

V-ReseArch^{edu}

Research & Development for Cybersecurity Engineering

Head count

- | | |
|-----------|------------|
| 1. Name 1 | 11.Name 11 |
| 2. | 12. |
| 3. | 13. |
| 4. | 14. |
| 5. | 15. |
| 6. | 16. |
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| 9. | 19. |
| 10. | 20. |
| | 21. |
| | 22. |

Web Cybersecurity – L0

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<https://v-research.github.io/edu/>

Agenda

An introduction to Cybersecurity [theory 1h]

- #whoami & course overview
- Beliefs on Cybersecurity
- Infosec and the CIA-triad evolution (1970-today)
- Attacker vs Hacker, Blue and Red Teams, ...
- Hacker Ethics and Laws against Attackers
- Cybersecurity Resources: CVE, CWE, CAPEC, WASC, NVD
- Cybersecurity Resources: OWASP, DEFCON, PHRAK, IEEE S&P

Brainstorming session - what is a cybersecure web app? [lab 1h]

- propose up to 10 keywords related to cybersecurity [15m]
- Proposals Review & Open Discussion [30m]

Coffee break [10m]

Hacking the HTTP [theory 30m + lab 1h30m]

- The WebGoat platform [15m]
- The HTTP protocol and the Client-Server architecture [15m]
- Webgoat lesson (General->HTTPBasic) [1h30m]
- ZAP HUD Tutorial

