IEEE NCA 2024

Platelet: Pioneering Security and Privacy Compliant Simulation for Intelligent Transportation Systems and V2X

https://gitlab.com/Matk3z/platelet

Mathias Kautz
mathias.kautz@epita.fr

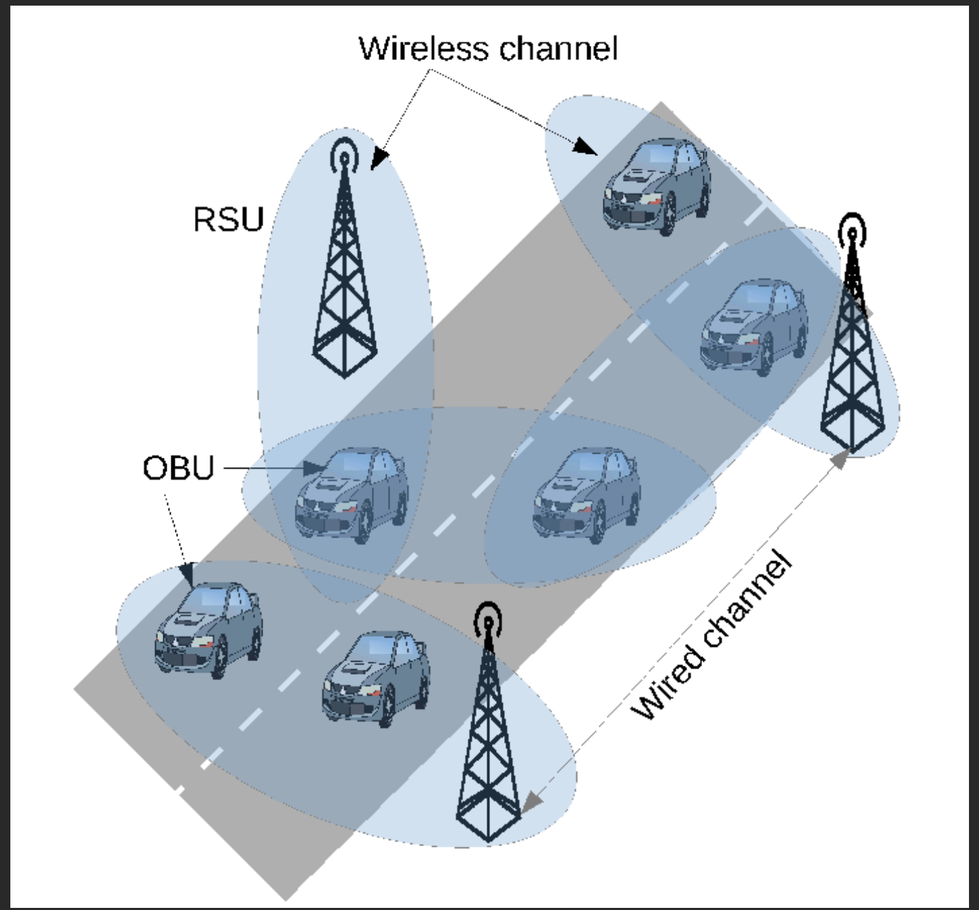
Badis Hammi
badis.hammi@telecom-sudparis.eu

Joaquin Garcia-Alfaro
joaquin.garcia_alfaro@telecom-sudparis.eu

ITS (intelligent transportation system)

