Vulnerabilità e Difesa dei Sistemi Internet

A.K.A. ETHICAL HACKING

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Vulnerabilità e Difesa dei Sistemi Internet

UNDER THE HOOD OF APPLICATIONS

What does it happen really on Internet?

Internet

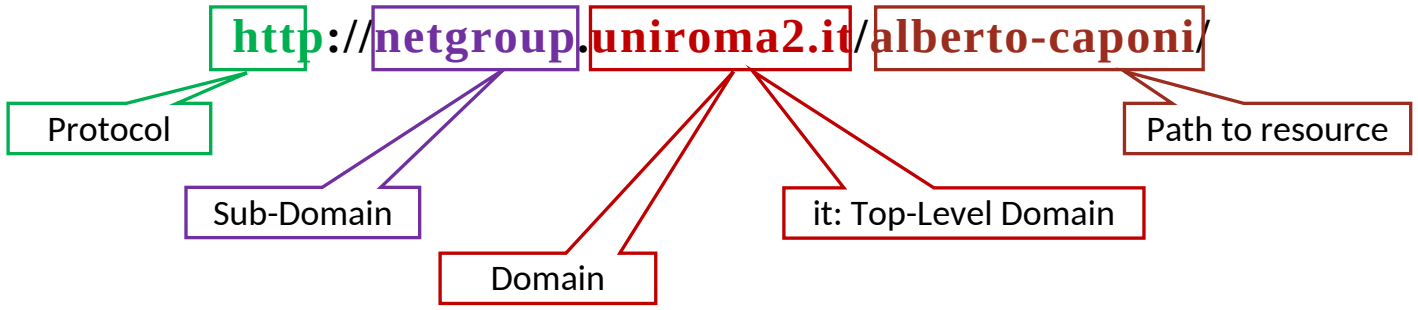
Client
(your devices)

Server
(google, facebook, etc.)

What a web page is?

a resource (i.e a file), specified by a
URL: Uniform Resource Locator.

e.g. my home page:



URL’s components

Protocol (also called “scheme”)
- How can the web resource be accessed?

http, https, ftp, …

Domain name
- Where is the page located?

google.com, …

Sub-Domain
- In which specific host of the domain?

netgroup, www, …

Resource Path
- Which is the specific path/name of the resource?

