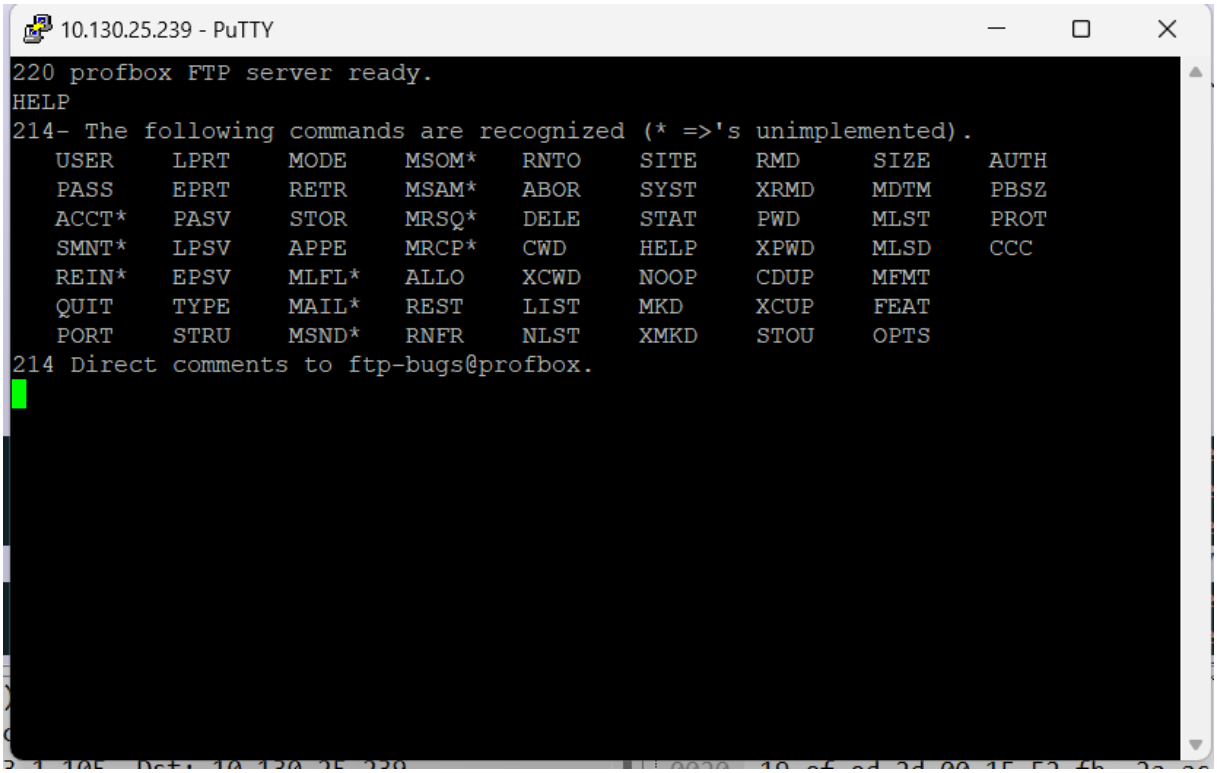
2. During the Upload, which server's port was used to transfer the file.



