



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP



Introduction to Cyber-Physical Systems and IoT Security

Alessandro Brighente

27/02/2023



Contacts

- Mail: alessandro.brighente@unpd.it
- Website:
<https://www.math.unipd.it/~abrighen/>

Education

- M.Sc in Telecommunication Engineering
- Ph.D. in Information Engineering
- Visiting researcher at Nokia Bell Labs and University of Washington
- Assistant professor, Department of Mathematics

Research Interests:

Security and Privacy in

- Wireless communications and signal processing
- Vehicular networks (cars, drones)
- Distributed ledger technology

- The course will be on Monday and Wednesday
- The schedule is [here](#)
- But, we will need to make some arrangements while approaching the end of the course (more on this later on)
- I will surely not be here on 08/05 and 10/05 and after 05/06
- The number of reserved days is more than the actual course duration
- 6 credits = 48 hours = 24 lectures

- During classes, we will explore attacks and countermeasures for CPS and IoT security
- We will provide you some code and simulators to test attacks and gain some insights on specific applications
- **Automotive**
 - In-Vehicle security
 - Car keys
 - Autonomous driving
 - Electric Vehicles
- **Industrial Networks**
 - Industrial networks
 - Industrial control
 - Smart Grids
 - Honeypots

- **Drones**
 - How do drones work?
 - Automation in drones
 - Sensors and sensor fusion
 - Location based services
- **IoT and IIoT**
 - IoT protocols and problems
 - Wireless communications security in IoT
 - Remote attestation
 - Industrial IoT

The exam will be both theoretical and practical

- Some questions on general topics, very likely multi-choice questions
- Small exercises to complete and test in the lab

Cyber-Physical Systems (CPSs) are characterized by the deep complex intertwining among :

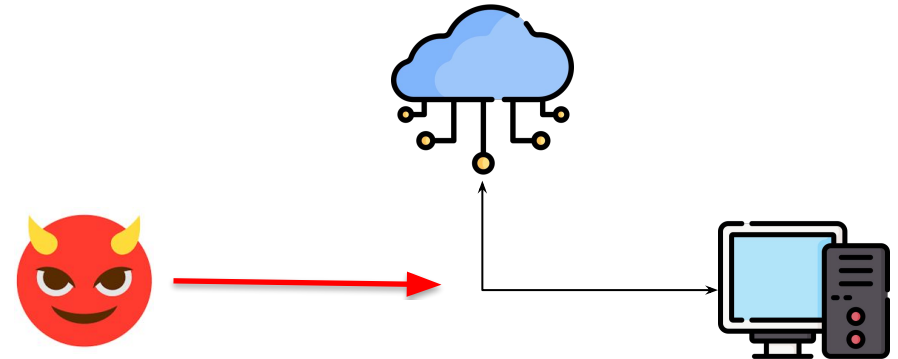
- The world of Physical Processes, or Operational Technology, or OT
- The world of Information Technology, or IT.

Some Example:

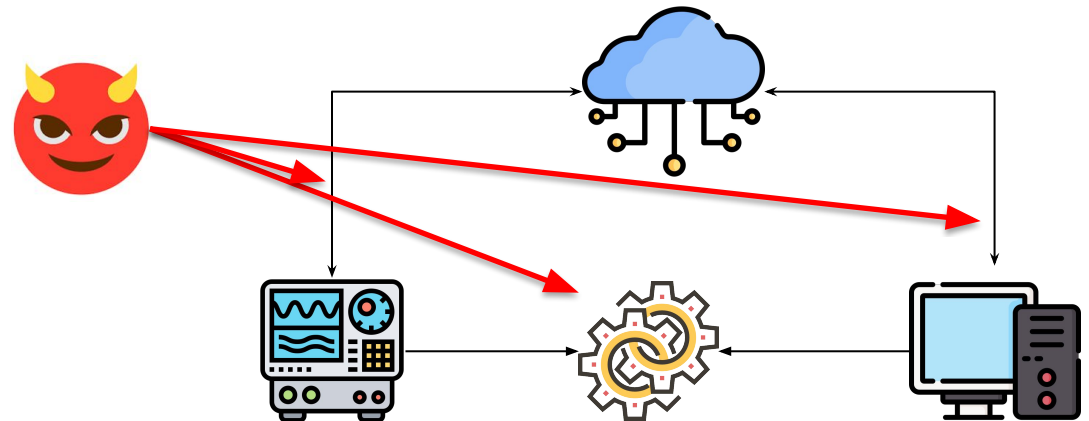
- *Smart Grid*
- *Smart Cars*
- *Industrial Control Systems*
- *e-Health Devices*