2012



2013

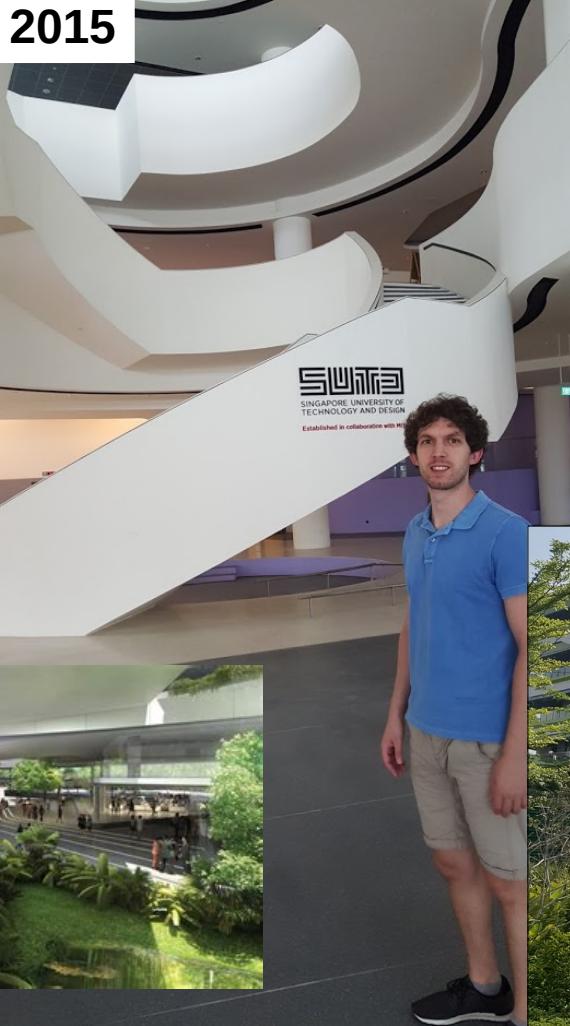


2015





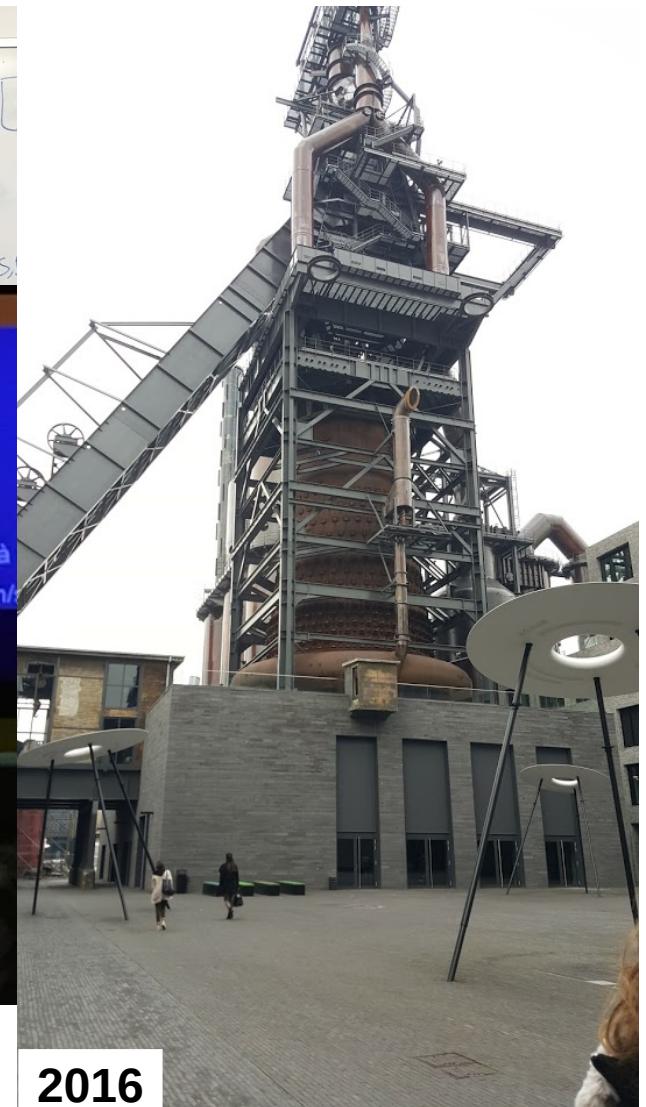
Established in collaboration with MIT





UNIVERSITÉ DU
LUXEMBOURG

SNT
securityandtrust.lu



2018



2018



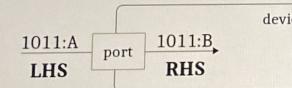
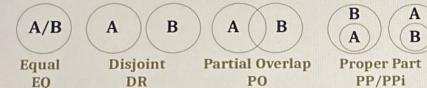
2020@V-Research



Cybersecurity Weakness Prediction (RIDI-Hypothesis)

In the ABF-Framework there exist **3 categories of weaknesses**:

- B/F errors in *behaviors* (functional architecture)
- A/F errors in *communications* (channels)
- A/B errors in *translations* (ports)



V-ReseArch

Given a calc
Connection
over a
category
Each category has 4 weaknesses

RCC Calculus	LHS	RHS
nominal	EQ	$y = x$
replace	DR	$y \neq x$
insert	PP	$y = x \cdot x'$
delete	PPi	$y \subset x$
inject	PO	$y = x' \cdot y', x' \subset x, y' \neq x$



There are other (similar) weaknesses:
Selective drop
Selective drop+insert





MARCONI DAY - 2016/2017

2019



Raspberry Pi – ESP8266

Raspberry Pi

- Mini computer
- Dotato di pin GPIO
- Raspbian Stretch



ESP8266

- Circuito integrato
- Dotato di pin GPIO
- Integra un modulo WiFi
- Buon quantitativo di RAM per l'uso in campo IoT



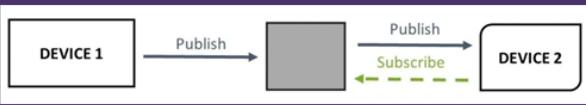
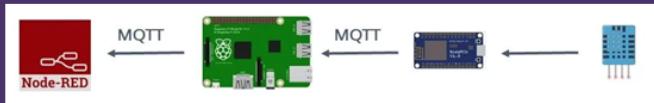
MagicMirror



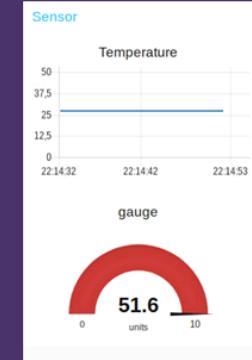
IoT

Publish / Subscribe System

- Un server MQTT riceve, memorizza e rende disponibili i dati
- I client pubblicano dati in determinati «Topic» o vi si iscrivono per visualizzarne il contenuto



```
mqtt_esp8266
74void loop() {
75
76    if (!client.connected()) {
77        reconnect();
78    }
79    if(!client.loop())
80        client.connect("ESP8266Client");
81
82    now = millis();
83    // Publishes new temperature and humidity every 30 seconds
84    if (now - lastMeasure > 10000) {
85        lastMeasure = now;
86        // Readings may also be up to 2 seconds "old" (its a very slow sensor)
87        float h = dht.readHumidity();
88        // Read temperature as Celsius (the default)
89        float t = dht.readTemperature(false);
90
91        // Verifica lettura. Se una lettura fallisce, si esce e si ritenta
92        if (isnan(h) || isnan(t)) {
93            Serial.println("Lettura fallita dal DHT22");
94            return;
95        }
96
97        // Compute temperature values in Celsius
98        float hic = dht.computeHeatIndex(t, h, false);
99        static char temperatureTemp[7];
100        dtostrf(hic, 6, 2, temperatureTemp);
101
102        static char humidityTemp[7];
103        dtostrf(h, 6, 2, humidityTemp);
104
105        // Publishes Temperature and Humidity values
106        client.publish("room/temperature", temperatureTemp);
107        client.publish("room/humidity", humidityTemp);
108
109        Serial.print("Humidity: ");
110        Serial.println(h);
111        Serial.print("Temperature: ");
112        Serial.print(t);}
```



IoT

What is Cybersecurity? Everybody knows vs Nobody knows

*“Those who believe they have discovered it [the truth] are the **dogmatists**”*

Sextus Empiricus, Outlines of Pyrrhonism

“Academics treats it as inapprehensible”

Sextus Empiricus, Outlines of Pyrrhonism

“The skeptics keep on searching”

Sextus Empiricus, Outlines of Pyrrhonism

Cybersecurity

is the protection of computer systems and networks from the theft of or damage to their hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide.