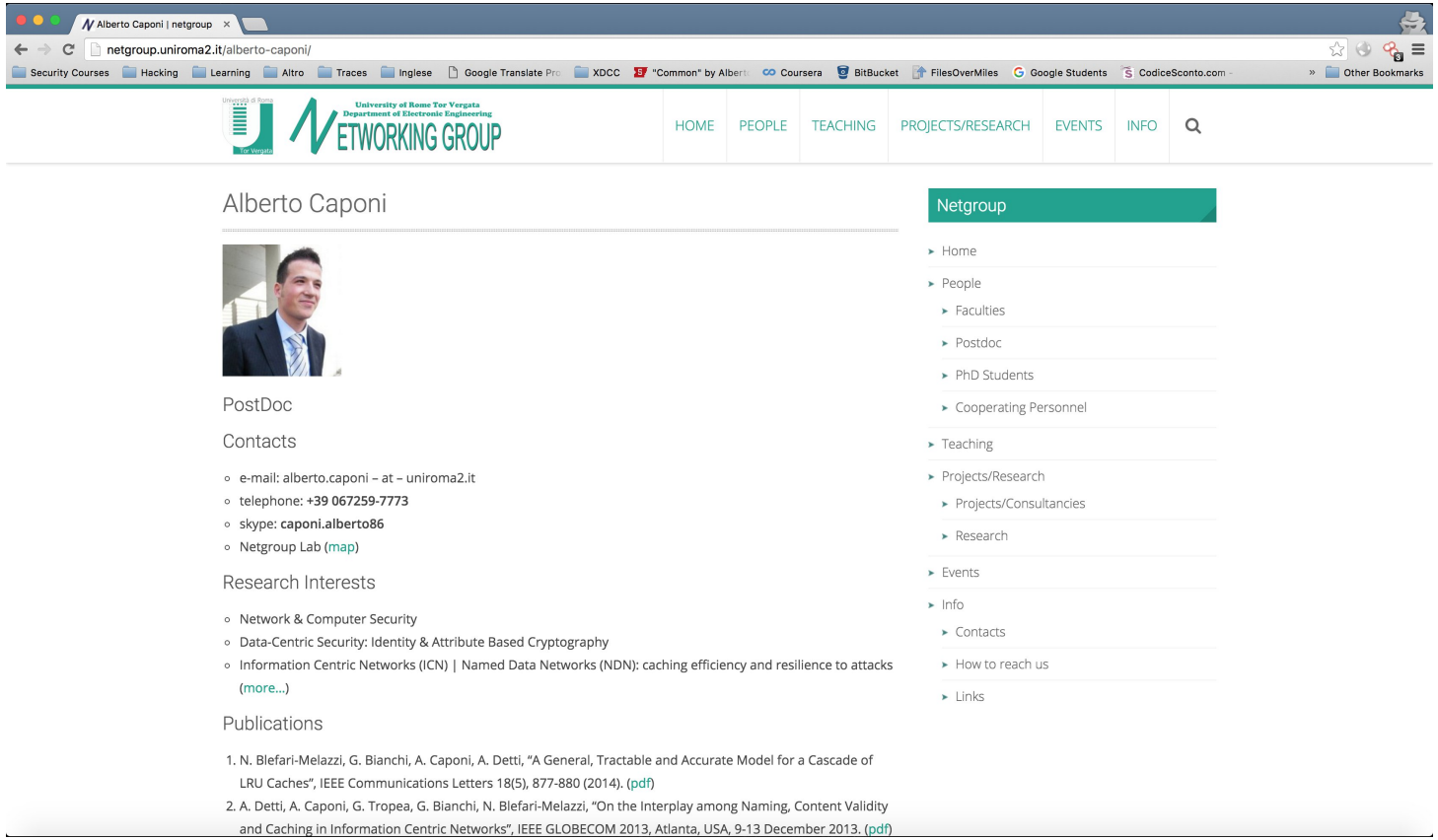
index.html, home.php, …

URL Parameters: /login.php?user=alberto&pass=1234

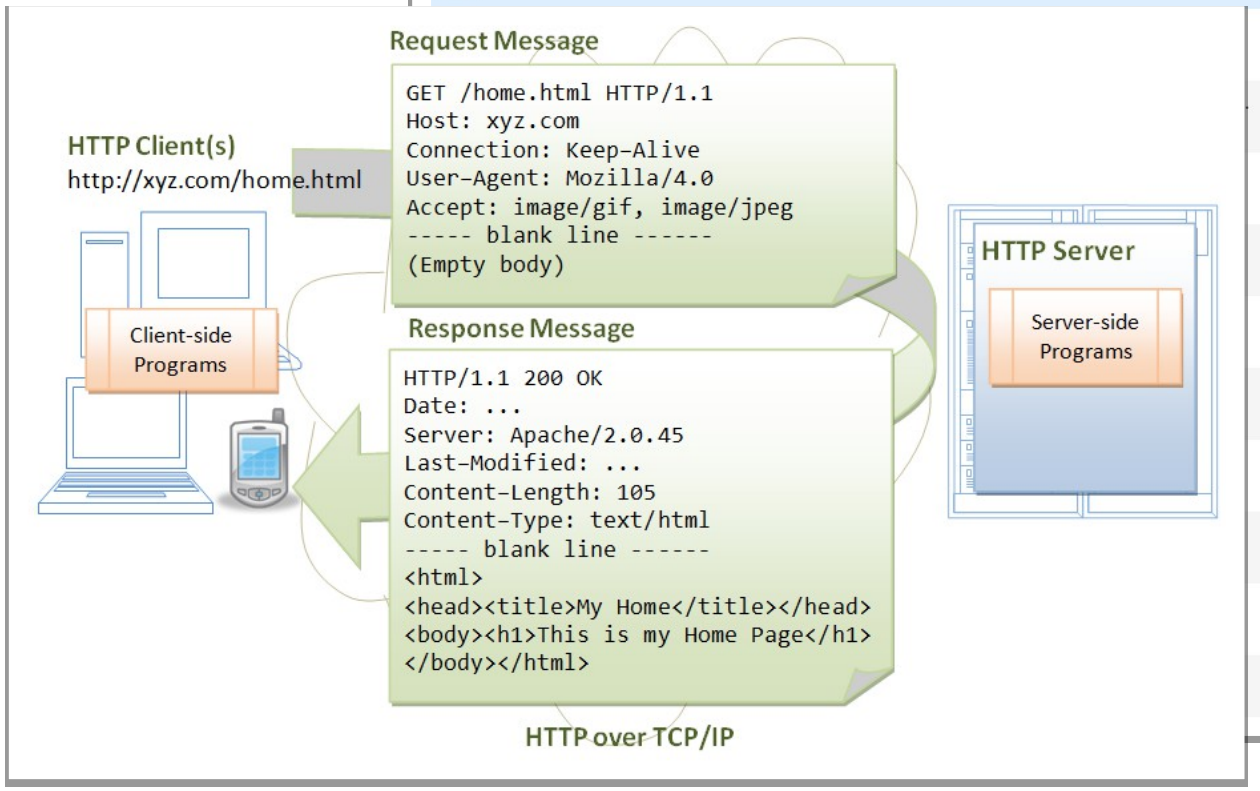
What a protocol is?

- A common language between client and server that defines:
  - A common set of rules & messages that allow the client to be understood by the server:
    - Web —> HTTP
    - E-mail —> SMTP
    - File Transfer —> FTP
    - …