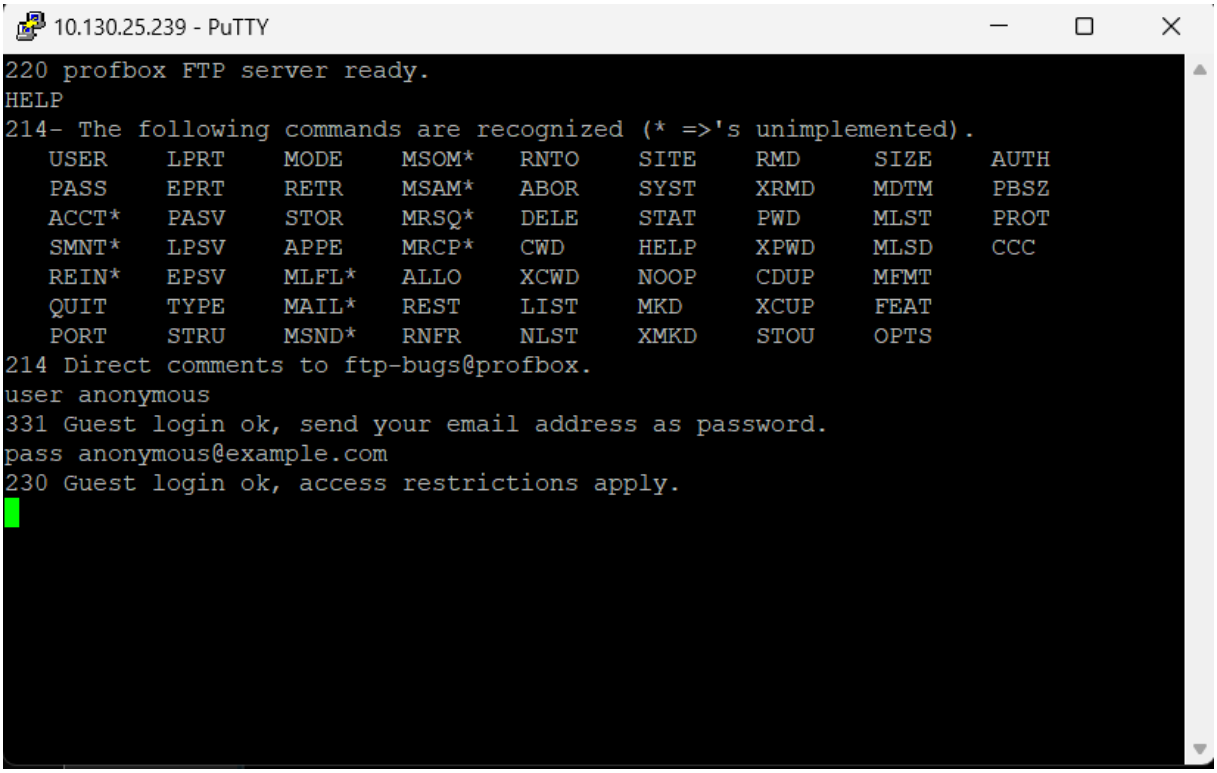
Create a folder

We will create a file on the remote server in the command line. First open PuTTY, and to establish the connection we need to enter the IP address of the server and port 21, then choose the RAW method and finally press connect.

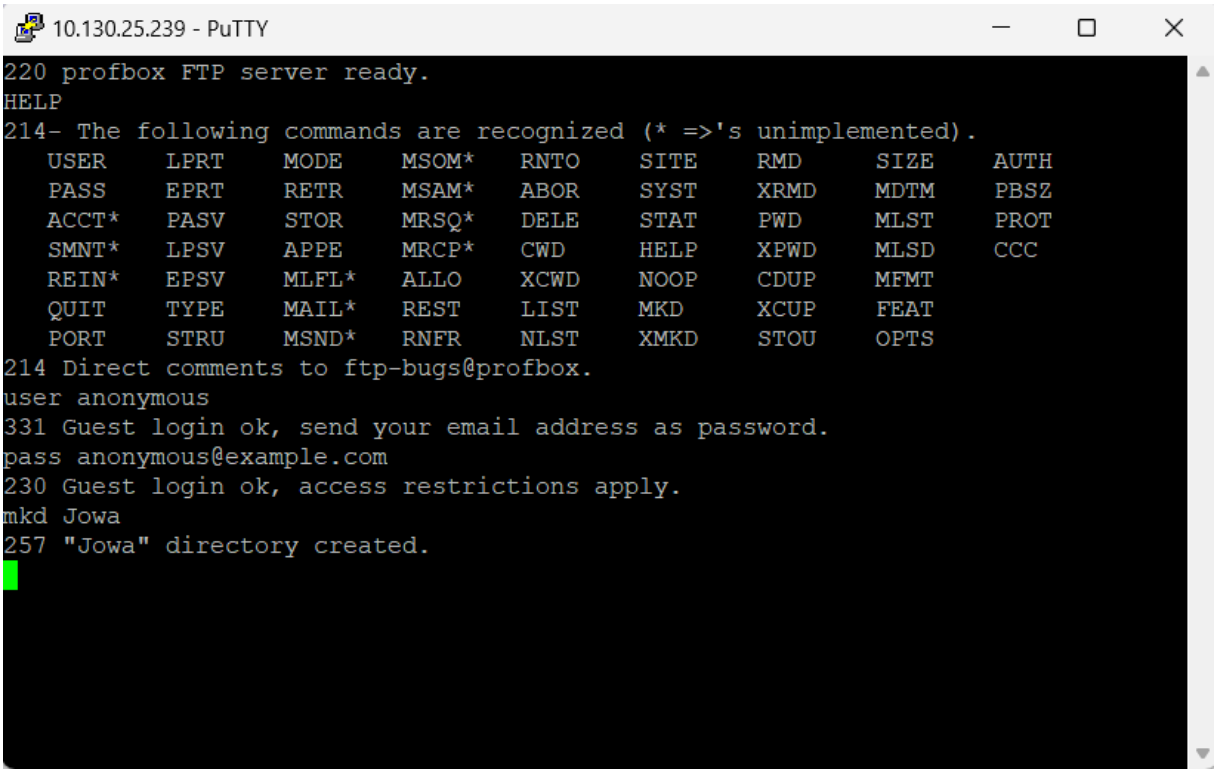
This is what is displayed afterwards. In order to have the rights to create a folder, you will have to do a few things on the command line, first you must authenticate yourself. We will consult the list of commands implemented by the FTP server and enter "help".