The only truly secure system is one that is **powered off, cast in a block of concrete** and **sealed** in a lead-lined room with armed guards — and **even then I have my doubts.**

[...] things can be declared insecure by observation, but not the reverse. There is no test that allows us to declare an arbitrary system or technique secure. This implies that claims of necessary conditions for security are unfalsifiable.

WIKIPEDIA
The Free Encyclopedia

Eugene H. Spafford
Purdue University

Cormac Herley
Microsoft Research

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Cormac Herley
Microsoft Research



CHOOSE YOUR DESTINY

The CIA-Triad

Let's reason together

How can I use \$RANDOM to choose one of you?

```
> echo $RANDOM  
> 14003
```

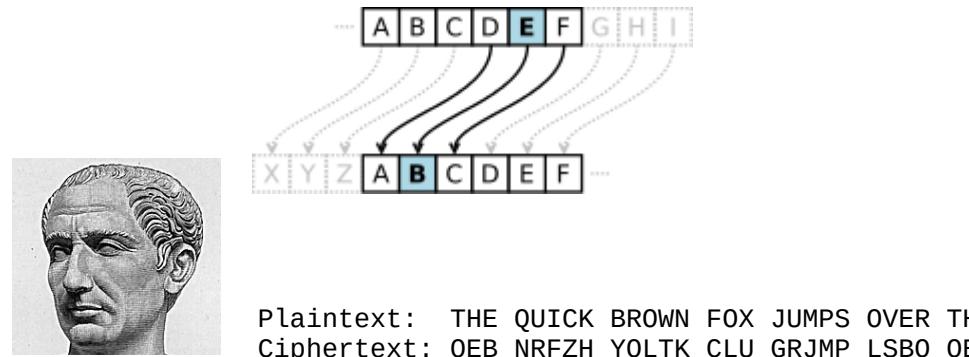
Unauthorized information release (Confidentiality): an unauthorized person is able to read and take advantage of information stored in the computer. This category of concern sometimes extends to “traffic analysis,” in which the intruder only observes the patterns of information use. From those patterns, the intruder can infer some information content. This category also includes the unauthorized use of a proprietary program.

Unauthorized information modification (Integrity): an unauthorized person is able to make changes in stored information – a form of sabotage. It should be noted that in the case of this kind of violation, the intruder does not necessarily see the information he has changed.

Unauthorized denial of use (Availability): an intruder can prevent an authorized user from referring to, or from modifying information, even though the intruder may not be able to refer to, neither modify the information themselves.

Confidentiality

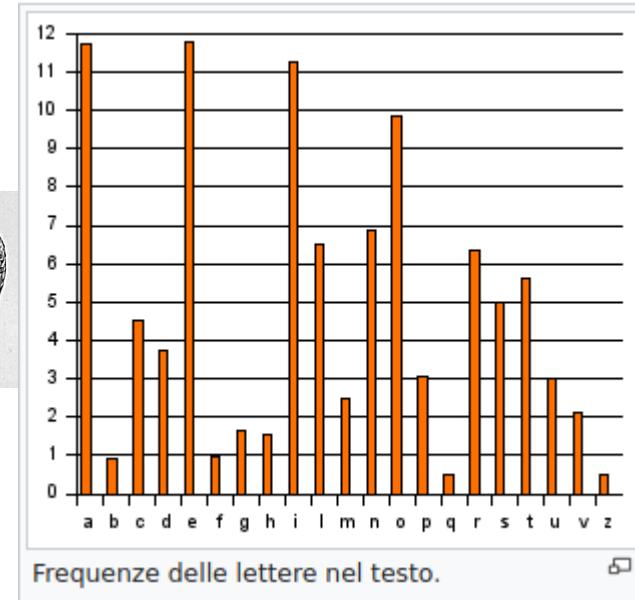
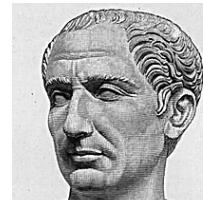
More on this in L3



