Nuevas Tecnologías de Ciberseguridad y Analítica de Datos para Subestaciones Eléctricas

SecureGrid

New generation of electronic equipment to build a more secure power grid

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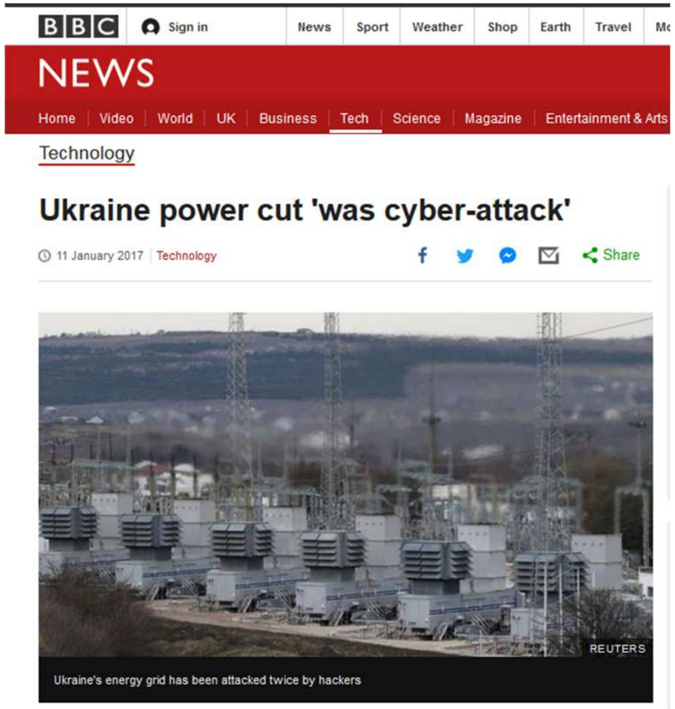
Digitalisation is increasing vulnerability in the grid

- The number of external connection attempts has increased in the last years
- Regulation is confused
- The measures applied in other sectors are not directly applicable:
  - Availability versus confidentiality. We can not disconnect a system when we suspect an attack.
  - Response times.
  - Geographic and equipment dispersion



Technology

Ukraine power cut 'was cyber-attack'

11 January 2017 | Technology

Ukraine's energy grid has been attacked twice by hackers

SecureGrid

Nuevas Tecnologías de Ciberseguridad y Analítica de Datos para Subestaciones Eléctricas

- Funded by the Basque Government
- HAZITEK Programme (2016-2018)
- Budget: ~ 4M€
- Develop technology to Increase the security of the IEDs in electrical substations.
- Positioning the Basque Country as an international reference in cybersecurity for Smart Grids.