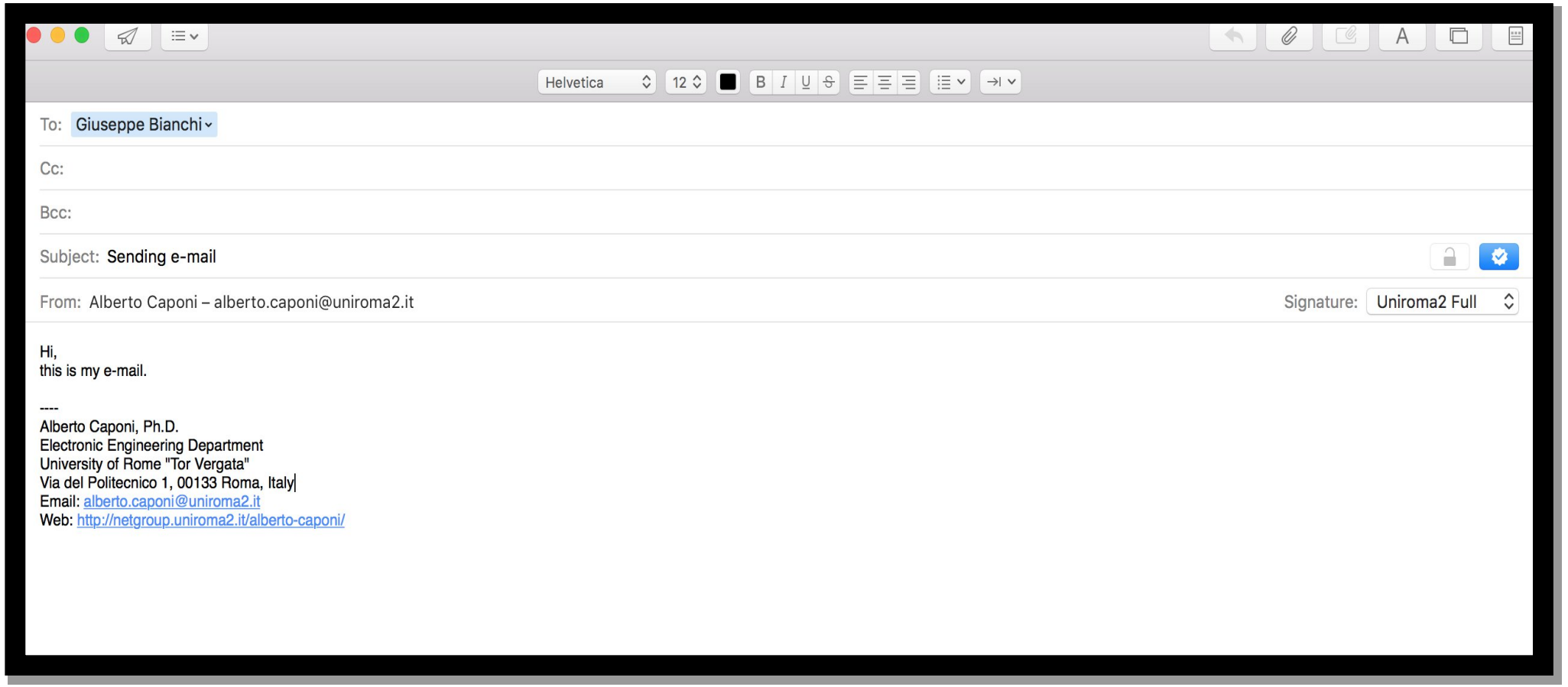
HTTP Protocol



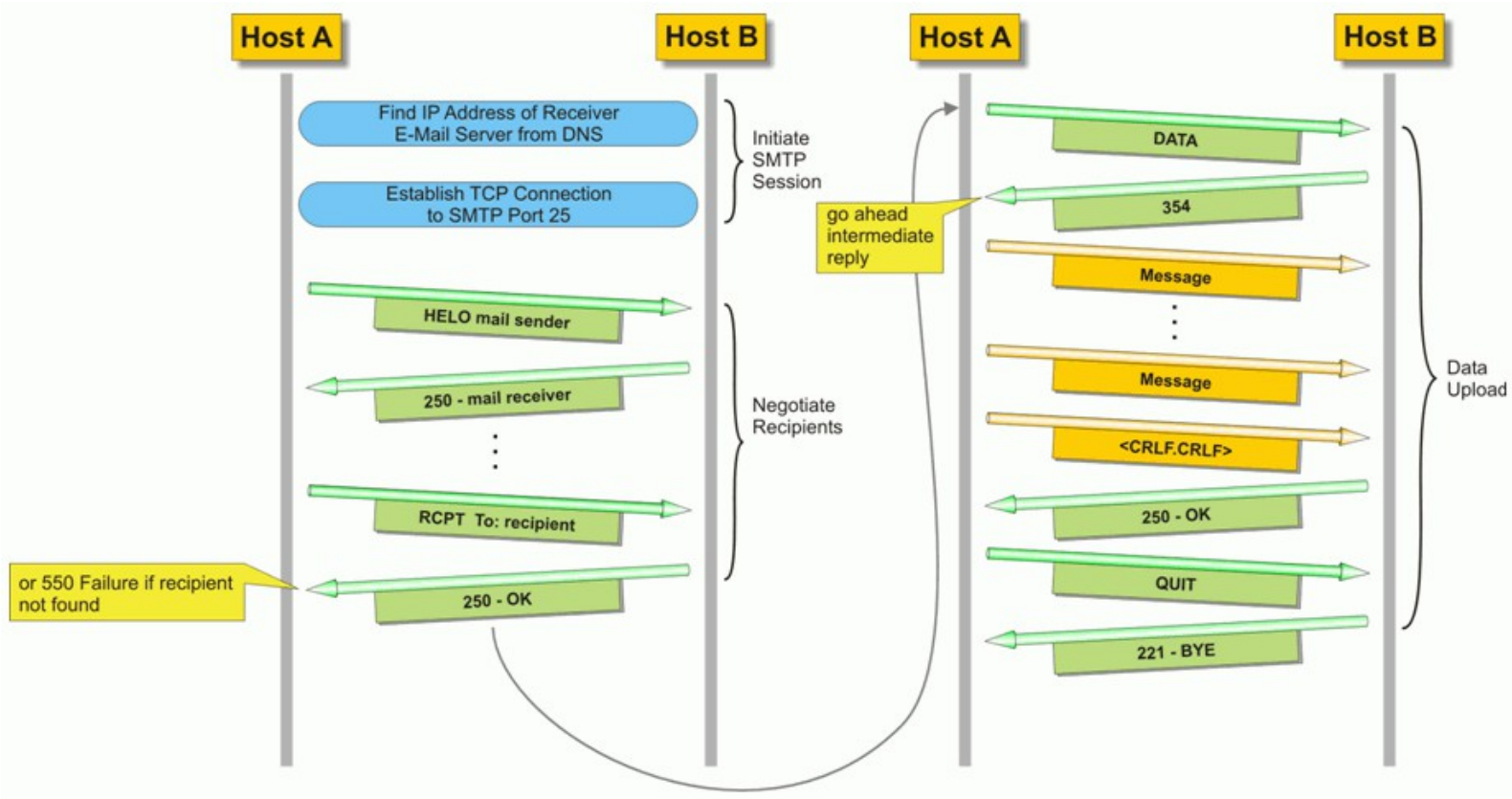
HTTP Protocol: under the hood



SMTP Protocol



SMTP Protocol: under the hood



Applications manage protocols

```
macbook-markin:~ markin$ telnet netgroup.uniroma2.it 80
Trying 160.80.221.15...
Connected to netgroup.uniroma2.it.
Escape character is '^]'.
GET /alberto-caponi/ HTTP/1.1
Host: netgroup.uniroma2.it
```

Applications manage protocols

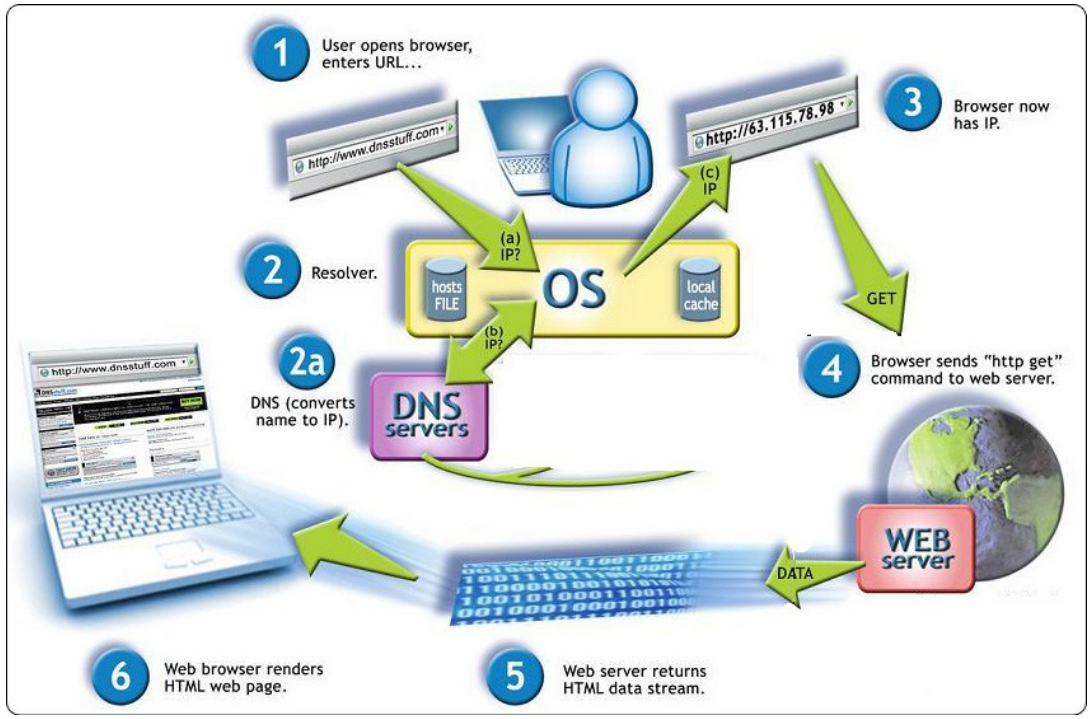
```
macbook-markin:~ markin$ telnet smtp.uniroma2.it 25
Trying 160.80.6.23...
Connected to smtp.uniroma2.it.
Escape character is '^]'.
220 smtp-2015.uniroma2.it ESMTP Sendmail 8.14.4/8.14.4/Debian-8; Mon, 15
IL)-[160.80.103.191]
HELO uniroma2.it
250 smtp-2015.uniroma2.it Hello [160.80.103.191], pleased to meet you
MAIL FROM:<giuseppe.bianchi@uniroma2.it>
250 2.1.0 <giuseppe.bianchi@uniroma2.it>... Sender ok
RCPT TO:<alberto.caponi@uniroma2.it>
250 2.1.5 <alberto.caponi@uniroma2.it>... Recipient ok
DATA
354 Enter mail, end with "." on a line by itself
FROM: Giuseppe Bianchi <giuseppe.bianchi@uniroma2.it>
TO: Alberto Caponi <alberto.caponi@uniroma2.it>
Reply-To: Giuseppe Bianchi <attacker@foo.com>
SUBJECT: [URGENT] I lost my Credit Card!
Please Alberto,
send me your credit card data. I lost mine and need it urgently!

Best Regards,
GB
.
250 2.0.0 u1FHXpT8000719 Message accepted for delivery
quit
221 2.0.0 smtp-2015.uniroma2.it closing connection
Connection closed by foreign host.
macbook-markin:~ markin$
```