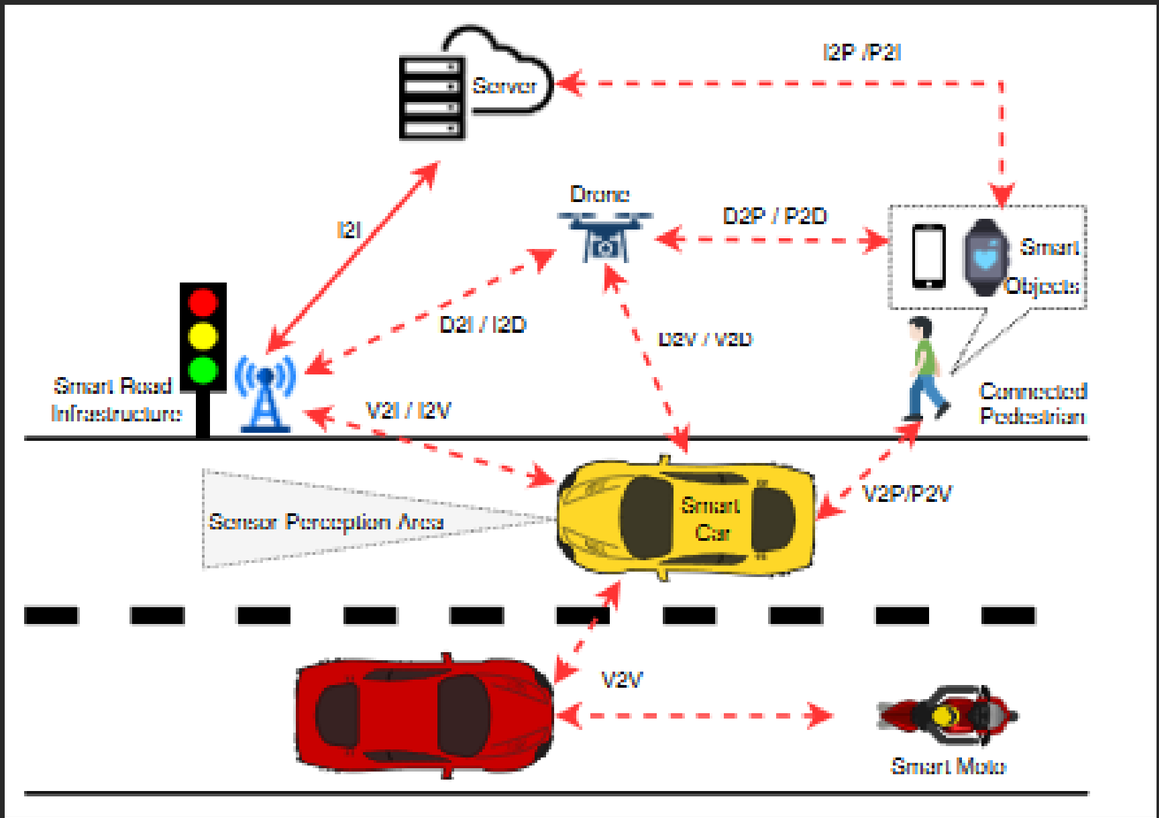
Applying new technologies to transport systems

In the context of a connected city, the presence of an inter-vehicular network is a central issue.



Simple VANET network schematic [1]

C-ITS Network



Advanced C-ITS network [3]

The network is made out of two types of nodes:

- RSU nodes (road-side units)
- OBU nodes (on-board units)

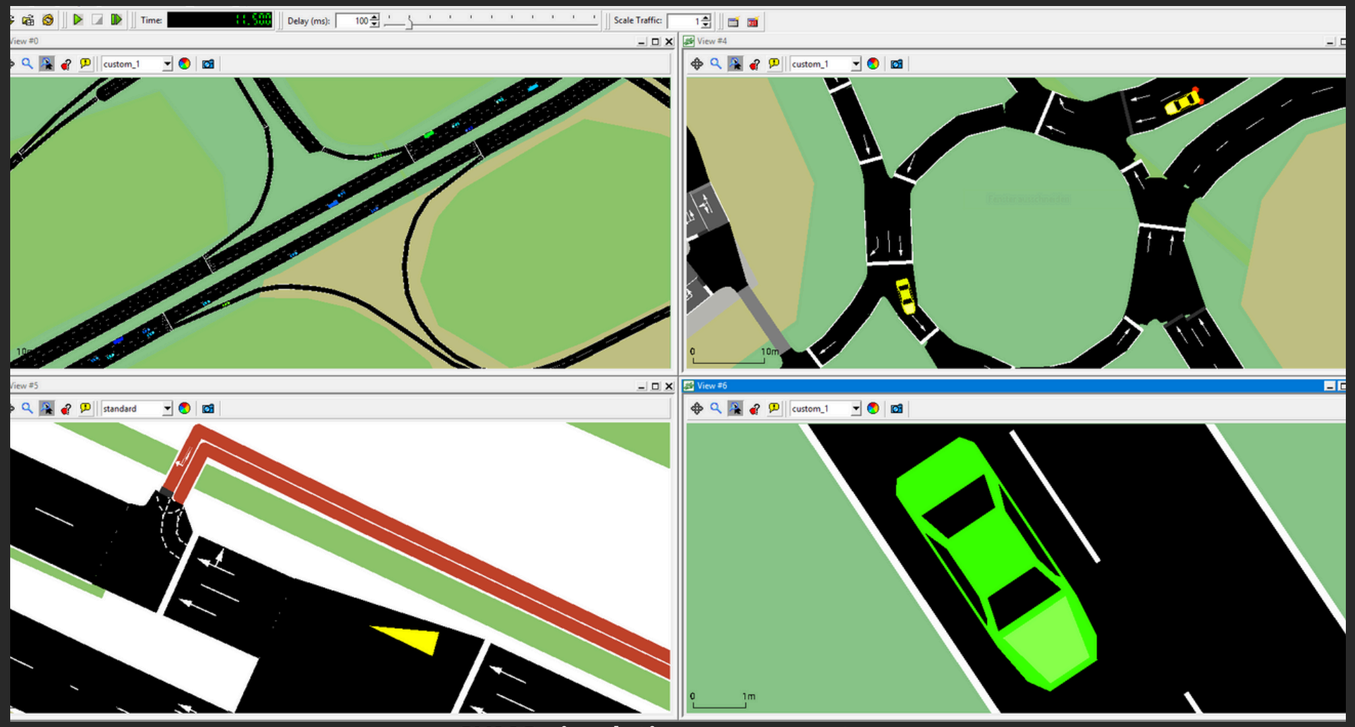
Initially **Ad Hoc**, recent solutions are increasingly based on **existing infrastructures** (cellular data, centralized servers, etc.).