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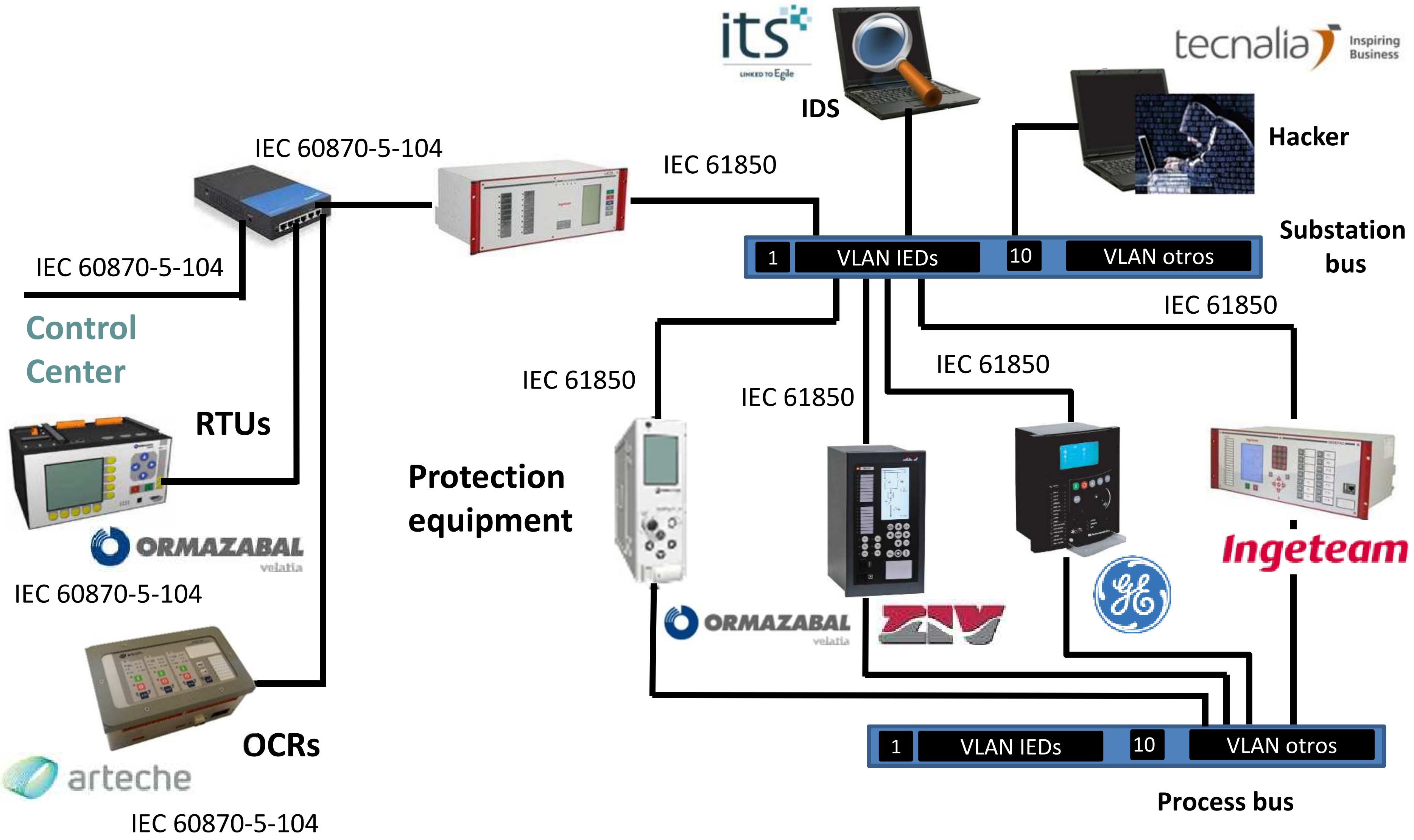

its

IDS

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Hacker

IEC 60870-5-104

IEC 61850

Substation bus

1 VLAN IEDs 10 VLAN otros

IEC 60870-5-104

Control Center

IEC 61850

IEC 61850

IEC 61850

IEC 61850

RTUs

ORMAZABAL velatia

IEC 60870-5-104

Protection equipment

ORMAZABAL velatia

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OCRs

arteche

IEC 60870-5-104

1 VLAN IEDs 10 VLAN otros

Process bus

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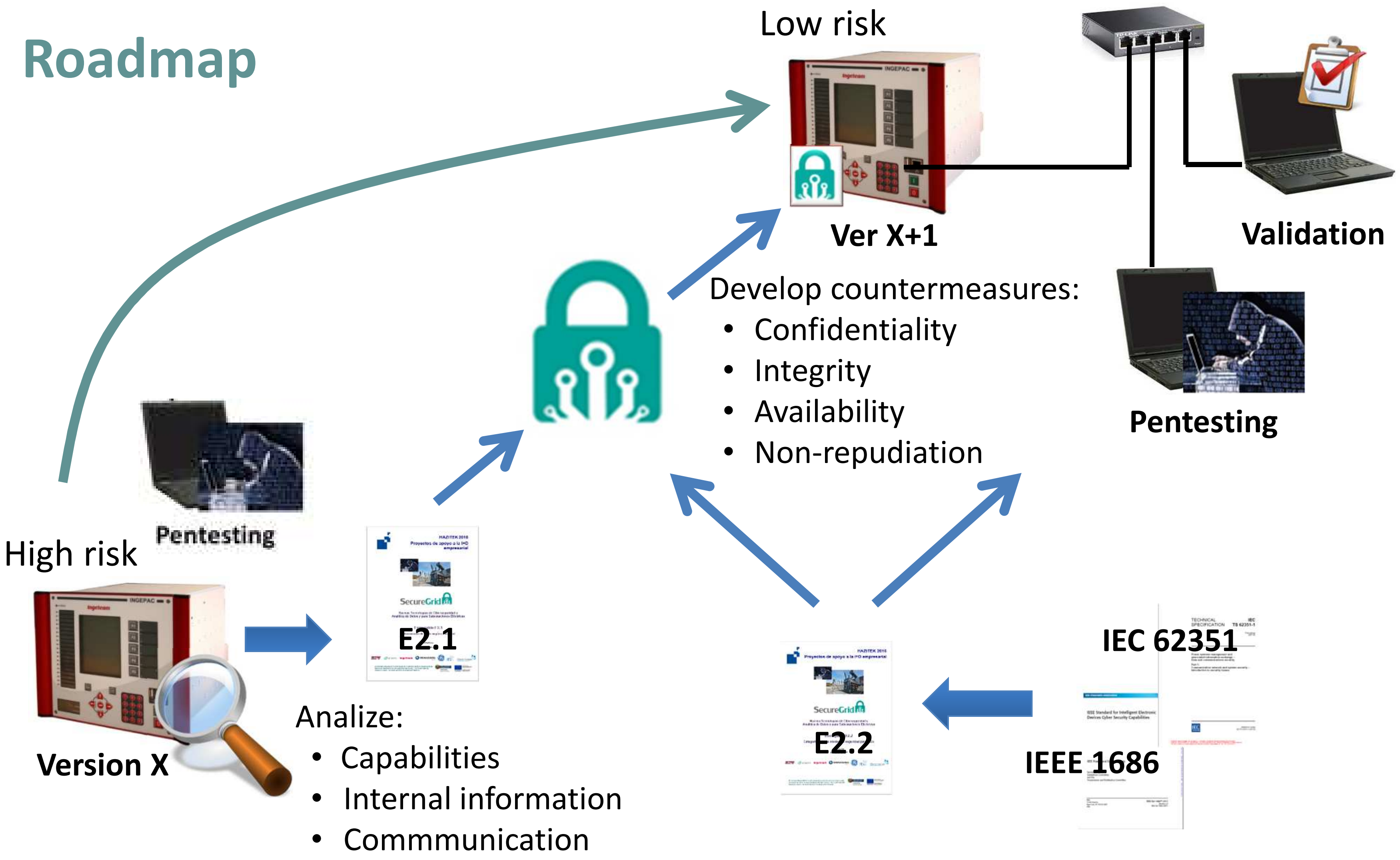
Regulation