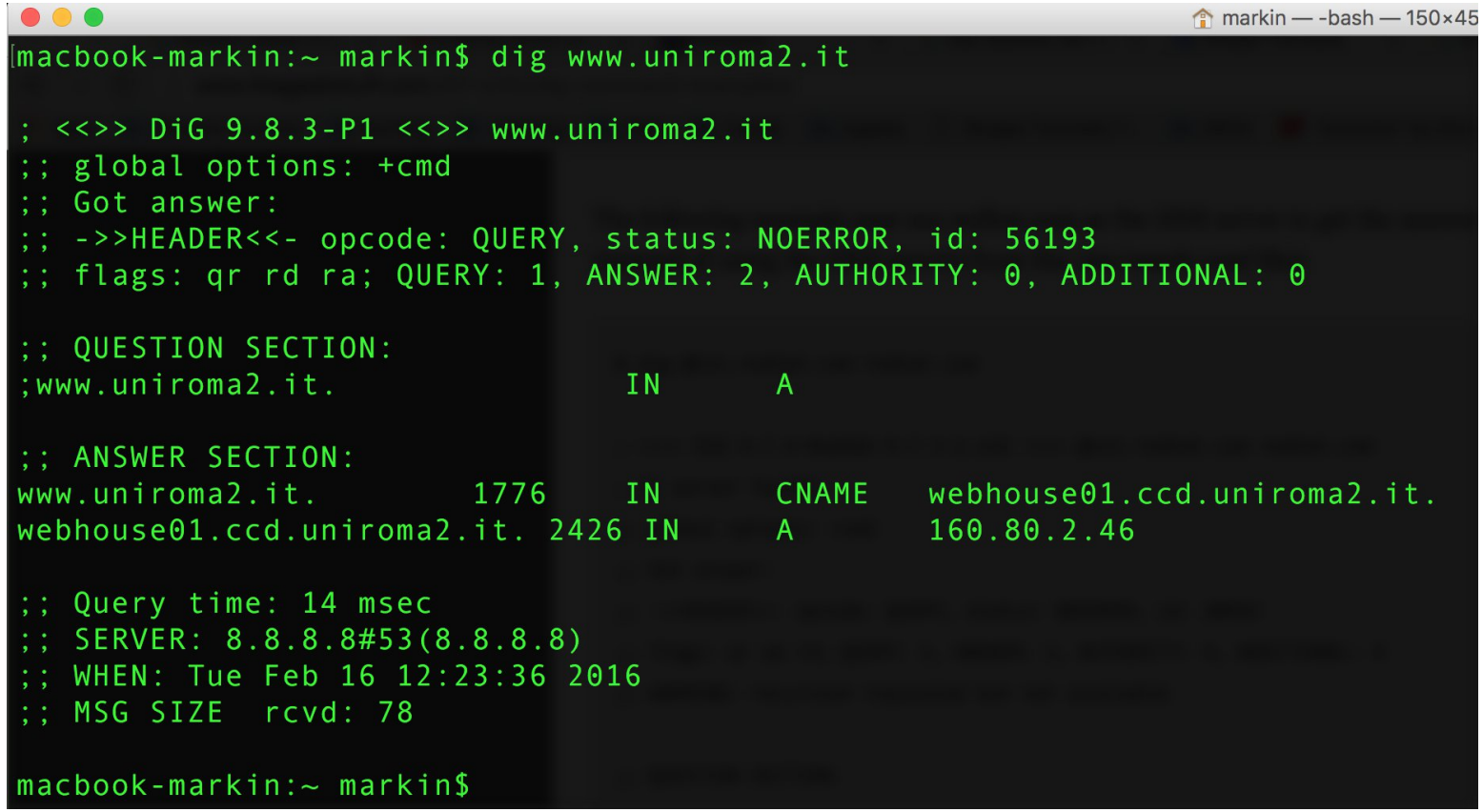
Domain name is translated to number

We need the exact address of the resource's server

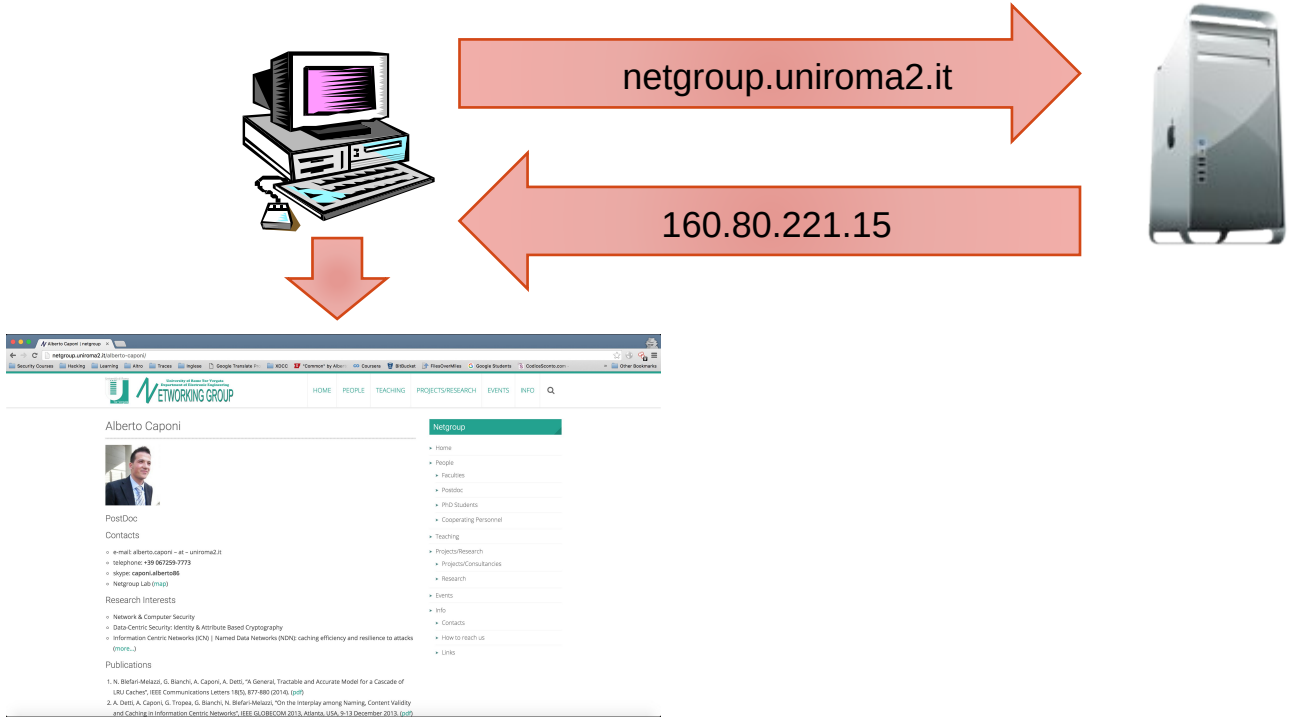
- Should be unique in the World!
- Humans remembers strings but…machines likes numbers!



Domain name is translated to number



Domain Name System

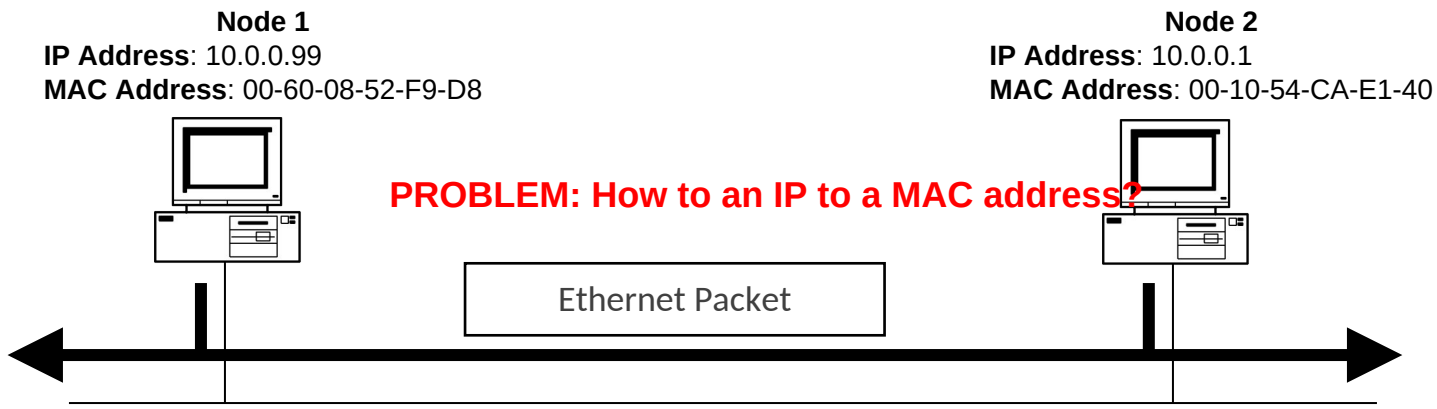


IP or MAC addresses?