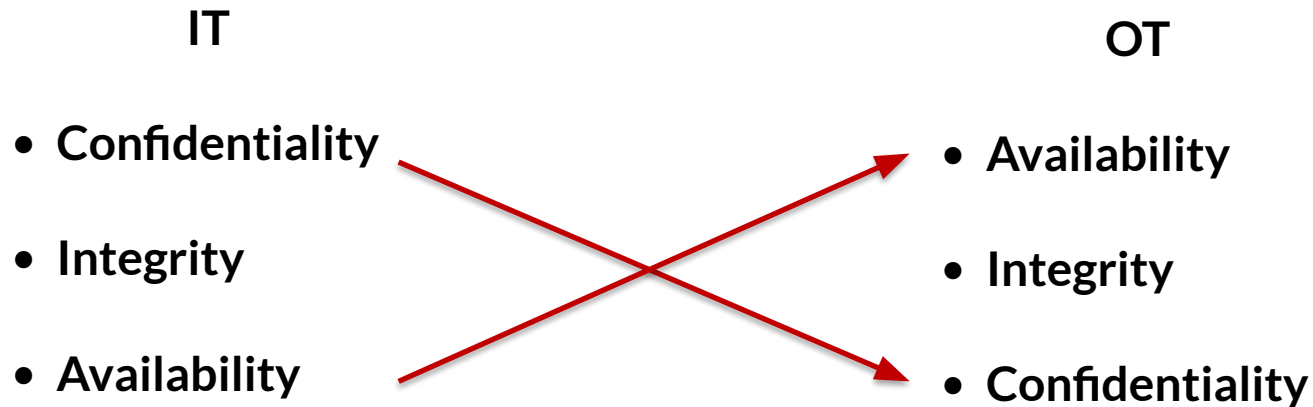
Traditional IT Systems



Cyber-Physical Systems



According to the literature on CyberSecurity, CIA paradigm is **reversed**:



What if we lose Availability of nuclear plants monitoring data?



Do we have to care?



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP



DIPARTIMENTO
MATEMATICA
HUMAN INSPIRED TECHNOLOGY
Research Centre

WIRED BACKCHANNEL BUSINESS CULTURE GEAR IDEAS MORE ▾

ANDY GREENBERG SECURITY 07.21.2015 06:00 AM

Hackers Remotely Kill a Jeep on the Highway—With Me in It

I was driving 70 mph on the edge of downtown St. Louis when the exploit began to take hold.