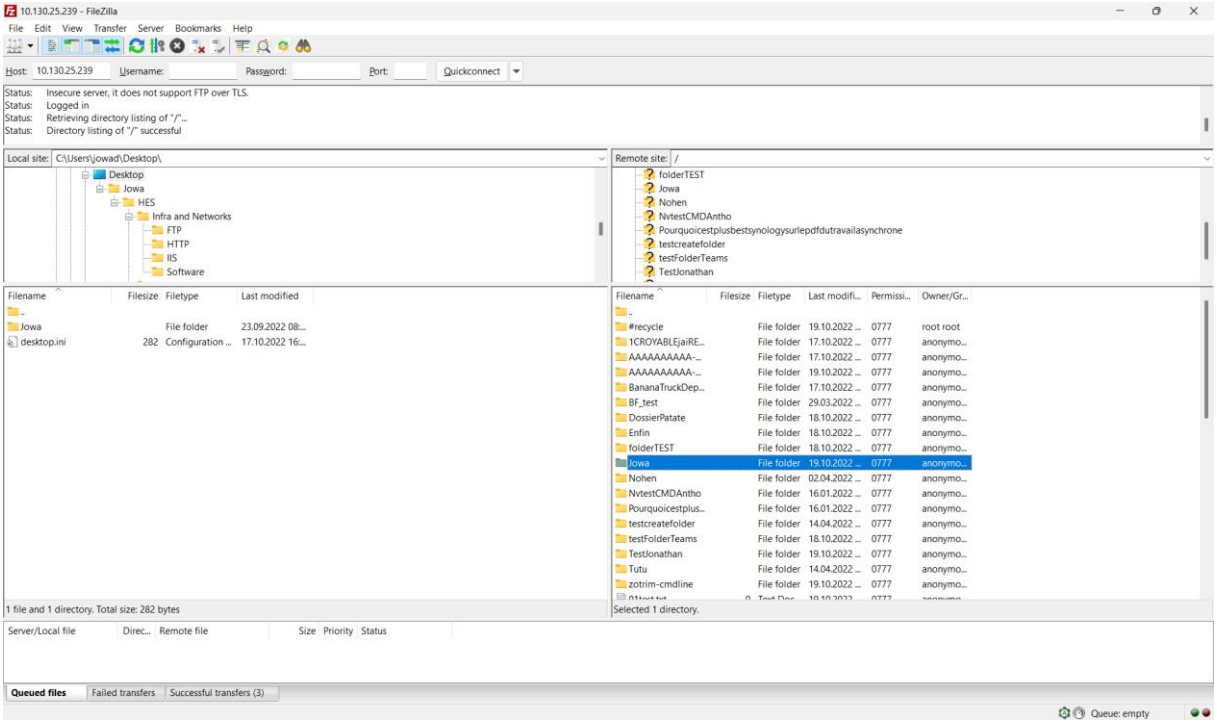


Here is the one we are interested in: So, enter the command "USER anonymous" and then "PASS anonymous@example.com". The user value "anonymous" is mandatory and the password is the one you want.



We are authenticated now we want to create a new folder, the command is “make directory” so mkd followed by the folder name "mkd myFolder". The server replies that the folder has been created successfully! This way we can check if everything went well on FileZilla and if so, the file is present.





Download a file

Downloading is more complicated. We have to go through the same steps as before but with a few more. The connection, then the authentication commands are done as before but we are not going to create a folder this time but to download so for that we are going to put ourselves in passive mode here is the command to send to the server: "pasv". The server answers us, and we have to calculate the port: P1 * 256 + P2 = 217 * 256 + 21 = 55573.

The PORT verb

A PORT request asks the server to use a different mechanism of creating a data connection: the server makes a TCP connection to the client.

The PORT request has a parameter in the form

`h1,h2,h3,h4,p1,p2`

meaning that the client is listening for connections on TCP port `p1`*256+`p2` at IP address `h1.h2.h3.h4`. (The RFC 959 formal syntax does not allow any of these numbers to be 0. The formal syntax is wrong.)