V2X Network simulators

Testing on road = too expensive

Simulators are available to test these solutions in a digital environment.

Firms use **closed source** simulator but academic researchers needs **open source** simulators



SUMO simulation screen capture

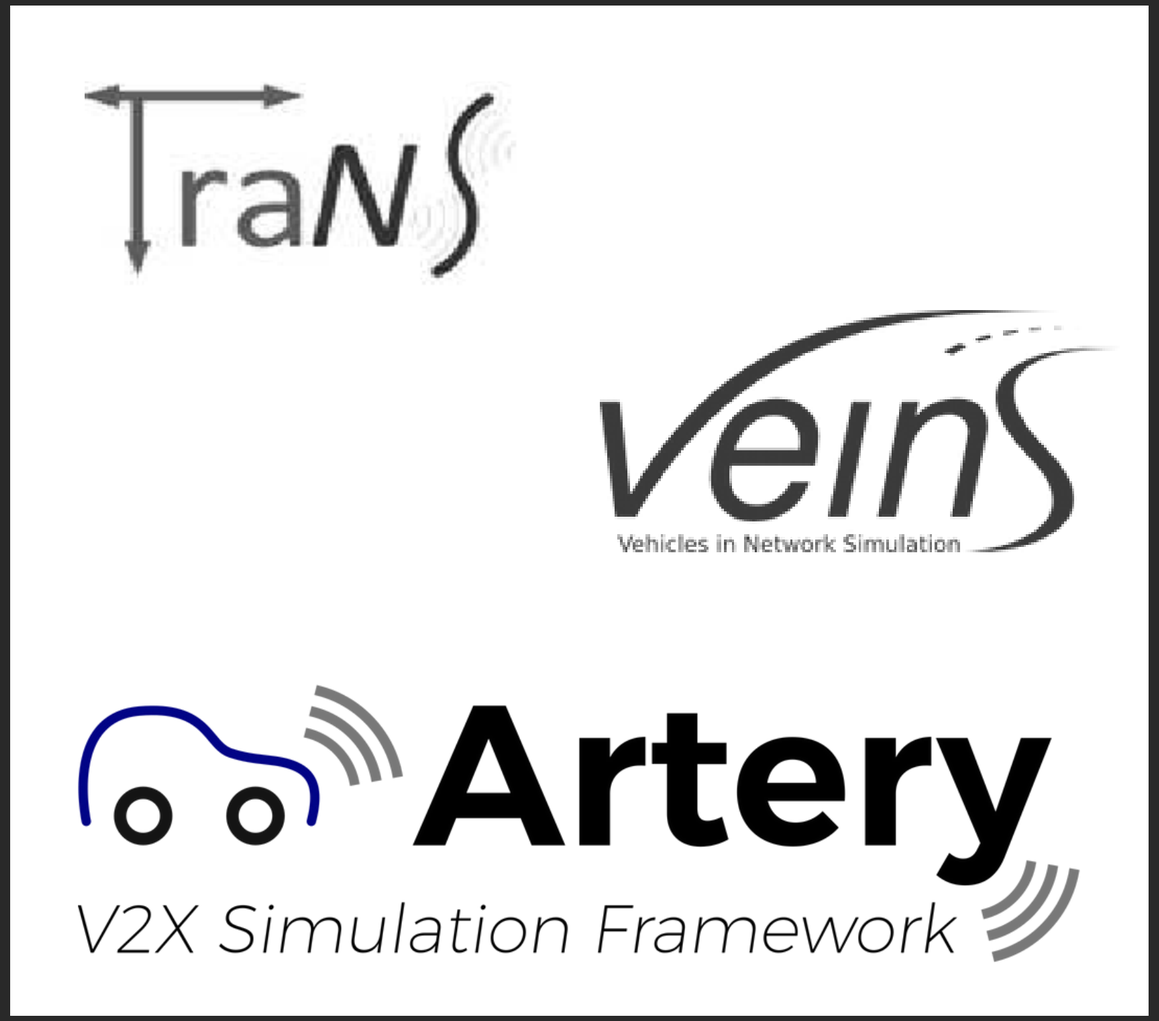
State of the art

Many simulators exists but most are **ancient** and made for **older needs** of V2X network