Forbes

EDITORS' PICK | Apr 29, 2021, 10:48am EDT | 18,895 views

Watch A Tesla Have Its Doors Hacked Open By A Drone



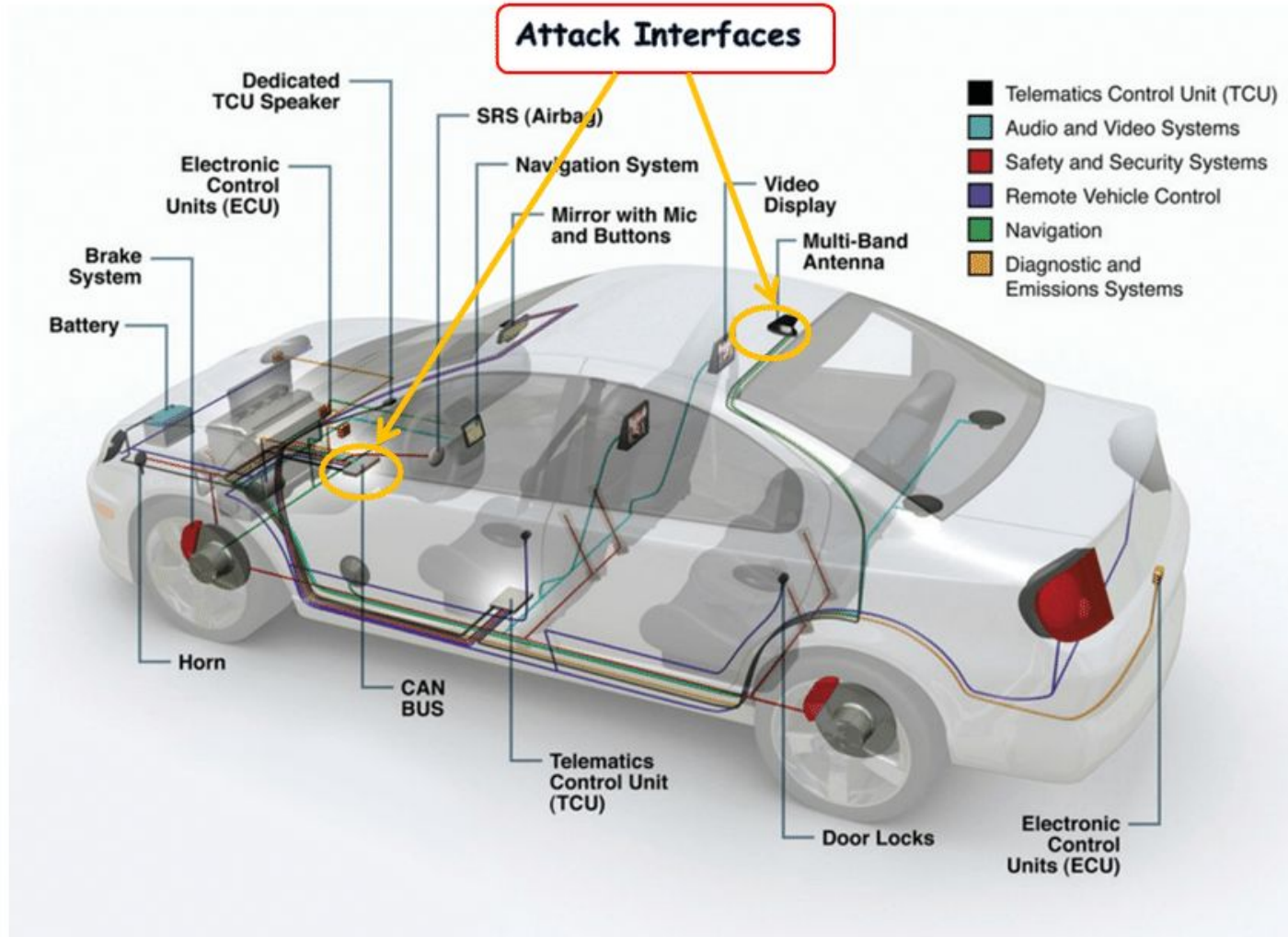
AFRICA UK ITALY SPAIN MORE ▾ NEWSLETTERS ALL

BMW and Hyundai hacked by Vietnamese hackers, report claims

Hacks linked to Ocean Lotus (APT32), a group believed to operate with orders from the Vietnamese government.