<https://md5decrypt.net/en/Caesar/>

Confidentiality

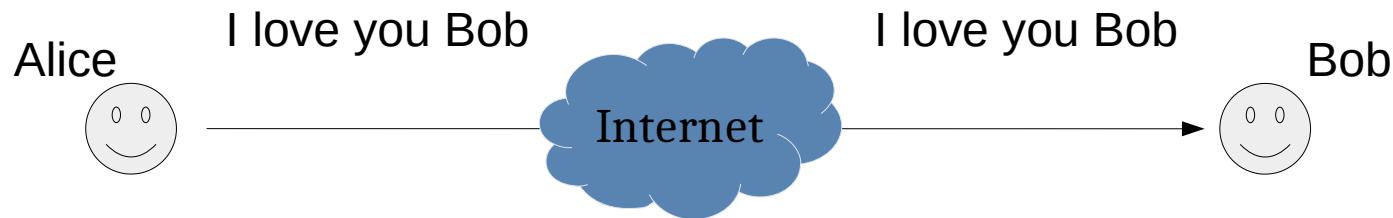
More on this in L3



OVER THE LAZY DOG
LSBO QEB IXWV ALD

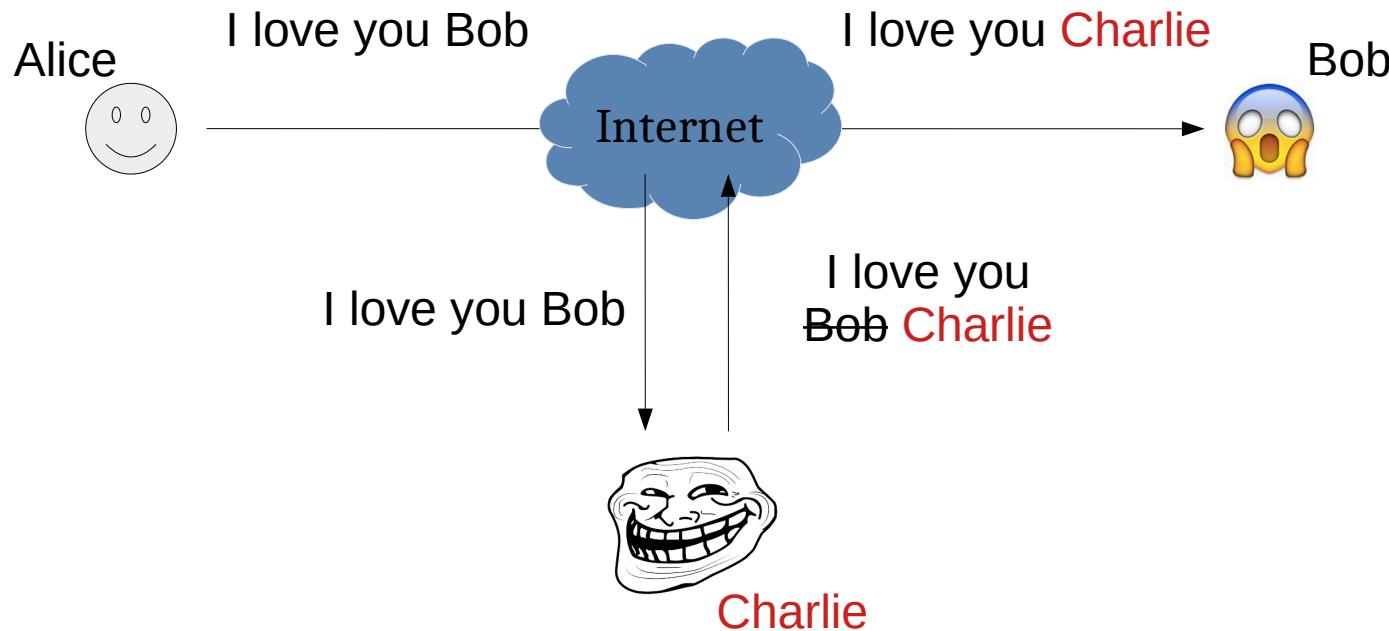
Integrity

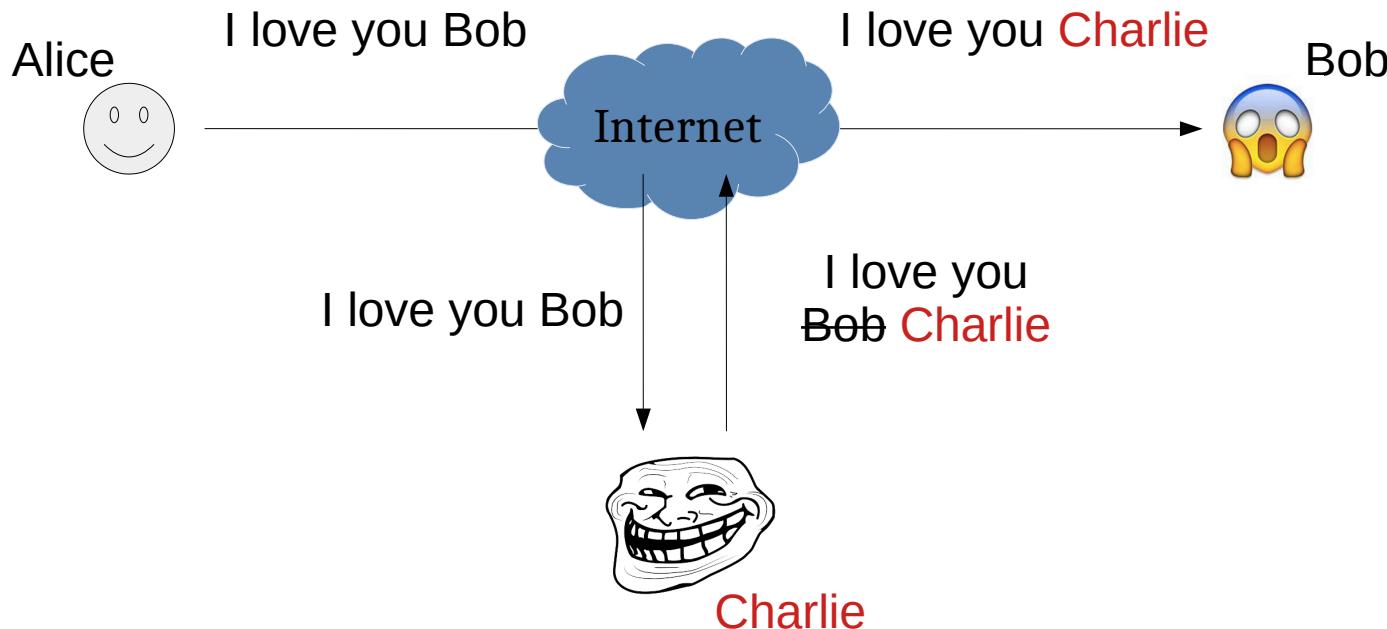
More on this in L3



Integrity

More on this in L3





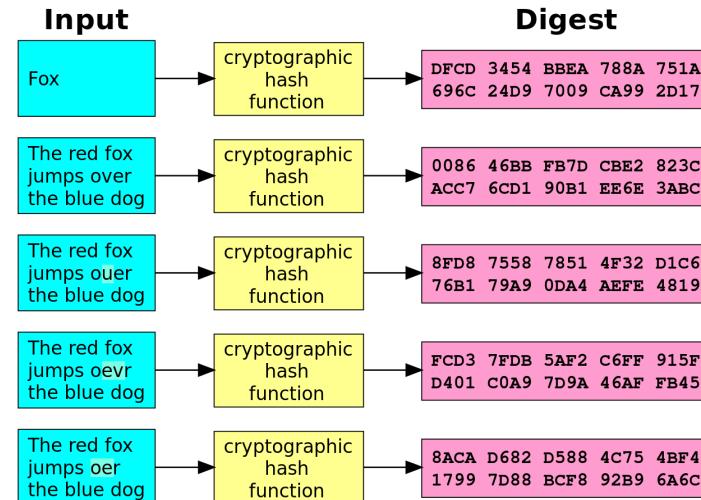
How can we solve this issue?

<https://www.menti.com/>
Code: 69 24 95 0

The ideal cryptographic hash function has the following main properties:

- 1) it is deterministic, meaning that the same message always results in the same hash
- 2) it is quick to compute the hash value for any given message
- 3) it is infeasible to generate a message that yields a given hash value
(i.e. to reverse the process that generated the given hash value)
- 4) it is infeasible to find two different messages with the same hash value
- 5) a small change to a message should change the hash value so extensively that the new hash value appears uncorrelated with the old hash value (avalanche effect)

WIKIPEDIA
The Free Encyclopedia



Availability

404

The requested slide was not
found on this deck

Beyond the CIA-Triad?

Unauthorized information release (Confidentiality): an unauthorized person is able to read and take advantage of information stored in the computer. This category of concern sometimes extends to “traffic analysis,” in which the intruder only observes the patterns of information use. From those patterns, the intruder can infer some information content. This category also includes the unauthorized use of a proprietary program.

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**Have you ever heard of (or can you come up with)
any other cybersecurity property?**

<https://www.menti.com/>
Code: 69 24 95 0

Evolution of Security Properties

Year	Definition	Legend
1970s	infosec = CIA	Confidentiality, Integrity, Availability
1980s	infosec += (Au, nR)	Authenticity and non-Repudiation
1990s	infosec += CSpec	Correctness in Specification
2000s	infosec += RITE	Responsibility, Integrity of people, Trust, Ethicality

Table 3: Chronological progression of the CIA triad

Confidentiality: protects information from being accessed/understood by non-authorized parties