- Which regulation should I apply?
  - IEC 62443. Evaluation of the safety of systems and equipment.
  - IEEE 1686. Security model for IEDs.
- How to apply it?
  - IEC 62351 (IEC 60870, IEC 61850)
    - Part 3 - IEC 60870-5-104
    - Part 4 to 6 - IEC 61850
    - Part 8 - RBAC
    - Part 10 – Architecture
- How to certify it?
  - Testbook of the IEEE 1686

SecureGrid Model – Specification IEEE 1686

High (A)	**5.4.x** – Communication encryption **5.5.x** – Firmware signing	**5.4.x** – Communication encryption **5.5.x** – Firmware signing	**5.5.x** – Role management in the config SW **5.5.x** – Firmware signing	**5.4.x** – Communication encryption
Medium (B)	**5.1.x** – Role management **5.5.x** – Role management in the config SW	**5.1.x** – Role management **5.5.x** – Role management in the config SW	**5.3.x** – Events and alarms monitoring **5.6** – Port activation and deactivation	**5.1.x** – Role management **5.2.x** – Audit record **5.3.x** – Events and alarms monitoring **5.5.x** – Role management in the config SW
Low (C)	**5.1.x** – Access control to IED **5.5.4** – Access control to config SW	**5.1.x** – Access control to IED **5.3.x** – Events and alarms monitoring **5.5.4** – Access control to config SW	**5.1.x** – Role management **5.2.x** – Audit record	**5.1.x** – Access control to IED **5.5.4** – Access control to config SW
Level / Req.	**Confidentiality**	**Integrity**	**Availability**	**Non-repudiation**

Roadmap



Low risk

Ver X+1

Validation

Pentesting

Develop countermeasures:

- Confidentiality
- Integrity
- Availability
- Non-repudiation

High risk

Pentesting

Version X

E2.1

Analize:

- Capabilities
- Internal information
- Commmunication

E2.2

IEC 62351

IEEE 1686

Improvements to the equipment

IEEE 1686

- Today, the equipment incorporate:
  - improved generation and management of passwords.