[Click me for the video!](#)

CAN bus



The V2X Communication Paradigm



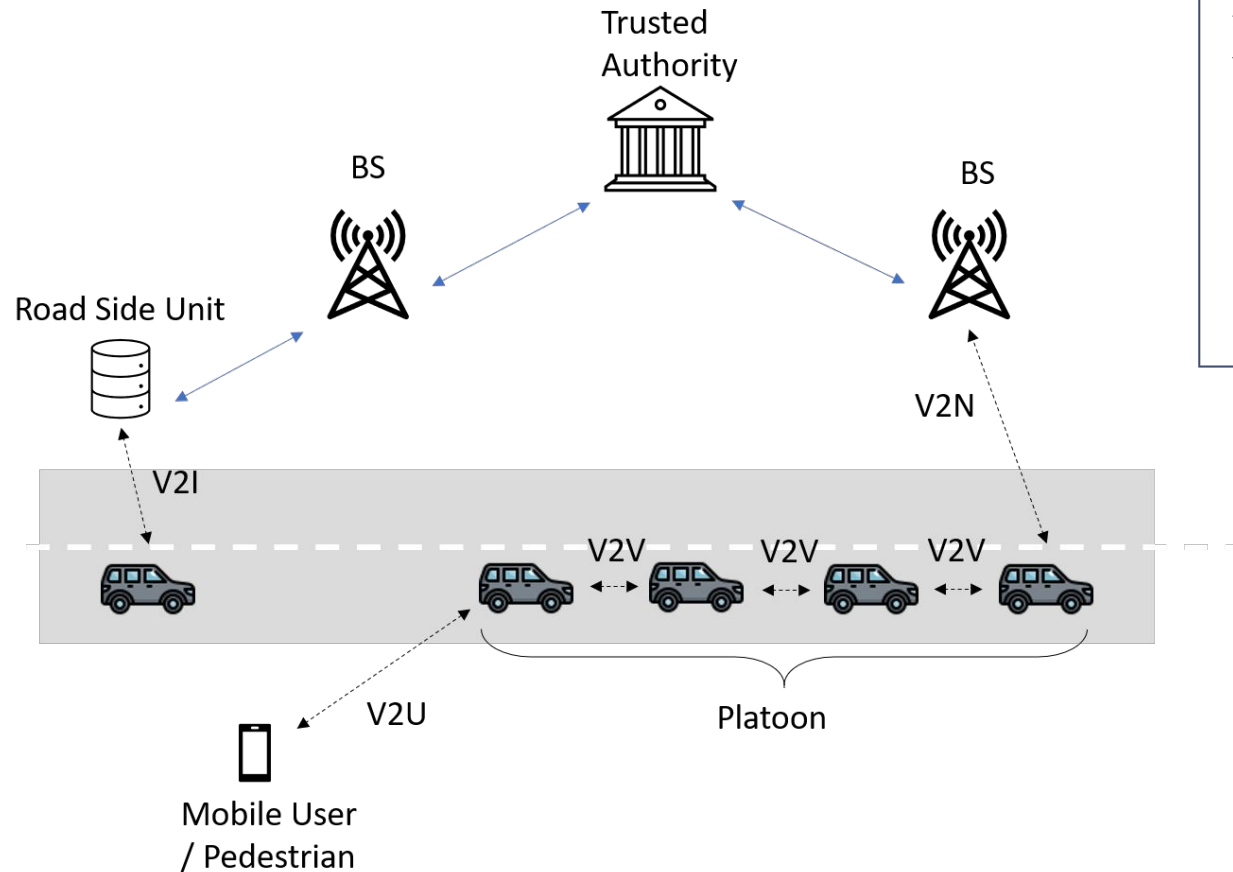
UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP



DIPARTIMENTO
MATEMATICA
HUMAN INSPIRED TECHNOLOGY
Research Centre



↔ Wired Link
↔ Wireless Link

V2N = to network

V2V = to vehicle

V2I = to infrastructure

V2N = to network

V2U = to user

Vehicles Platoon



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP



DIPARTIMENTO
MATEMATICA
HIT HUMAN INSPIRED TECHNOLOGY
Research Centre

Benefits of organizing vehicles in platoons:

- Fuel Efficiency
- Road Capacity
- Road Safety
- “Greener”



Vehicle-to-Grid (V2G)