The most recent simulator implementing the ETSI standard are **Artery and iTetris**

Artery and iTetris:

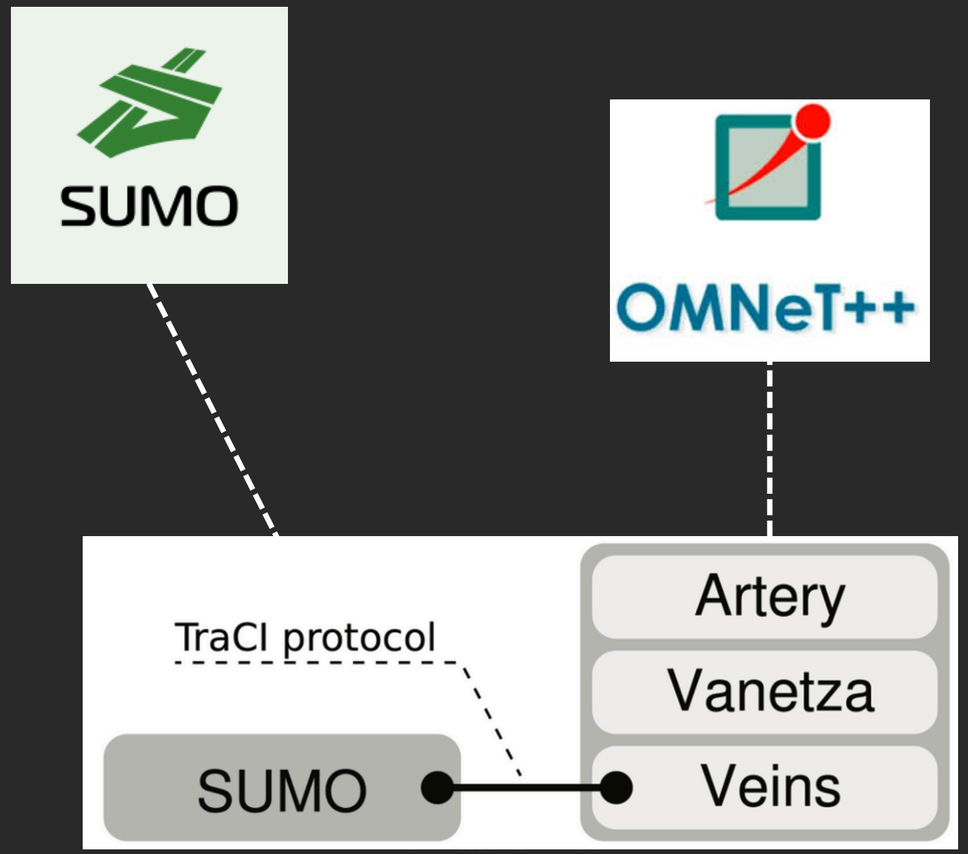
- Pros: most **efficient** platform to run ETSI simulators
- Cons: still lack consideration for **privacy** and **security**



State of the art

Simulator	Traffic simulation	Network simulation	ETSI-compliant	IEEE-compliant	5G and Beyond compatible	Signature implementation	Certificate renewal	pcap logging	EC and PC implementation	Certificate pool implementation
TraNS	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
GrooveSim	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗
iTETRIS	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗
Veins	✓	✓	✗	✓	✓	✗	✗	✗	✗	✗
Artery	✓	✓	✓	✗	✓	✓	✗	✗	✓	✗
Platelet	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓

Artery’s architecture



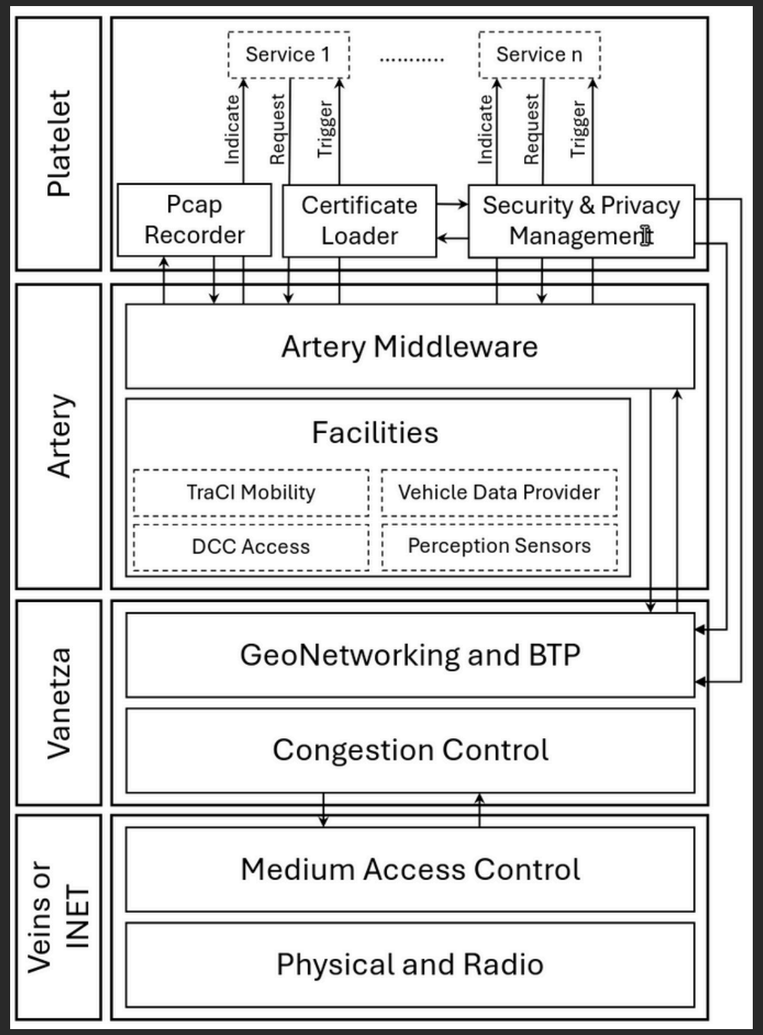
Artery simplified architecture [2]

Based on SUMO and Omnetpp

Most advanced ETSI based ITS simulator

- Omnetpp: Network simulator
- SUMO: Traffic simulator
- Vanetza: Library implementing the ETSI standard used heavily inside Artery and Platelet

Platelet



Platelet Architecture [6]

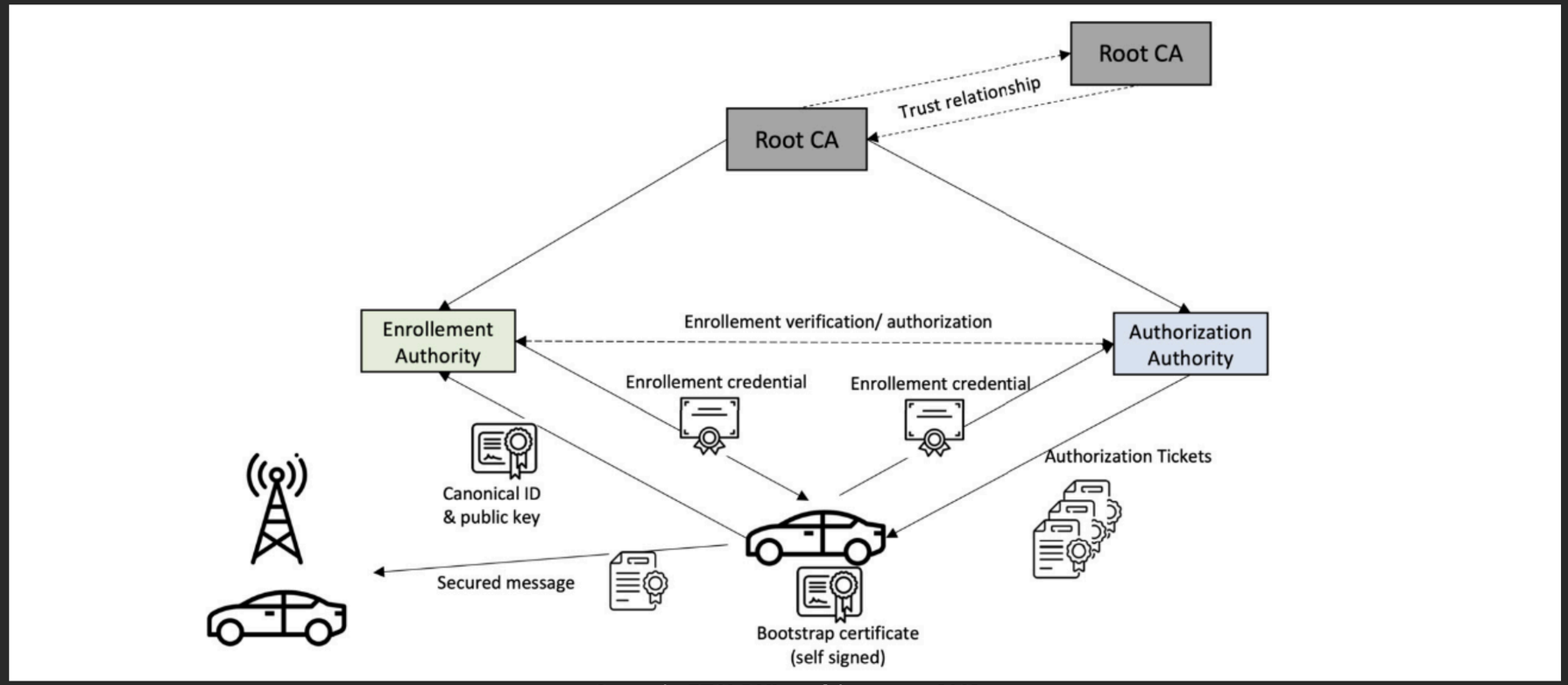
First simulator to implement proper **security** and **privacy** management