Integrity: makes it evident if information is modified by non-authorized parties

Availability: information is accessible to authorized parties

Authenticity: guarantees the identity of a party

Non-repudiation: guarantees that a party cannot dispute its authorship

Anonymity: hiding the (real) identity of a party

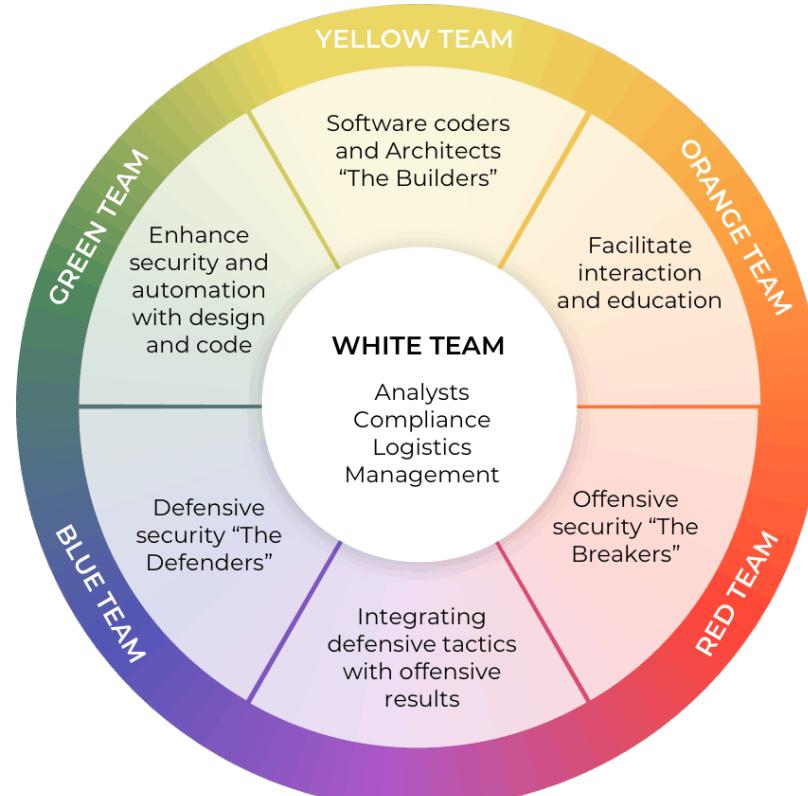
Trust? How do you know that my name is Marco? Do you trust Google? Myself? Someone who knows me?

Hacker? Red Team? Blue Team?

The **hacker culture** is a subculture of individuals who enjoy the intellectual challenge of creatively overcoming limitations of software systems to achieve novel and clever outcomes

A **security hacker** is someone who explores methods for breaching defenses and exploiting weaknesses in a computer system or network

Defend to Defend



Attack to Defend



@aprilwright

Choose the Dark Side Do Not



1. Be an **Hacker!**
2. The Red Team is **not** the Dark side
3. Joining the Dark side is **much more difficult** than you think
1. Don't be stupid, they'll catch you

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Choose the Dark Side Do Not



1. Be an **Hacker!**
2. The Red Team is **not** the Dark side
3. Joining the Dark side is **much more difficult** than you think
 1. Don't be stupid, they'll catch you
 2. Don't put your family at risk
 3. Still want to join the dark side? **Please don't!**