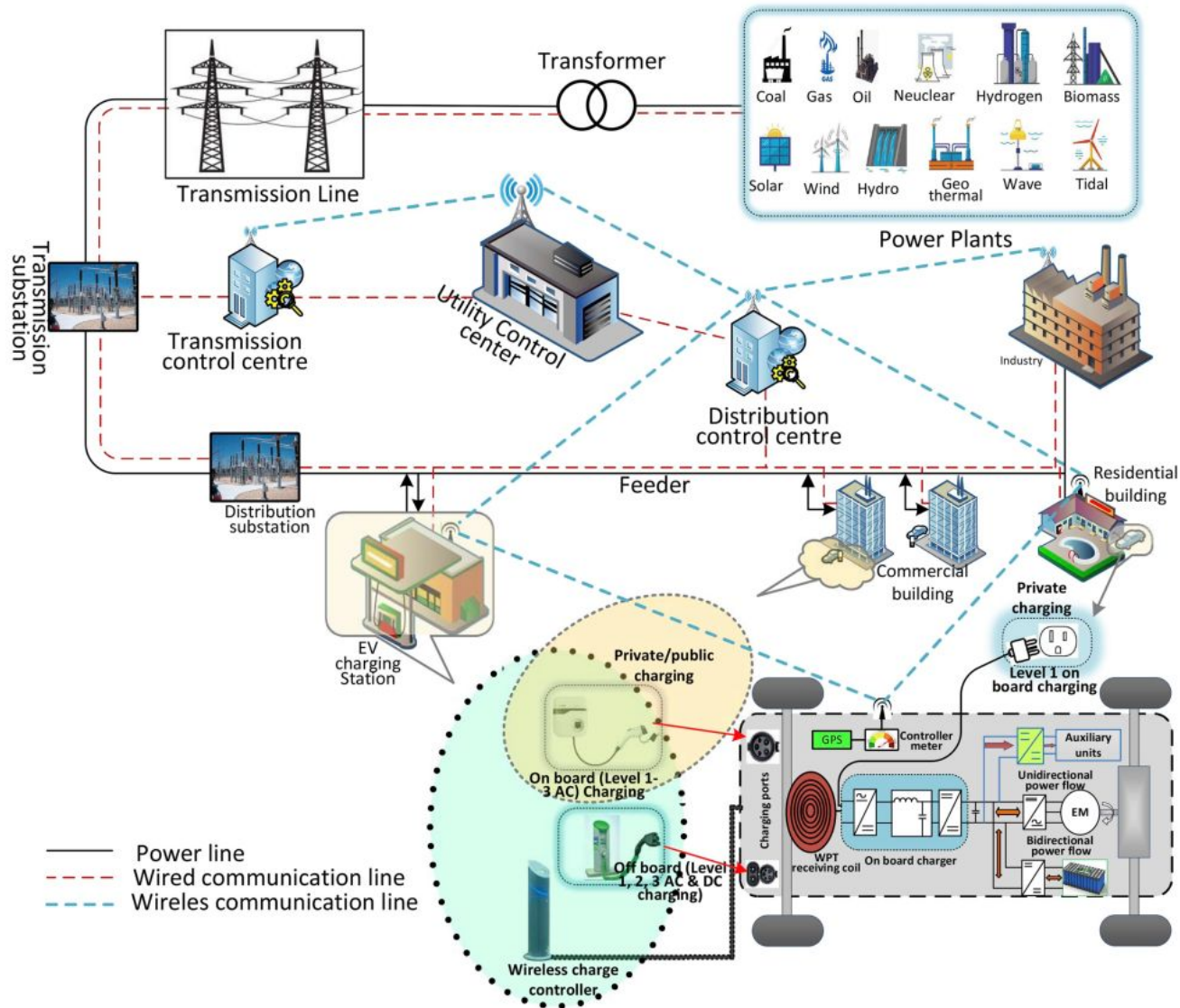
UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP



DIPARTIMENTO
MATEMATICA
HUMAN INSPIRED TECHNOLOGY
Research Centre



- IoT devices are employed in safety-critical systems



Structure of a Drone



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



SPRITZ
SECURITY & PRIVACY
RESEARCH GROUP

- Multiple modules to acquire and process data
- Communication module as enabler