Two new components:

- A **pcap recorder** allowing for easier verification of completed scenarios
- A proper **certificate loader** allowing vehicles to send secured messages

A **fully integrated** standalone app to manage **secured** scenarios

PKI, security and privacy managment



Generic ETSI PKI architecture [12]

StaticCertificateLoader

Artery has no certificate loading module

This Loader works by loading a stack of pre generated certificate and distributing them during the simulation

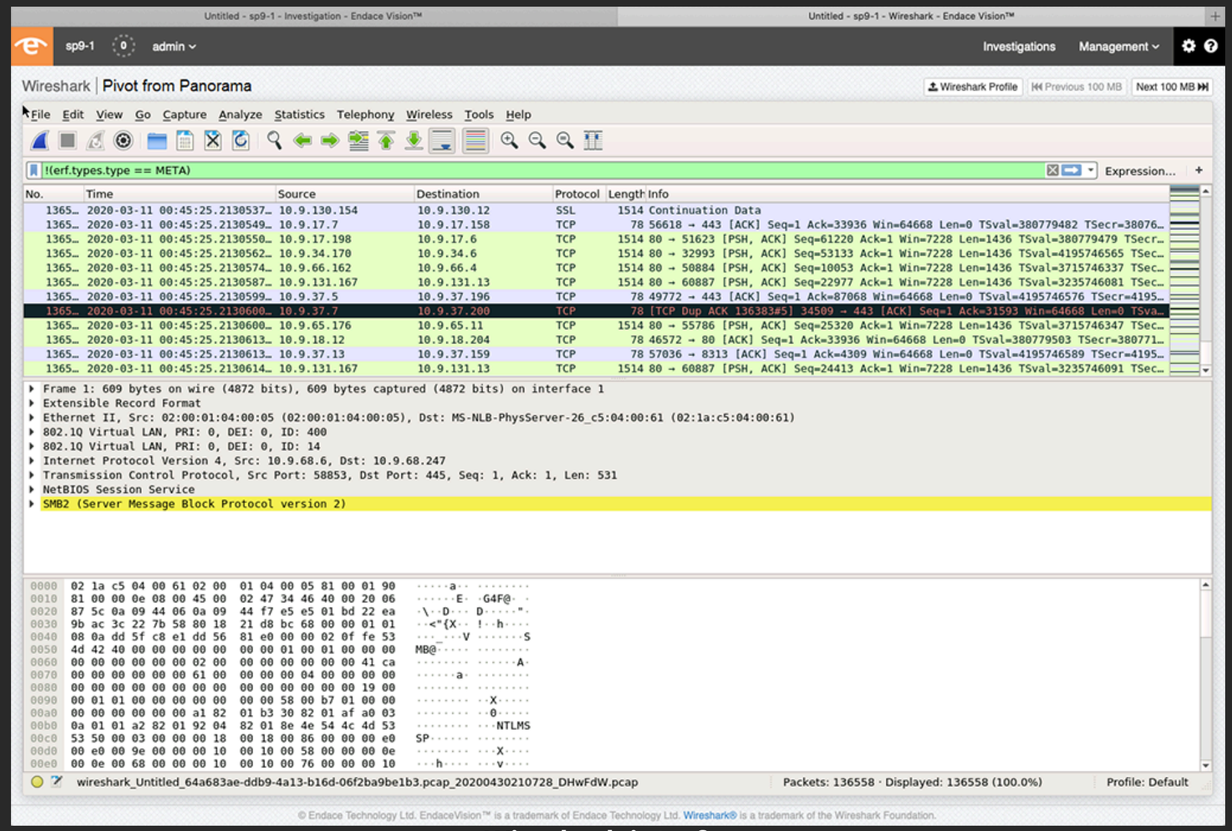
Checks the authenticity and integrity of the certificate while loading it