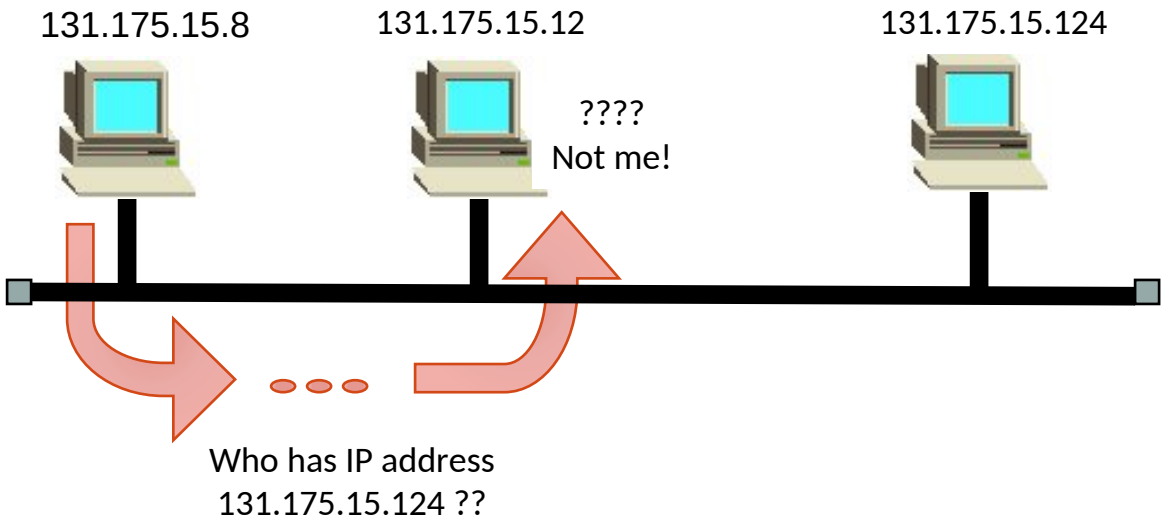
Physical Networks don’t uses IP addresses

- IP address depends on the network you are connected to!
- What if you move from that network to another one?

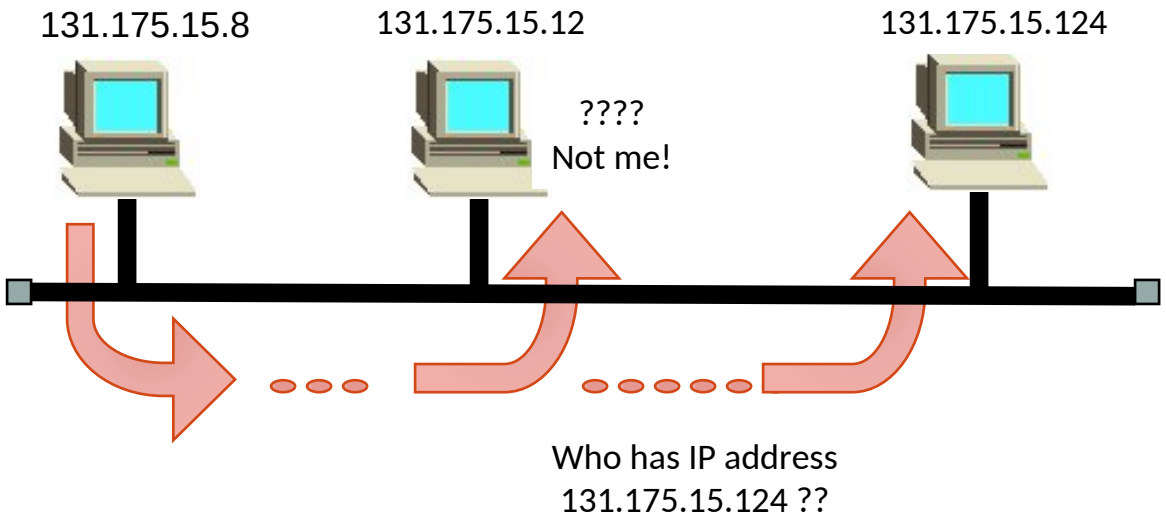
Needs to use the pre-stamped address of your network card: MAC address!