    Clauses 5.x.1
  - disconnection after a period of inactivity
  - role-based access systems
  - generation and management of an audit record containing basic information on events and alarms related to the security of the equipment

    Clauses 5.x.2
- Ongoing work:
  - monitoring of the activity related to security aspects

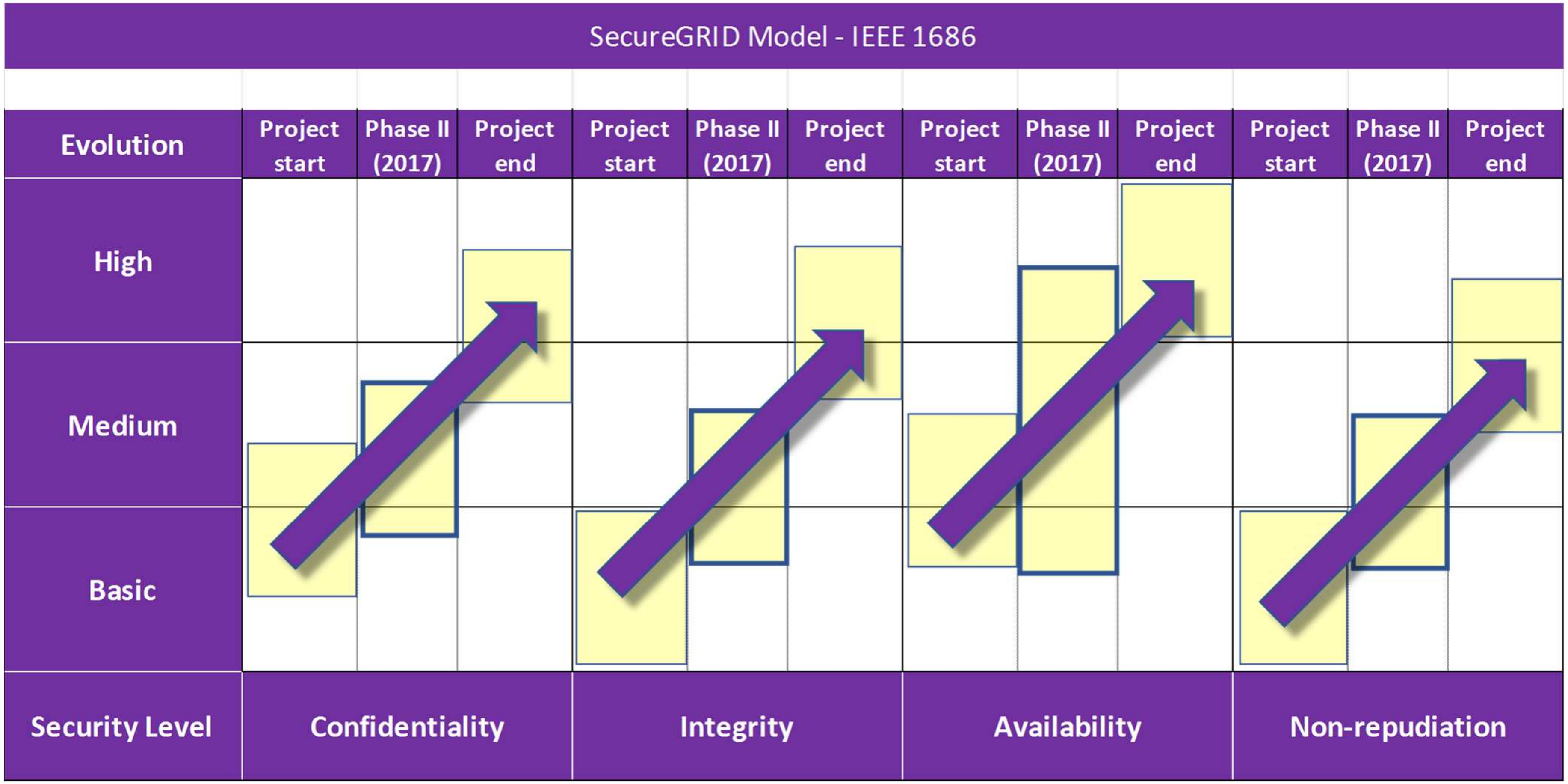
    Clauses 5.x.3
  - encryption of communications,

    Clauses 5.x.4
  - signature of the firmware and authentication of the configuration software