The server normally accepts PORT with code 200. If the server was listening for a connection, it stops, and drops any connections already made.

The server does not connect to the client's port immediately. After the client sends RETR and after the server sends its initial mark, the server attempts to connect. It rejects the RETR request with code 425 if the connection attempt fails; otherwise it proceeds normally.

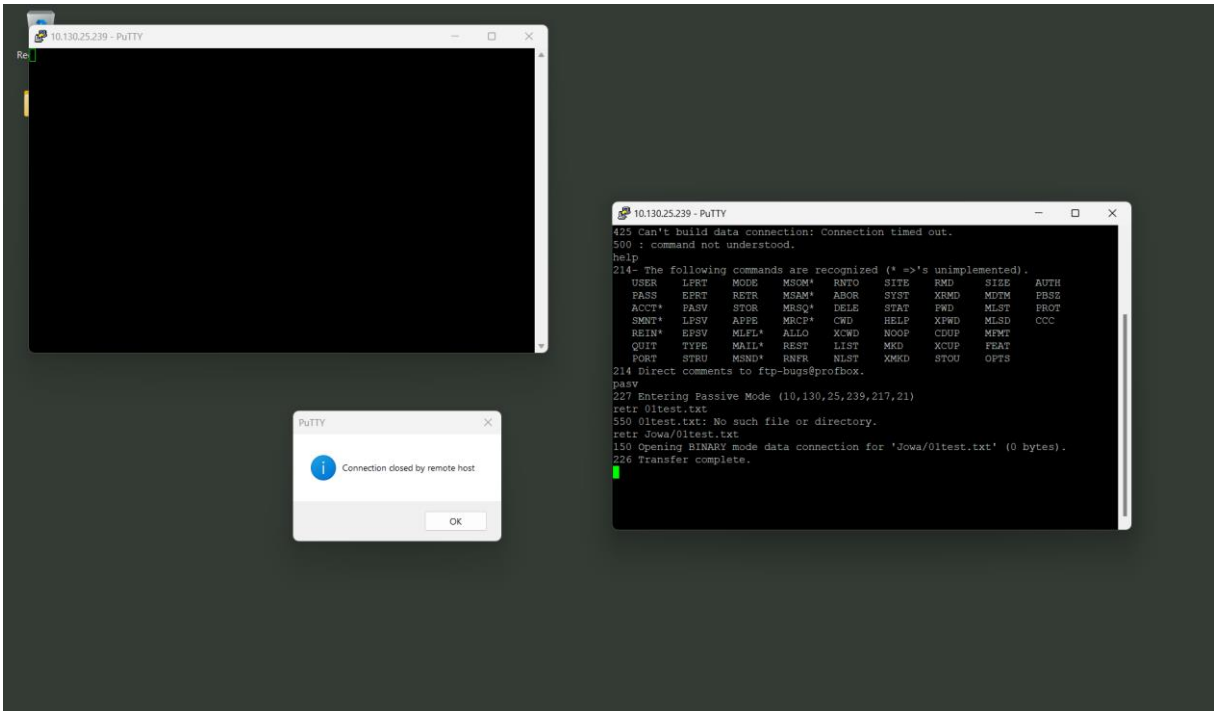
In theory, the client can send RETR without a preceding PORT or PASV. The server is then supposed to connect to port 20 at the client's IP address. In practice, however, servers refuse to do this.

For security reasons, clients should never use PORT. However, some clients still rely on PORT, and will give up on a file transfer if PORT is rejected. My current recommendation is that servers continue to support PORT.

[6]

We must use the "retrieve" command followed by the name of the file to download so that the server understands and listens, waiting for a connection from the client, therefore "retr 01test.txt" and press the "Enter" key. At this time, we must create a second tunnel to receive the file and for this we will create a second PuTTY session.

So, we launch a second PuTTY process, and we enter the IP address and the port calculated previously, 55573. With the RAW connection method and finally press connect. A new window opens and initializes the connection. If the window disappears, it means that the passive mode is not activated or that the port calculation is incorrect or that you went too slow between the "retr 01test.txt" command step of the first session and the opening of the second session.



[6] https://cr.yp.to/ftp/retr.html

Upload a file

The process for uploading is the same as the download step and moreover we can directly write in the second window the content of the file to be uploaded. The command to send our file is "stor 02test.txt".

When the second window is open you can write whatever you want, and the data is transferred when this same window is intentionally closed.

You can then for all exercises check your terminal actions on the FileZilla interface. So, you can see that the file has been sent!