PcapItsRecorder

Pcap: packet recording file format

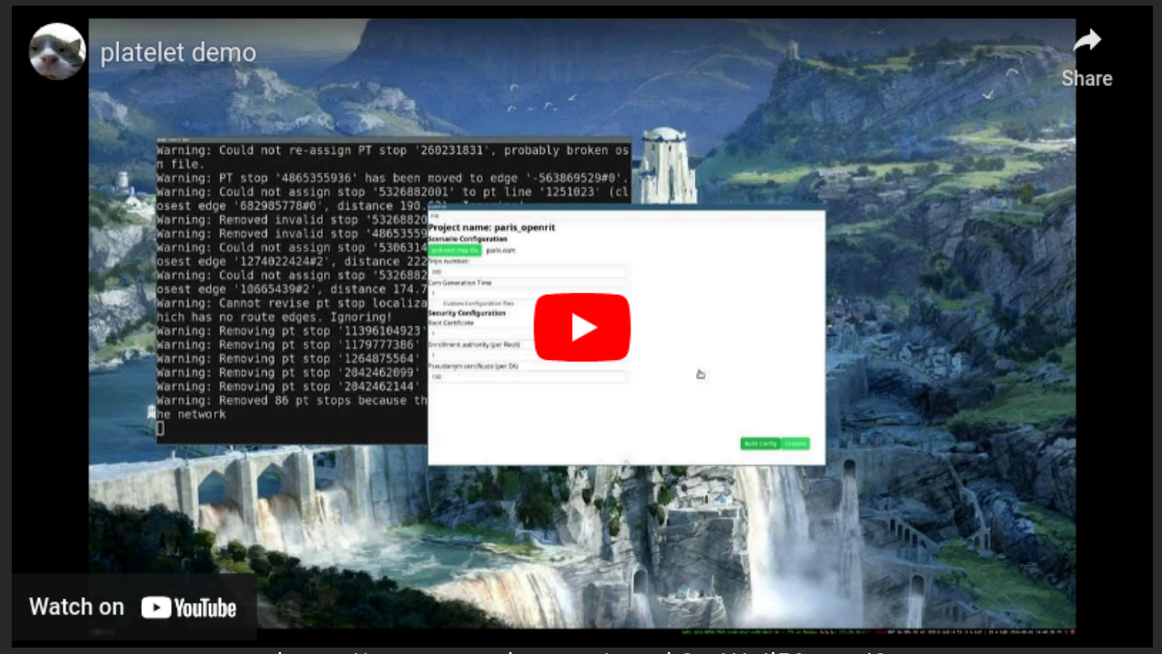
There was **no recorder** previously in the project