Choose the Dark Side Do Not

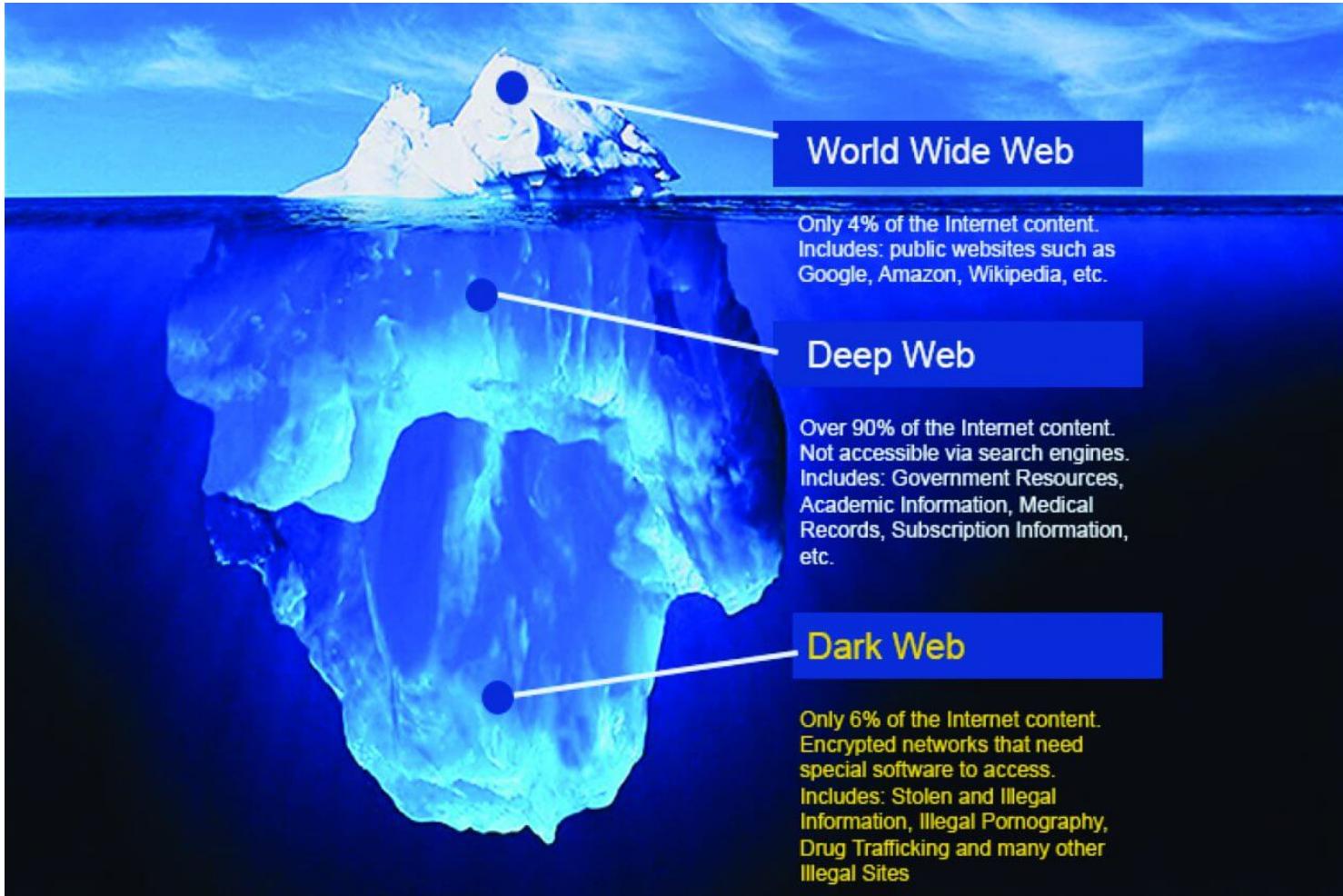


- 1. Be an E
- 2. The Re
- 3. Joining
- 1. Don't b
- 2. Don't p
- 3. Still wa

Ok, let's **join the dark side** and **bypass the controls** that limits our freedom to read PHRAK @311Verona