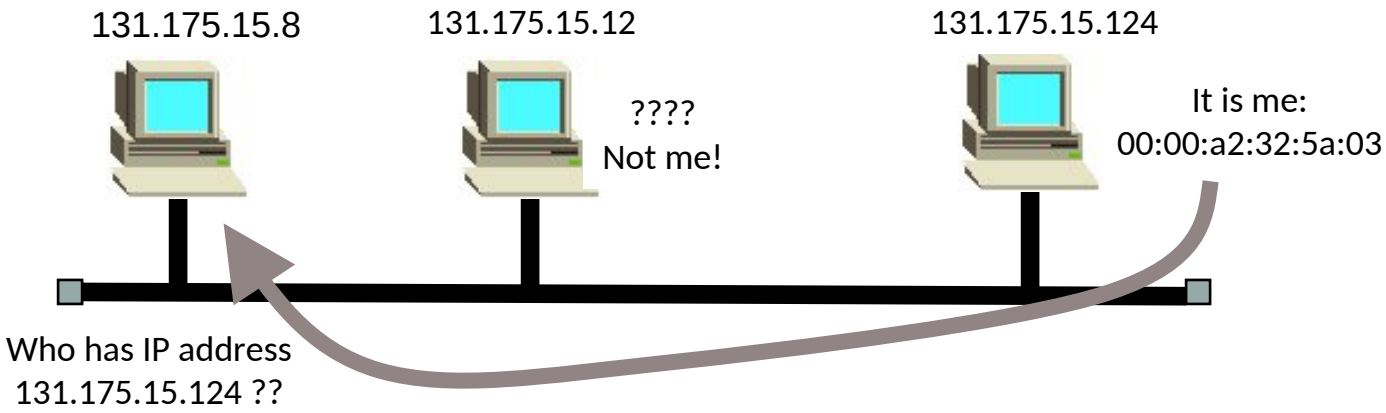
Address Resolution Protocol



Address Resolution Protocol



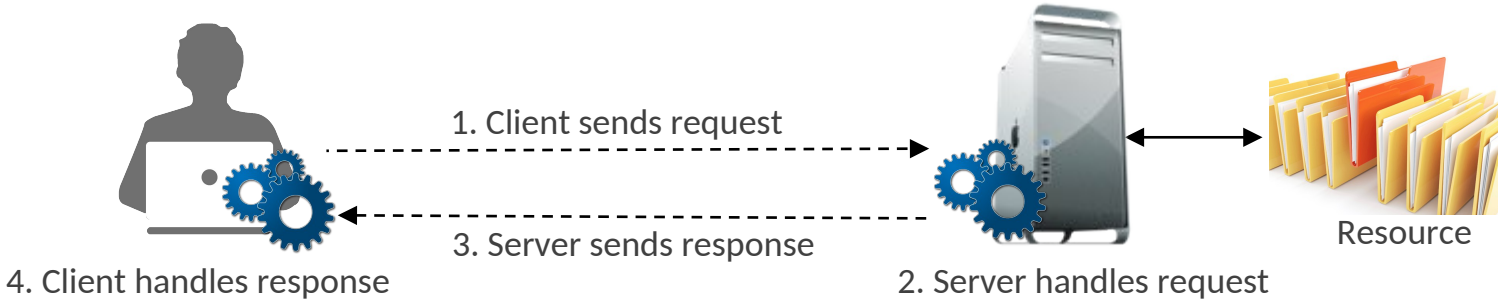
Address Resolution Protocol



Client-Server Model Overview

Client asks (*request*) ⇨ *Server provides (response)*

Typically: single server - multiple clients



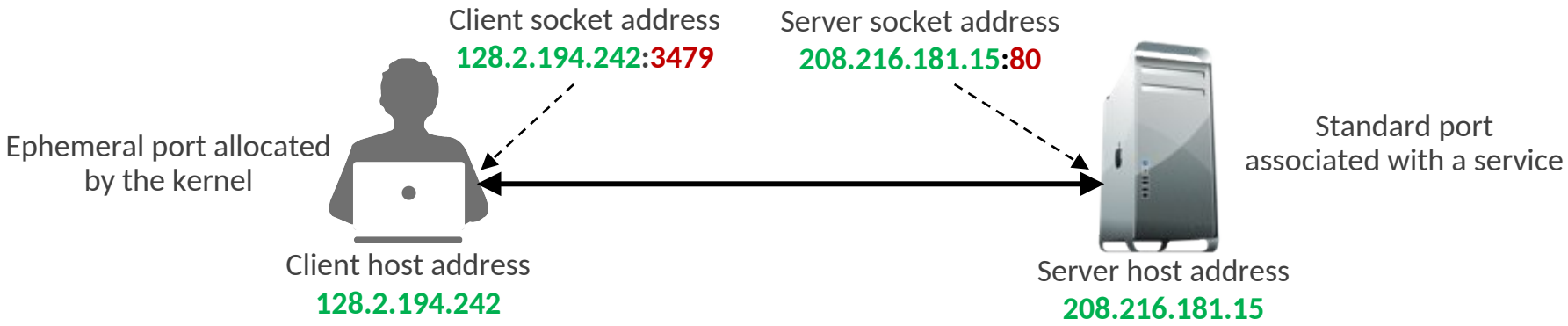
Clients and servers are processes running on physical host machines

Client-Server Model Overview

Address the machine on the network
- By IP address

Address the process
- By the “port” number

The pair of IP-address + port – makes up a “socket-address”



Client

Examples of client programs

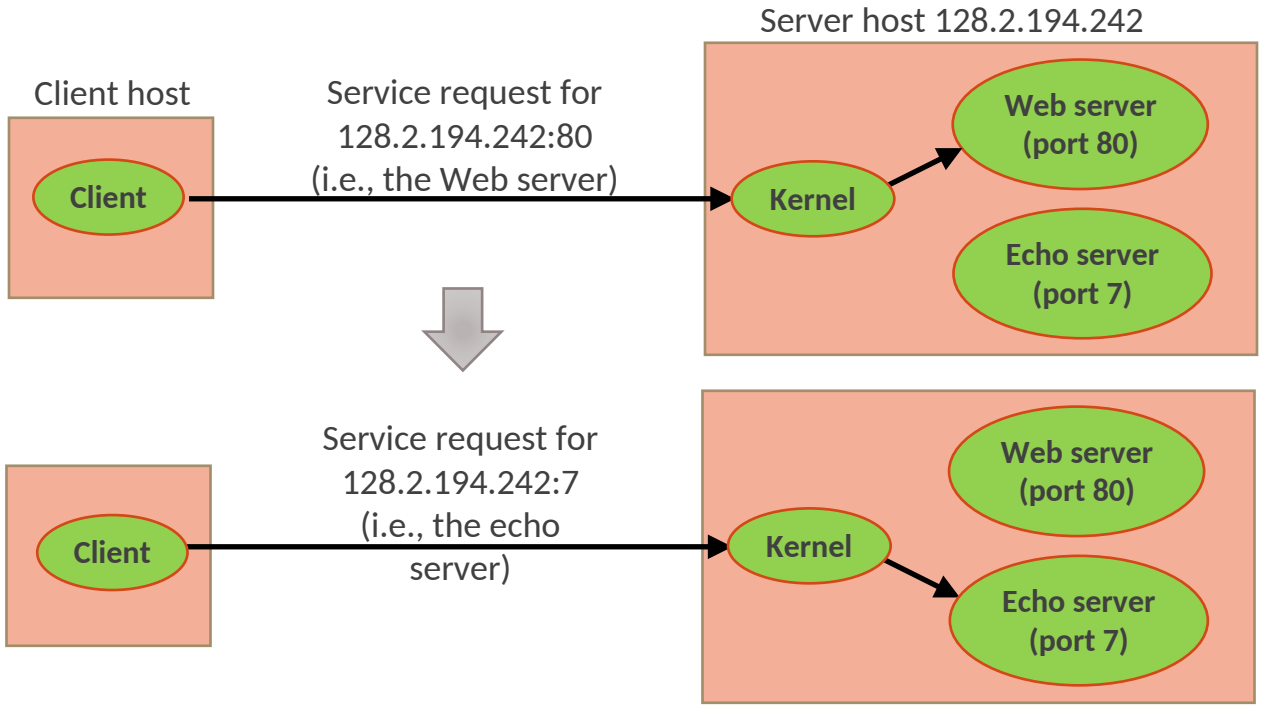
- Web browsers, ftp, telnet, ssh

How does a client find the server?

- The IP address in the server socket address identifies the physical host
- The (well-known) port in the server socket address identifies the service
  - Implicitly identifies the server process that performs that service

- Examples of well known ports:
  - Port 7: Echo server
  - Port 23: Telnet server
  - Port 25: Mail server
  - Port 53: DNS
  - Port 80: Web server

Using Ports to Identify Services



Vulnerabilità e Difesa dei Sistemi Internet

FIRST HANDS-ON TO KALI & LINUX

Booting up Kali Linux

You can find Kali Linux Virtual Machines at this link

Kali Linux contains over 300 forensics and penetration testing tools
- finding your way around them can be a daunting task at times

The default credentials for the Kali VM are:
- **Username:** kali
- **Password:** kali

The Kali Linux menu presents a large number of tools
- It helps to understand the context and usage of a tool
- Familiarize yourself with the available tools and their categories

Find, Locate, and Which

Prior to using the **locate** utility, we must run **updatedb**

- It builds a local database of all files on the filesystem
- Once the database has been built, **locate** can be used to easily query this database when looking for local files

```
root@kali:~# updatedb
root@kali:~# locate sbd.exe
/usr/share/windows-binaries/backdoors/sbd.exe
```

The **which** command searches through the directories that are defined in the *$PATH* environment variable

- If a match is found, **which** returns the full path to the file as shown below

```
root@kali:~# which sbd
/usr/bin/sbd
```

Find, Locate, and Which

The **find** command is a more aggressive search tool than **locate** or **which**.

- Find is able to recursively search any given path for various files
- It has a lot of options for files attributes
  - E.g. **permissions, owner**

```
root@kali:~# find / -name sbd*
/usr/share/doc/sbd
/usr/share/windows-binaries/sbd.exe
/usr/share/windows-binaries/backdoors/sbd.exe
/usr/share/windows-binaries/backdoors/sbdbg.exe
/usr/bin/sbd
/var/lib/dpkg/info/sbd.md5sums
/var/lib/dpkg/info/sbd.list
```

Find, Locate, and Which

Programs that are configured for SetUID:

- find / -perm -4000 –print

Programs that are configured for SetGID:

- find / -perm -2000 –print

Files that are readable by anyone in the world:

- find / -perm -2 -type f –print

Hidden files:

- find / -name ".*"

bash

Imagine you are tasked with

- finding all of the subdomains listed on the *cisco.com* index page
- find their corresponding IP addresses.