    Clauses 5.x.5
  - activation and deactivation of communication ports

    Clauses 5.6

Current situation - november 2018



SecureGRID Model - IEEE 1686

Evolution

Project start | Phase II (2017) | Project end

High

Medium

Basic

Security Level

Confidentiality

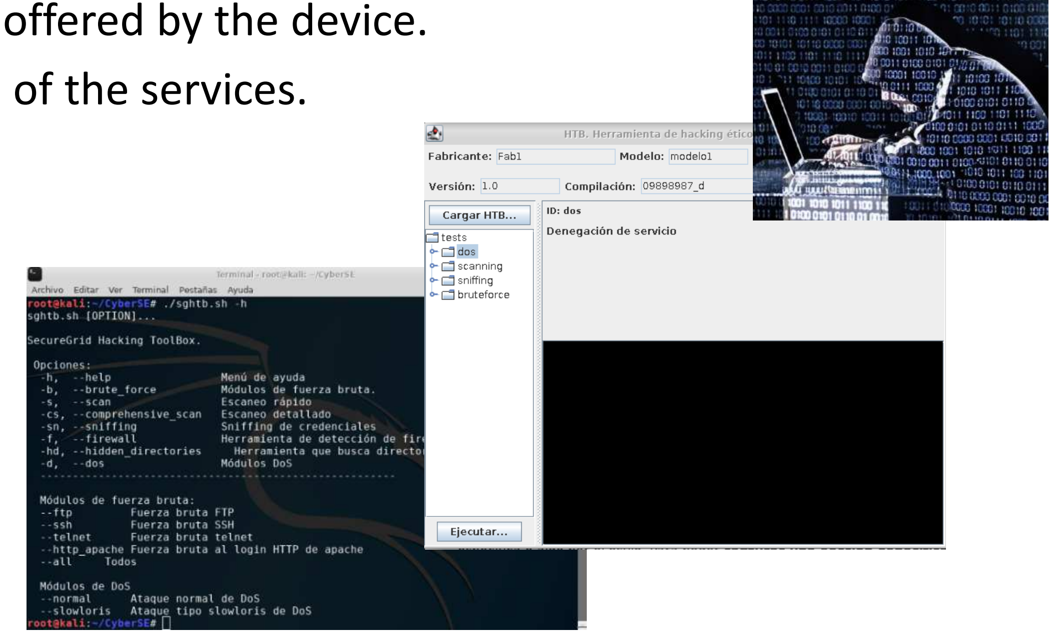
Integrity

Availability

Non-repudiation

Ethical hacking toolbox

- Allows to perform a set of penetration tests to discover the vulnerabilities that the device presents:
  - Discovery of the services offered by the device.
  - Obtaining the credentials of the services.
  - Denial of Service
- Integrated tools:
  - Nmap
  - Metaspoloit
  - W3af
  - Ettercap
  - Slowloris



```
root@kali:~/CyberSE# ./sghtb.sh -h
sghtb.sh [OPTION]...

SecureGrid Hacking ToolBox.

 Opciones:
  -h,  --help                 Menú de ayuda
  -b,  --brute_force          Módulos de fuerza bruta.
  -s,  --scan                 Escaneo rápido
  -cs, --comprehensive_scan   Escaneo detallado
  -sn, --sniffing             Sniffing de credenciales
  -f,  --firewall             Herramienta de detección de fire
  -hd, --hidden_directories     Herramienta que busca directo
  -d,  --dos                  Módulos DoS
  -----------------------------------------------------------

  Módulos de fuerza bruta:
  --ftp         Fuerza bruta FTP
  --ssh         Fuerza bruta SSH
  --telnet      Fuerza bruta telnet
  --http_apache Fuerza bruta al login HTTP de apache
  --all     Todos

  Módulos de DoS
  --normal      Ataque normal de DoS
  --slowloris   Ataque tipo slowloris de DoS
root@kali:~/CyberSE# 
```

Fabricante: Fab1 Modelo: modelo1

Versión: 1.0 Compilación: 09898987_d

ID: dos

Denegación de servicio

Conclusions

- Manufacturers are immersed in a process to improve the security of electrical equipment:
  - Make it more difficult to take control of the equipment from an external system, and avoid spreading to other equipment.
  - Registration of actions related to security.
  - Encrypted and signed communications.
  - Strengthen the equipment availability.
- Added value of collaboration between competitors.
- Ethical hacking as a tool applied to the improvement of security of IEDs during the manufacturing process.
- It is essential to combine the measures developed in the project (OT) with improved IT security measures.

There is still a lot to do…!

- Share and check the project results with utilities.
- Definition of technological lines for the project to evolve
  - Recovery from attacks
  - Honeypots
- Adaptation of electronic equipment to the evolution of regulation, which increasingly includes more security aspects.
- Tecnalia has a Cybersecurity Laboratory for Smart Grid:
  - It is part of the Cybersecurity Node of the "Digital Innovation Hub" of Advanced Manufacturing in the Basque Country.
  - It allows the simulation of new (and more complex) attack scenarios, as well as testing new equipment and attack detection systems.

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Thank you!

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http://www.clusterenergia.com/securegrid

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