Just a step towards Anonymity



Just a step towards Anonymity

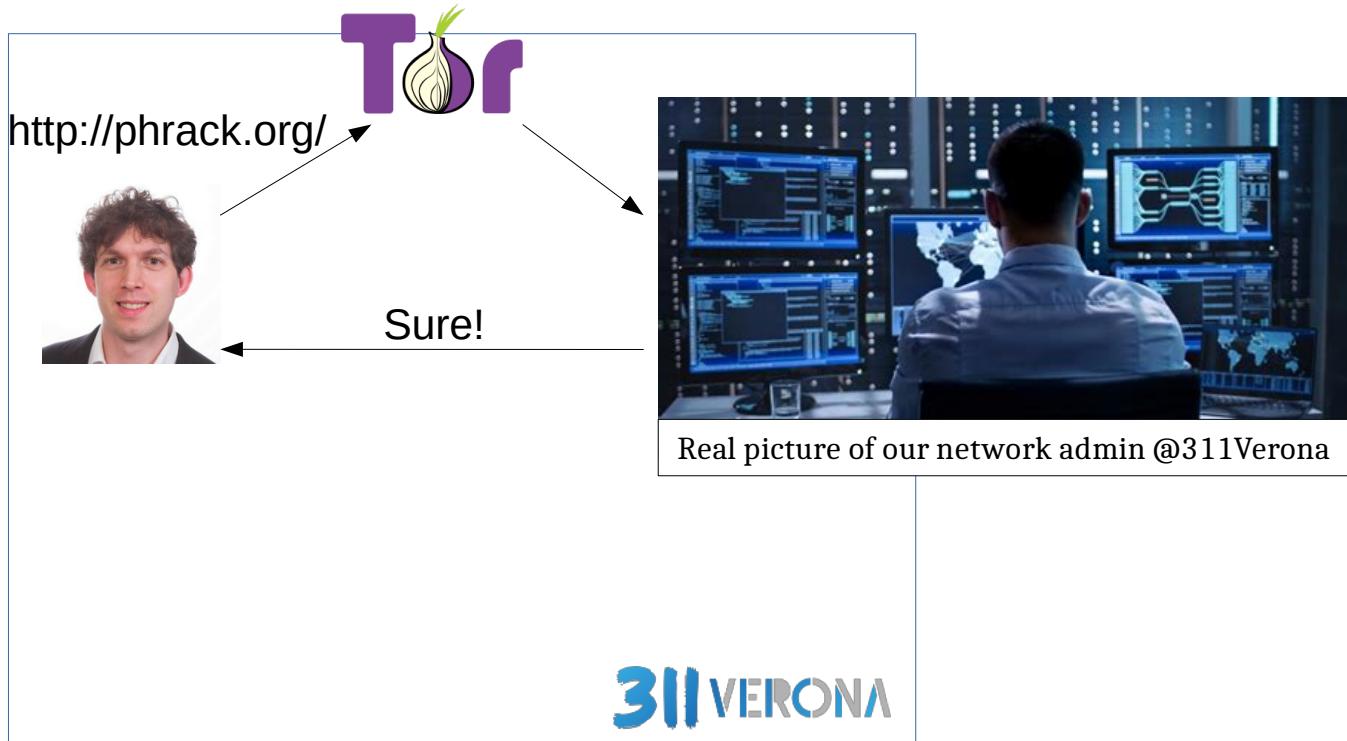


Just a step towards Anonymity

<https://www.torproject.org/download/>

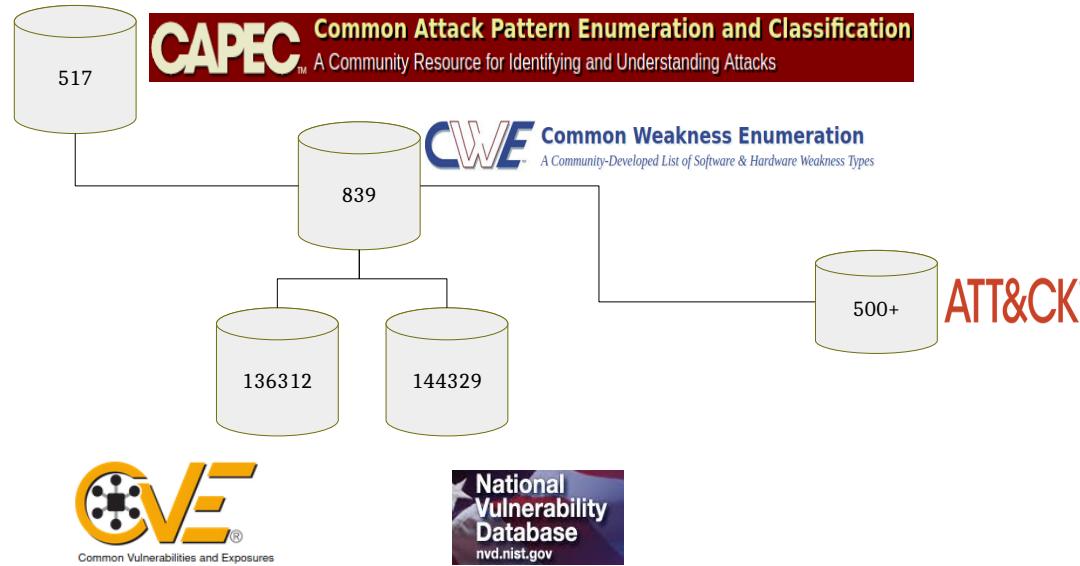
Defend yourself.

Protect yourself against tracking, surveillance, and censorship.

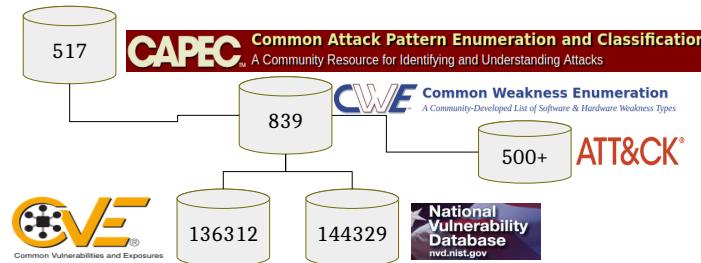


WHY?
Well, you must wait
Until L3 :)

Online Resources (for the practical person)



Online Resources (for the practical person)



Errors

- ↑ Weak System [CWE] why → Weak sanitization function
Authentication logic
- Vulnerable System [CVE] how → SQL-injection with payload 'or 1=1'
- System under attack [CAPEC] what → Authentication bypass
Security=authentication

Online Resources (for the various hacker)



<http://phrack.org/>



<https://owasp.org/>



<https://www.ieee-security.org/TC/SP2021/>



<https://defcon.org/>

Browse for 20 mins, then exam! :P



<http://phrack.org/>



<https://www.ieee-security.org/TC/SP2021/>



<https://owasp.org/>



<https://defcon.org/>

capec.mitre.org/



cwe.mitre.org/



<https://attack.mitre.org/>



<https://nvd.nist.gov/>



cve.mitre.org/



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- propose up to 10 keywords related to cybersecurity [15m]
- Proposals Review & Open Discussion [30m]

Coffee break [10m]

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<https://www.menti.com/>
Code: 99 56 45 6

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