Thanksfully! A **packet reader** exists inside wireshark

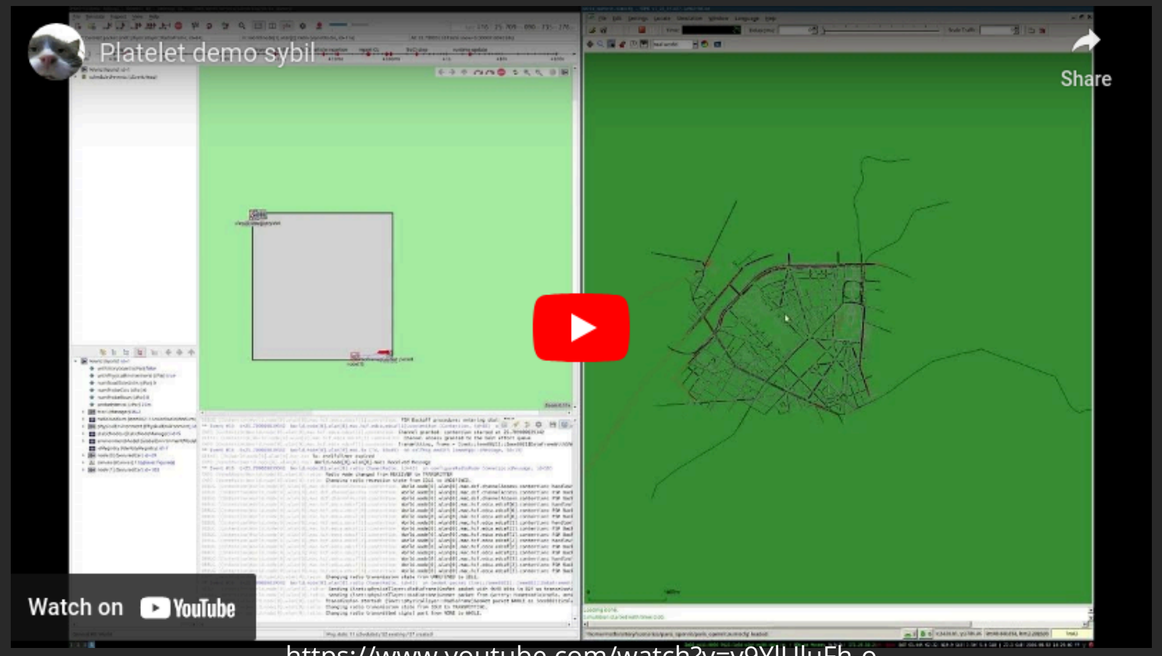


Wireshark interface

Demo



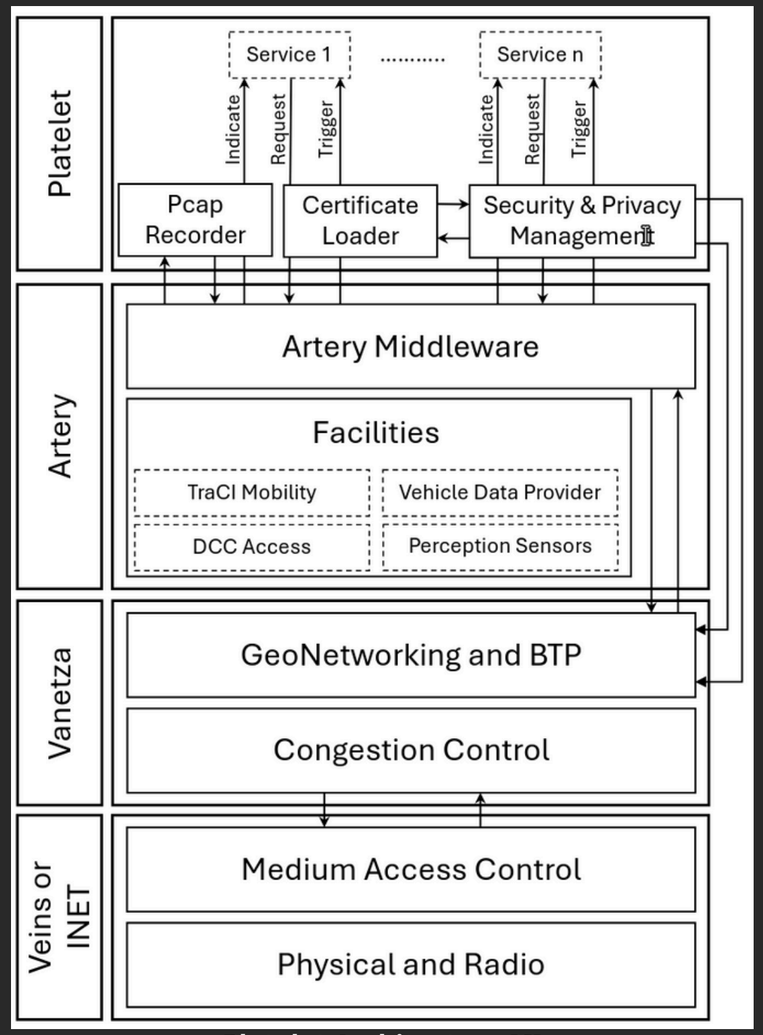
https://www.youtube.com/watch?v=WuIl59mwxi0



https://www.youtube.com/watch?v=v9YlUluFh-o

https://gitlab.com/Matk3z/platelet

To conclude



Platelet Architecture [6]

There was no simulator implementing **security** and **privacy** management allowing for unrealistic scenarios

Platelet allow for **secured** scenarios simulation and provides more component to **facilitate** it

To make researcher's life **easier** we centralized tools in a single **GUI app**

Bibliography

- Mukesh Saini, Abdulhameed Alelaiwi, Abdulmotaleb El Saddik, 2015, How Close are We to Realizing a Pragmatic VANET Solution? A Meta-Survey
- R. Riebl, H. Gunther, Christian Facchi, L. Wolf, 2015, Artery: Extending Veins for VANET applications
- Badis H, Jean-Philippe M, Jonathan P, 2022, PKIs in C-ITS: Security functions, architectures and projects: A survey
- Agachai S, H.W. Ho, 2017, Smarter and more connected: Future intelligent transportation system
- Jonathan P, Florian S, Michael F and Frank K, 2014, Pseudonym Schemes in Vehicular Networks: A survey
- Mathias K, Badis H, Joaquin G, 2024, Platelet: Pioneering Security and Privacy Compliant Simulation for Intelligent Transportation Systems and V2X
- Artery Documentation, http://artery.v2x-research.eu/
- Omnet++ documentation, https://omnetpp.org/documentation/
- Vanetza documentation, https://www.vanetza.org/
- Institut européen des normes de télécommunications, ETSI TS 103 096
- Institut européen des normes de télécommunications, ETSI EN 302 637-2
- Institut européen des normes de télécommunications, ETSI TS 102 940