Start by downloading the cisco.com index page using the **wget** command

```
root@kali:~# wget www.cisco.com
--2013-04-02 16:02:56--  http://www.cisco.com/
Resolving www.cisco.com (www.cisco.com)... 23.66.240.170,
Connecting to www.cisco.com (www.cisco.com)|23.66.240.170|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 23419 (23K) [text/html]
Saving to: `index.html'
100%[======================================>] 23,419      --.-K/s   in 0.09s
2013-04-02 16:02:57 (267 KB/s) - `index.html' saved [23419/23419]

root@kali:~# ls -l index.html
-rw-r--r-- 1 root root 23419 Apr  2 16:02 index.html
```

bash

```
root@kali:~# grep "href=" index.html | cut -d "/" -f 3 | grep "\." | cut -d
'"' -f 1 | sort -u
blogs.cisco.com
communities.cisco.com
csr.cisco.com
developer.cisco.com
grs.cisco.com
home.cisco.com
investor.cisco.com
learningnetwork.cisco.com
newsroom.cisco.com
secure.opinionlab.com
socialmedia.cisco.com
supportforums.cisco.com
tools.cisco.com
www.cisco.com
www.ciscolive.com
www.meraki.com
```

netcat

Connecting to a TCP/UDP port can be useful in several situations:

- To check if a port is open or closed
- To read a banner from the port
- To connect to a network service manually

```
root@kali:~# nc -lvp 1234
listening on [any] 1234 ...
10.0.2.15: inverse host lookup failed: Unknown host
connect to [127.0.0.1] from (UNKNOWN) [10.0.2.15] 35336
hi my name is John!
hi my name is Anne!
```

```
root@kali:~# nc 127.0.0.1 1234
hi my name is John!
hi my name is Anne!
```

netcat

```
root@kali:~# nc -lvp 1234 < .ssh/authorized_keys
listening on [any] 1234 ...
10.0.2.15: inverse host lookup failed: Unknown host
connect to [127.0.0.1] from (UNKNOWN) [10.0.2.15] 35330
```

```
root@kali:~# nc 127.0.0.1 1234
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQCu8Ghr7LPQPp0e2yxN+2ALq/LVN3CgGpdwYQ8Yd2/s
GexcCjtwIJMOQOT7/bIAAR3/UQMWjXV+rGtsDgqEctyEBBEIevzE1CmY2Vp13sSWFKxDVvEBBtMDO7Ud
vshzF68TRVMMWZWVOGzDoZZd7mVNgjz6lldSnKtv8rx5SL/uHKQja9SyGuR9JoKa2eNGzrF0KRZLXwwl
HXN5GwmJLA8wIbjQM962IYGhDDjG1xSFfGO15xjabCh7bHtNk3Qb5WRNBBRmTEvlJG6eMokIsW6u6H/9
2sKazemx8MYc+qS88EeYZsy+fW8MyAT0od0m9surajf+tmYim9Rpvn/gu3T7 pentest-env
```

netcat

- Netcat can be used for file transfering too:
  - **Sender side**: nc -w 3 [destination] [port] < [file]
  - **Receiver side**: nc -l -p [port] > [file]

netcat

```
root@kali:~# nc -lvp 1234 -e /bin/bash
listening on [any] 1234 ...
10.0.2.15: inverse host lookup failed: Unknown host
connect to [127.0.0.1] from (UNKNOWN) [10.0.2.15] 35338
```

```
root@kali:~# nc 127.0.0.1 1234
whoami
root
ls
bettercap
Desktop
Documents
Downloads
index.html
Music
Pictures
Public
Templates
Videos
```

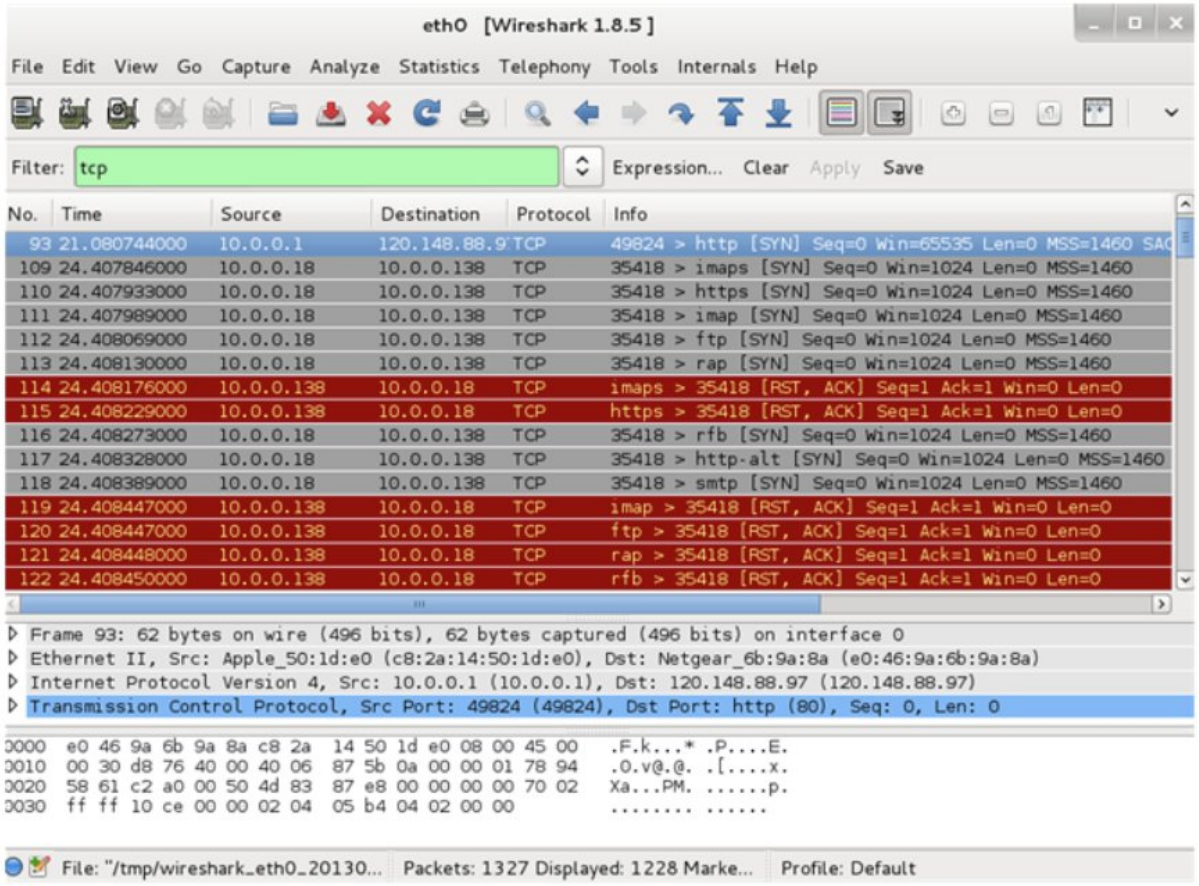
wireshark

Network sniffer like wireshark are useful to:

- Understand a protocol
- Debug a network client
- Analyze traffic in your network

Explore wireshark:

- Capture filters
- Display filters
- Follow streams



tcpdump

We might not have access to GUI network sniffers such as Wireshark:

- We can use the command line **tcpdump** utility

- **tcpdump -r password_cracking_filtered.pcap**
- **tcpdump -n -r password_cracking_filtered.pcap | awk -F" " '{print $3}' | sort -u | head**
- **tcpdump -n src host 172.16.40.10 -r password_cracking_filtered.pcap**
- **tcpdump -n dst host 172.16.40.10 -r password_cracking_filtered.pcap**
- **tcpdump -n port 81 -r password_cracking_filtered.pcap**
- **tcpdump -nX -r password_cracking_filtered.pcap**
- **tcpdump -A -n 'tcp[13] = 24' -r password_cracking_filtered.pcap**
- **tcpdump -A -n -r password_cracking_filtered.pcap | grep "HTTP/1.1 ”**

What happened?

Vulnerabilità e Difesa dei Sistemi Internet

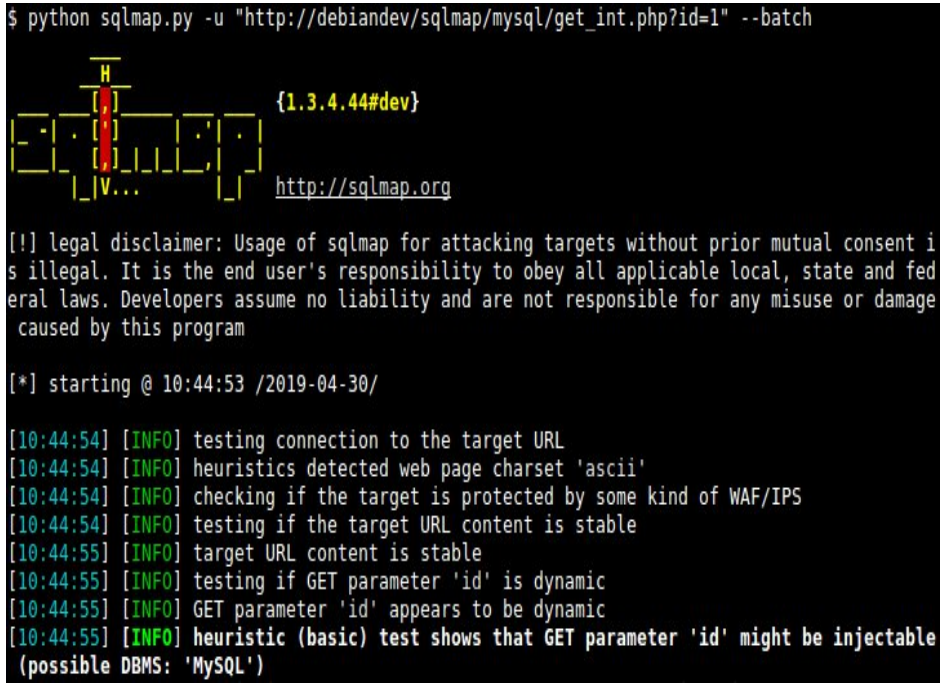
PENTEST FRAMEWORKS - INTRODUCTION

Metasploit framework

- Well known framework, used to generate ***payloads*** that can be used to exploit a particular vulnerability
- Supports payloads and exploits for several protocols, languages and frameworks such as:
  - HTTP/s
  - MySQL
  - SSH
- Furthermore, it allows the generation of automatic artifacts such as ***bind/reverse shell*** for Linux/Windows etc…
- **Won't be allowed at the exam!**

SQL Map

- Useful framework for the testing and automation of ***SQL injections***
- Support for more or less every kwown database (both commercial and none):
  - MySQL
  - Oracle
  - PostreSQL
  - Microsoft SQL Server
  - …
- Open source, can be downloaded here
- **Won't be allowed at the exam!**

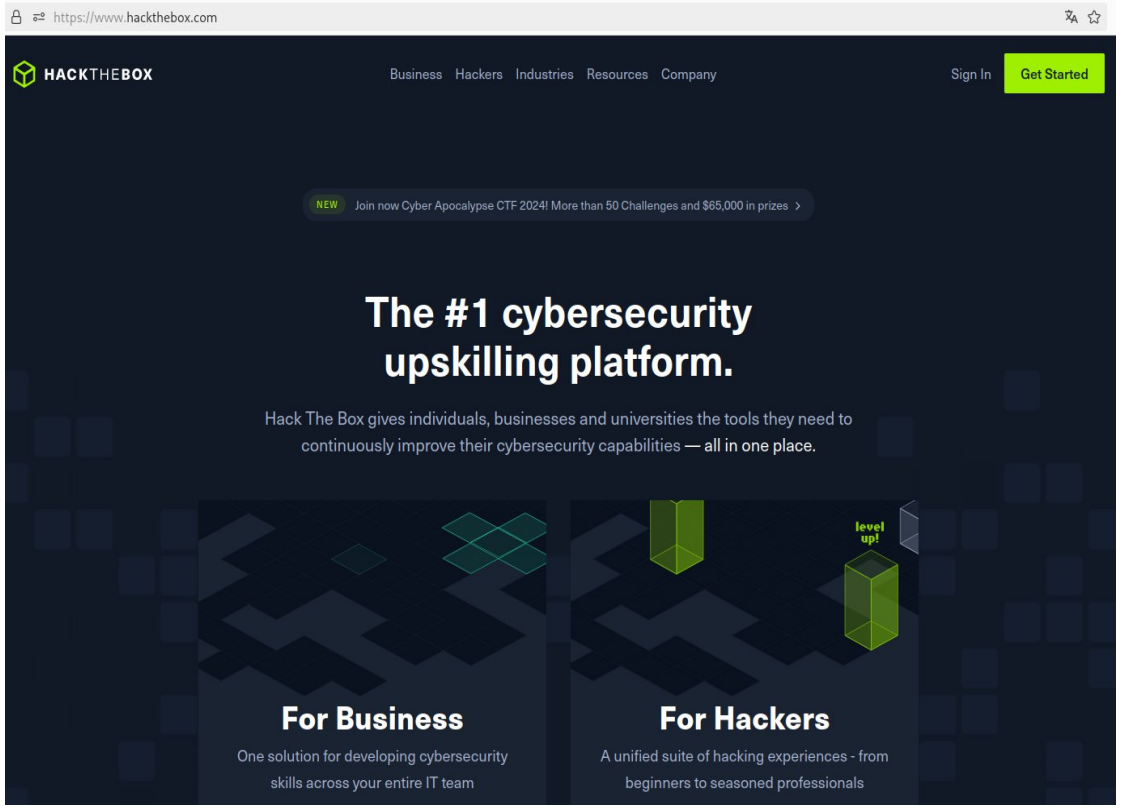


Vulnerabilità e Difesa dei Sistemi Internet

TRAINING PLATFORM

Hack the box

- The most well known platform for penetration testing training
- In the last years, it also offers an ***academy program***
- Where to register:
  - Hack the box
  - Hack the box academy: you can find training modules under "**All modules**"



Try hack me

- Similar to hack the box
- Certification program, certificates can be earned (there's a fee to pay for exam access)
- Where to register:
  - Try hack me registration

FYI

- At the end of the course, your Hack the box and Try hack me profiles will be evaluated
- If you did enough training and machine solves, there could be **bonus points** on the final exam vote ☺

Conclusion

THAT ALL FOLKS!

Thank you for your attention 😄 !